

**INFORMATION SOCIETY TECHNOLOGIES
(IST)
PROGRAMME**



Contract for:

Concerted Action/Thematic Network

Annex 1 - "Description of Work"

Project acronym: **EUNITE**

Project full title: **European Network on Intelligent Technologies for Smart Adaptive Systems**

Proposal/Contract no.: IST-2000-29207

Related to other Contract no.: n/a

Date of preparation of Annex 1: 30 October 2000

Operative commencement date of contract: *see Article 2.1 of the contract*

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1. Project summary

CA & TN CPF Form – Form A1



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Project Acronym ²	EUNITE	Proposal No ³	IST-2000-29207
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A1.

Project Summary ⁴¹

Objectives(maximum 1000 characters)

EUNITE aims to join forces of Intelligent Technologies for exploiting the potential of their synergies towards building Smart Adaptive Systems and promote their practical implementations. EUNITE aims to encourage the joint exploitation of intelligent systems techniques and activities that intent to build Smart Adaptive Systems in industry by:

- Promoting the dialogue between the separate research communities of Intelligent Technologies
- Shorten the lead time from scientific innovation to actual applications in industry or economy via technology transfer actions
- Encourage new enterprises coming into this area with success stories and best practice information
- Strengthen European training activities and collaboration

Description of the work (maximum 2000 characters)

The network will be comprised by three groups aiming to interconnect theory and application in an effective scheme:

A) The Research Theory & Development (RTD) group will deal with theoretical aspects of the integration of Intelligent Technologies for Smart Adaptive Systems. The RTD group will organise Conferences-Symposia-Workshops related to Intelligent Technologies and Smart Adaptive Systems, will disseminate scientific excellence via publications and will stimulate scientific co-authoring. Its members are expected also to provide executive summaries on these subjects, to work on joint case studies and seek guidelines for the “*Best Methodology*” on applying Smart Adaptive Systems.

B) The Industrial Business Application (IBA) group focusing on 5 sectors of economy: Industry; Transportation; Telecommunication & Multimedia; Medicine & Healthcare; Finance, Trade & Services. The IBA group will also organise Conferences-Symposia-Workshops and try to increase awareness of applied Smart Adaptive Systems and their benefits in its areas. Special actions are foreseen to encourage the use of these technologies and systems in SMEs and to help young researchers to get connected with the market.

C) The Technology Transfer and Education (TTE) group that will provide the necessary information flow and education in order to promote the area and enlarge the domain of potential users. The TTE group is subdivided in two groups. The Technology Transfer (TT) group will develop strategies and actions for missing links between the research community and industry by issuing patent guidelines and related services, organising benchmarking and competitions and reporting feasibility/case studies. The Training and Education group will set up a server with a Learning Center where beyond educational activities will develop didactic methods and a dictionary/definition list.

All three groups are in close collaboration and will produce under the supervision of the Steering Committee a comprehensive Roadmap on Hybrid Intelligent and Smart Adaptive Systems, stating the research challenges, the technology penetration and education of these areas. The Steering Committee apart from the overall co-ordination, assessment of the network and Roadmap activity supervision, will seek collaborations with other networks and research communities enfavouring also relations with associated and third countries

The Service Center of EUNITE will support all aforementioned activities and among others will develop and administrate a dedicated WWW space and disseminate information through a Newsletter and a CD-ROM.

Milestonesand expected results (maximum 500 characters)

Most tasks will be continuous and span over the duration of the project. At the end of the first year main deliverables like the Roadmap, Dictionary, Training Center, Patent guidelines and e-archives should be already formed and work in a draft mode. In addition, reports and proceedings of the different meetings will be available. At the end of the second and third year, the updated and upgraded versions of deliverables of the first year will be available.

2. Project objectives

EUNITE, the **E**uropean Network on **I**ntelligent **T**echnologies for *Smart Adaptive Systems*, will be an open Network of Excellence having a twofold goal:

- a) to join forces within the area of Intelligent Technologies for better understanding of the potential of hybrid systems and to provide guidelines for exploiting their practical implementations and particularly,
- b) to foster synergies that contribute towards building *Smart Adaptive Systems* implemented in industry as well as in other sectors of the economy.

EUNITE aims to encourage the joint exploitation of intelligent systems techniques and activities with the intent to build successful broad (i.e. not restricted to traditional applications of Intelligent Systems like Intelligent Control) *Smart Adaptive Systems* in industry by:

- Promoting dialogue between the separate research communities of Intelligent Technologies through conferences, symposia, publications etc., and encouraging scientific work on development and application of *Smart Adaptive Systems*.
- Providing a common platform for scientists, which will shorten the lead time from scientific innovations to actual applications in industry or economy. This emphasises the technology transfer topic of EUNITE.
- Providing associated nodes of the Network (in different sectors of economy), and also decision makers and practitioners outside EUNITE, with success stories and best practice information showing the technical and economical potential of adaptive systems which combine these technologies. This aims to encourage new applications, and also to encourage new enterprises coming into this business.
- Promoting trans-European training activities in this field. The main challenge is to utilise fully the possibilities of Internet and establish connections with other operators who work with the application of Networking and Virtual Technologies in training.
- Establishing co-operation with nodes and bodies from EC associated countries that have expertise or are interested in Intelligent Technologies by assisting them to be integrated in the EC research community.
- Providing a Roadmap in order to describe the state-of-the-art and the vision for the *Hybrid* and *Smart Adaptive Systems*. This Roadmap should be considered in close connection with existing Roadmaps of Networks of Excellence in Intelligent Technologies (ERUDIT, NeuroNet, MLNet, Evonet, CoIL) and give decision makers and all workers of the area the insight as to where these technologies are going and what solution potential they include.
- Supporting promising young researchers in the field by providing them with continuing education and facilitating their mobility and exchange between the nodes of excellence. Also, EUNITE should support the creation of spin-off ventures and other similar entrepreneurial activities from young scientists who want to exploit their ideas.
- Establishing links and co-operating with scientific networks and other organisations -in particular with Networks of Excellence that are active in close research areas like qualitative reasoning and computational logic.

The success of the activities undertaken for achieving these goals can be assessed by:

1. Number of reports and case studies, state-of-the-art surveys and their European-wide distribution.
2. Increase in the number of significant research proposals in the area of EUNITE, specially if they are initiated by EUNITE nodes.
3. Increase in the number of scientific reports and papers in the area of combined applications of Intelligent Technologies and *Smart Adaptive Systems*.
4. Initiated events and training activities. The use of training products initiated by nodes in WWW. The number of successful cases of scientific mobility exchange.
5. Number and quality of task forces initiated by EUNITE in order to tackle the research challenges of designing stable adaptive hybrid systems.

Research Challenges

The quest for Adaptive Systems

Intelligent technologies, including *neural networks, fuzzy systems, methods from machine learning, evolutionary computing, qualitative reasoning, and computational logic*, have recently lead to many successful industrial applications that involve complex relationships between input and output data specially

in cases where an explicit model with physical laws is absent. Examples are applications in the domains of diagnostics, monitoring, forecasting, quality control, data mining, and many others. While being powerful and contributing to increased efficiency of industrial processes, most solutions using intelligent technologies lack one important property: they are not *adaptive* (or not adaptive enough), when environmental conditions change. In other words, most such solutions have to be redesigned - in many cases from scratch - when the setting or environmental parameters change significantly.

At first sight for intelligent technology, adaptivity appears to be *the* central issue. The typical "learning by example" concept combined with techniques inspired by biological concepts is supposed to provide enhanced adaptivity. However, on second sight, it becomes clear that most techniques for "learning" are used for one-time estimation of models from data, which remain fixed during routine application. "True" online learning, in most cases, has not reached a level mature enough for industrial applications.

The quest for adaptive system behaviour is not new and is a central issue in areas such as control systems (adaptive control). Ashby [1] in one of these early definitions on adaptive behaviour wrote: "... *adaptive behaviour* is equivalent to the behaviour of a stable system, the region of stability being the region of the phase-space in which all the essential variables lie within their normal limits."

According to Sagasti [2], there are four different forms of adaptation:

- *External adaptation*, adaptive behaviour in the presence of a stimulus originating from its environment.
- *Internal adaptation*, adaptive behaviour in the presence of a disturbance located in the *object* of the system.
- *Darwinian adaptation*, adaptive behaviour when the response is directed towards modifying its *object*.
- *Singerian adaptation*, adaptive behaviour when the response is directed towards modifying its *environment*.

Adaptive systems should thus have the following properties or characteristics: (i) work to find regions of stable behaviour (where all essential variables lie within wanted or predefined intervals), (ii) adapt to changing environments with algorithms, methods, models, instruments and technologies, which are appropriate and effective to provide stable behaviour, and (iii) use different strategies to build the adaptation programs: to provide adaptation to (iii.1) the environment or (iii.2) the object, and adaptation of (iii.3.) the environment or (iii.4) the object.

Smart adaptive systems (i.e. adaptive systems that are developed with the aid of Intelligent Technologies) should seek stability in the Ashby sense: their adaptive behaviour should converge faster, more effectively and in a more appropriate way than standard adaptive systems. This is due to either learning and/or reasoning capabilities or to the intervention of and/or interaction with smart human controllers or decision makers.

Intelligent Technologies and closely related areas can offer ideas and solutions that, at least in theory or on laboratory prototypes, can contribute to the problem of adaptivity. These include:

- methods for online and reinforcement learning
- methods for adapting fuzzy sets
- methods for solving the "catastrophic interference problem" with many neural networks
- methods for growing or evolving structure
- methods from Bayesian inference for adapting models to every new data point
- methods for explicitly modelling switching behaviour, such as hidden Markov models.
- methods for automated deduction systems where theorem proving techniques can be used in the verification of hardware and software for building adaptive inference systems.

An *Adaptive System* in this context will be defined along two lines:

- A system is *adaptive* if it can perform even in the presence of non-stationary environments, which are manifested in significant smooth changes of the main characteristics in the data. Examples are monitoring systems in the presence of tool wear, medical diagnostic systems in the presence of a changing population, or forecasting of dynamically changing time series.
- Another type of *adaptivity* is that required by systems which are designed for one application class and must be transferred to several different instances of this application. Examples are monitoring or diagnostic systems that should run on different machines, which are of similar type but each having their individual characteristics. Adaptivity in this sense is closely related to reusability of models to minimise the effort for re-development.

Both types of adaptivity are demanded in virtually every industrial sector. Therefore, increased focussed research on truly adaptive intelligent technologies is likely to lead to major technological advances on a medium to long term scale.

Integration of Intelligent Technologies

Although Intelligent Technologies nowadays have reached a mature stage and each one is separately penetrating more and more application fields they show very little interaction with each other. Hybrid Intelligent Systems are more common in theory and experimentation and less in the application field although

recently there has been increasing activity. Indeed, few theoretically sound methods exist which support the analysis and design of such systems. Usually, the design of systems of this nature is often characterised by ad hoc rules-of-thumb and extensive prototype testing. However, as systems grow more complex and available data increase, exhaustive testing is becoming impractical. There is a need for guidelines regarding design, testing and assessment as well as an improved understanding of the fundamental nature of engineering systems with embedded hybrid intelligence.

Research on smart adaptive systems is of a long-term nature for the following reasons. First, only partial solutions have been proposed in the past, which need integration into a common framework. Thus a major goal of EUNITE will be to bring scattered research results together and to motivate the development of a generic framework for smart adaptive systems. Secondly, relatively little experience about the routine application of smart adaptive systems is available. This entails high risks with respect to technology transfer. Therefore, another goal of EUNITE will be to initiate long-term studies in the application of adaptive systems in practical use, the results of which will be transferred back to research. Only these two major actions together can guarantee a major step forward in developing feasible adaptive solutions on a large scale. Thirdly, the application of adaptive systems bears high risks in itself, since without careful monitoring of the adaptively changing behaviour of the system unstable or unwanted behaviour can ensue. Therefore, EUNITE will motivate research on how to ensure the stability and robustness of adaptive systems.

Another question, which is related to *adaptive systems* is whether the combination of such technologies can give better solutions or improve the adaptive behaviour. It is well known for example that neural networks have been successfully implemented to tune fuzzy memberships and that evolutionary algorithms are increasingly used to optimise the other techniques. But, the question is to what extent these hybrid schemes improve the overall adaptive performance of the system and which combinations or architectures should have been chosen for optimal performance? This is still an open issue. By exploiting the strong assets of each method we should build more robust systems probably inspired from existing biological examples.

In robotics, for example, impressive advances in computation, communication, smart materials, and sensors bring closer to realisation the promise of building autonomous intelligent systems. Systems are needed which sense and manipulate their environment by gathering multi-modal sensor data, compressing and representing it in symbolic form, and using the representations to reason and learn about how to optimally interact with the environment. But the problem is hard because real-world environments are complex, dynamic, stochastic, and largely unknown. So, intelligent systems must accommodate massive sensory and motor uncertainty and act in real time.

Also, beyond the development of these specific methods, there is a challenge for a reexamination of traditional methods like control and statistics along with intelligent technologies with the criterion for best contribution to adaptivity. In parallel, there are areas like computational logic, where knowledge representation deals with computer modelling of knowledge with mechanised reasoning procedures that *draw inference* and *apply knowledge*. The problem of adaptivity as defined above, is also present in these type of approaches as well as in automated deduction systems (i.e. systems based on automated theorem proving techniques). But the research communities can also be united by addressing specific target areas. A raising problem for example and also an application area with great potential, specially due to the availability through the WWW and networking, is the deduction of useful knowledge from large databases. Building, developing and applying large deductive data bases is a multidisciplinary task where the research communities (informatics, statistics, computational logic, intelligent technologies) can focus and mutual benefit by their expertise. Already existing links (for example Computational Logic and Machine Learning) is a good starting point for this type of synergies.

Promising application areas of Smart Adaptive Systems

Application areas of *Smart Adaptive Systems* should not be considered in the restricted sense of *Learning Robots* that adapt to an environment (the typical problem of performing a task by self-navigating in an unknown spatial map and recognising objects and obstacles). A good example of *Smart Adaptive Systems* are the *Recommender Systems* that adapt to a Internet user needs. *Recommender Systems* are part of browsers or search engines on the web that recommend the user to look at certain documents on the web.

Recommendations are based on information about documents that the user finds interesting and on similarities between users and the documents that they find interesting. The paradigm is very general and can be applied to many kinds of information providers such as a TV guide, settings of parameters of editors, help facilities for computer users, etc.

Another promising area is the application of *Intelligent Sensors* that have increased impressively in recent years. *Intelligent Sensors* are implemented in a large number of consumer and industrial products. Today, it is difficult to imagine a high-end car without intelligent sensors. This significant leap forward in sensorics has been sustained by the development of new non-expensive, reliable sensors, as well as by the integration of innovative signal processing techniques. In many industrial products, very extensive computations are not

feasible, either because it would make the product too costly, too slow, or sometimes the limitation may simply be the power consumption, as for instance in products powered with batteries. In spite of all this limitations, many products, such as sensors, require complex algorithms for data processing. This is where soft computing finds one of its best field of applications.

Significant progress has been made in the domain of sensor validation, self-test, and automatic calibration. Despite these many success stories, important challenges are still ahead. The first one is to develop new sensors that overcome some of the limitations of existing technologies. The development of reliable *electronic noses* is an example of such a challenge. In general the great challenge is to create really *adaptive sensors* that are capable of re-tuning their parameters or re-designing depending on the situation.

Adaptive systems have found applications in domains that are tolerant to errors (for example in handwriting recognition). For many other systems (for example in process industry, transport, or security electronics) strong constraints on the degrees of liberty of the system must be set for security reasons. Validation is therefore probably another key issue that should be considered along with adaptation for future work.

For soft-computing applications in the areas of monitoring and quality in industrial production the problem of adaptivity is an important task. For example, a monitoring system successfully installed in a chemical company should be easily transferable to comparable facilities all over the world. So, the potential advantage of Intelligent Technologies to create solutions regardless of knowledge of the actual physical model of the process should be accompanied with maximum *portability* in order to minimise the installation time and costs for each new environment. For example, a good solution would be to incorporate an auto-tuning module in the delivered software and thus have no requirement for a human expert in the installation phase. There are some theoretical approaches, but few practical solutions in this field.

References/Bibliography

- [1] W.Ross Ashby, "Design for a Brain", Science Paperbacks, Chapman and Hall, London 1972.
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- [3] Spertus, E., and L. A. Stein, "A Hyperlink-Based Recomender System Written in SQL," *Workshop on Web Information and Data Management*, Washington, DC, November 1998.
- [4] Thuillard Marc., "Fuzzy wavenets: an adaptive, multiresolution, neurofuzzy learning scheme", Seventh European Congress on Intelligent Techniques and Soft Computing, Sept.13-16,1999 (Aachen), Contrib. cc6-1, CD Proc. (1999).

3. Participant list

List of Participants

Participant Role ¹	Participant number	Participant name	Participant short name	Country
C	1	ELITE Foundation – European Laboratory for Intelligent Techniques Engineering	ELITE	Germany
MB-KN	2	University of Oulu	UOULU	Finland
MB-KN	3	Aabo Akademi University	Aabo Akademi	Finland
MB-KN	4	Austrian Research Institute for Artificial Intelligence	OFAI	Austria
MB-KN	5	BAE Systems Electronics Ltd.	BAE Systems	United Kingdom
MB-KN	6	British Telecommunications plc	BT	United Kingdom
MB-KN	7	Cranfield University	Cranfield	United Kingdom
MB-KN	8	Czech Technical University in Prague	CTU FEE	Czech Republic
MB-KN	9	University of Vienna	UVI	Austria
MB-KN	10	Datamed S.A	DATAMED	Greece
MB-KN	11	De Montfort University	DeMontfort	United Kingdom
MB-KN	12	Technische Universiteit Delft	DUT	The Netherlands
MB-KN	13	Ente Nuove Tecnologie, Energia e Ambiente	ENEA	Italy
MB-KN	14	Erasmus University Rotterdam	EUR	The Netherlands
MB-KN	15	Faculty of Electrical Engineering and Computing in Zagreb	FEEC ZAGREB	Croatia
MB-KN	16	Universitat de Girona	Girona	Spain
MB-KN	17	Stichting Neurale Netwerken	SNN	The Netherlands
MB-KN	18	Helsinki University of Technology	HUT	Finland
MB-KN	19	Istituto Dalle Molle di Studi sull'Intelligenza Artificiale	IDSIA-SUPSI	Switzerland
MB-KN	20	University of Ulster at Jordanstown	University of Ulster	United Kingdom
MB-KN	21	The University of Sheffield	USFD	United Kingdom
MB-KN	22	Institut National de Recherche sur les Transports et leur Sécurité	INRETS	France
MB-KN	23	King's College London	KCL	United Kingdom
MB-KN	24	MIT - Management Intelligenter Technologien GmbH	MIT	Germany
MB-KN	25	Momatec GmbH	mmt	Germany
MB-KN	26	Université Paul Sabatier - Toulouse 3	U.P.S	France
MB-KN	27	National Technical University of Athens	ICCS/NTUA	Greece
MB-KN	28	Polish Academy of Sciences	SRI PAS	Poland
MB-KN	29	Politecnico di Bari Dipartimento di Architettura e Urbanistica & Dip. Electrical and Electronic Engineering	Poliba	Italy
MB-KN	30	University of Economics Prague	UEP	Czech Republic
MB-KN	31	Risoe National Laboratory	RISOE	Denmark
MB-KN	32	Sentient Machine Research B.V.	SENTIENT	The Netherlands
MB-KN	33	Siemens Building Technologies AG	SBT	Switzerland
MB-KN	34	Softeco Sismat SpA	SOFTECO	Italy

¹ C = Coordinator

MB-?? = Member, Key Node

MB-N = Member, Node

MB-KN	35	Spanish Council for Scientific Research	CSIC	Spain
MB-KN	36	University of the Aegean	AEGEAN	Greece
MB-KN	37	Technical University of Denmark	DTU	Denmark
MB-KN	38	Technical University of Kosice	ICT (UVT-CIT) TU Kosice	Slovak Republic
MB-KN	39	Technical University of Madrid	UPM	Spain
MB-KN	40	Technische Universität Clausthal	TU Clausthal	Germany
MB-KN	41	TSS - Transport Simulation Systems S. L.	TSS	Spain
MB-KN	42	University of Genova - Department of Biophysical and Electronic Engineering	DIBE	Italy
MB-KN	43	Universität Dortmund	UNI DO	Germany
MB-KN	44	Otto-von-Guericke Universität Magdeburg	UMD	Germany
MB-KN	45	Universitätsklinikum RWTH Aachen	KLINIKUM RWTH	Germany
MB-KN	46	Université Catholique de Louvain	UCL	Belgium
MB-KN	47	The University of Bristol	UNIVBRIS	United Kingdom
MB-KN	48	University of Chemical Technology and Metallurgy	UCTM	Bulgaria
MB-KN	49	Facultade de Ciencias e Tecnologia da Universidade de Coimbra	CISUC	Portugal
MB-KN	50	University of Crete	UoC	Greece
MB-KN	51	DaimlerChrysler AG	DCAG	Germany
MB-N	52	Rautaruukki Oyi	RR	Finland
MB-N	53	DAEDALUS Informatics Ltd.	Daedalus	Greece
MB-N	54	S.I. Vavilov State Optical Institute	SOI	Russia
MB-N	55	University of Manchester Institute of Science and Technology	UMIST	United Kingdom
MB-N	56	Fundacion LABEIN	LABEIN	Spain
MB-N	57	Start Engineering JSCo.	START	Bulgaria
MB-N	58	Hochschule für Technik, Wirtschaft und Sozialwesen Zittau/Görlitz	Zittau University	Germany
MB-N	59	University of Paris Dauphine XI	UPD	France
MB-N	60	Netherlands Energy Research Foundation	ECN	The Netherlands
MB-N	61	University of Twente	UT	The Netherlands
MB-N	62	Asociacion para el Desarrollo de la Ingeniera Conocimiento	ADIC	Spain
MB-N	63	University of Jyväskylä	JyU	Finland
MB-N	64	Coventry University	CU	United Kingdom
MB-N	65	University of Valladolid	UVA	Spain
MB-N	66	Association pour la Recherche Scientifique	ARS	France
MB-N	67	ALLOGG AB	Allogg AB	Sweden
MB-N	68	Universiteit Nyenrode Foundation	Nyenrode	The Netherlands
MB-N	69	Institut National Polytechnique de Toulouse	INPT	France
MB-N	70	Politecnico di Torino	POLITECNICO	Italy

4. Contribution to programme/key action objectives

One of the priorities in the IST Workpackage 2000 [Priorities for WP2000 (Chapter 2.4,p.8)] is "*To improve natural and personalised interactions with IST applications and services. This includes multi-lingual/multi-modal interaction systems that are adaptable to the user's preferences and lifestyle.*"

EUNITE particularly addresses the **IST 2000 - VI.2.2** action regarding "*Neuroinformatics for "living artefacts"* as in this call the aim is to "*explore new synergies between Neurosciences and Information Technologies in order to enable the construction of hardware/software "artefacts" that live and grow, i.e. artefacts that self-adapt and evolve beyond pure programming". Also EUNITE contributes to **IST 2000 - IV.3.2** about Software-Engineering for generic end-user services that has as objective to "*investigate, design and develop architectural frameworks, methods and tools to engineer adaptive, seamless and intelligent end-user services*". As already mentioned, the development of *portable* solutions in the Industrial environment is a core issue and software that uses Intelligent Technologies should be adaptive enough in order to achieve portability.*

The adaptability issue along with the use of Intelligent Technologies relates also to the other key actions of the IST Programme:

- IST 2000 - **I.2.1** action line for *Intelligent assistive systems and interfaces to compensate for functional impairments* where the focus is "*on recent advances in intelligent user-interfaces and personal devices, both capable of self-adaptation and/or easy customisation*".
- The IST 2000 **I.4.1** action line about *Intelligent environmental management, risk and emergency systems* refers also to the need of developing adaptive models in order to reduce environmental risk hazards.
- The IST 2000 - **I.5.4** *Intelligent systems for improved tourism and travel services* requests that these Intelligent Systems should "*integrate advances in dynamically customisable interfaces and support innovative business models together with the adaptation, re-use and integration of existing processes, services and dispersed information*".
- IST 2000 - **II.1.2** about *Knowledge management for eCommerce and eWork* aims to support systems that are "*highly adaptive, context-sensitive and with anticipatory knowledge management functionalities*". The "Recomender System" as already presented in the previous chapter is a typical example of such support tool.
- IST 2000 - **III.1.6** about *Virtual representations of cultural and scientific objects* has as objective to "*explore and experiment with novel ways of creating, manipulating, managing and presenting new classes of intelligent, dynamically adaptive and self-aware digital cultural objects*".

5. Membership

EUNITE is open to European participants: departments of companies in industry and trade, SMEs, as well as public institutions, scientists, and practitioners in applied research institutions, and universities who are active in the domain covered by the Network.

There are two types of nodes in the network:

- **Key Nodes²** are assigned according to the structure in groups (see Figure 1 Structure of EUNITE) and with the obligation to accomplish the tasks in the workpackages that the group is responsible. Per workpackage there is a Key Node (a leading Key Node), that will lead the effort and organise the activities. These leading Key Nodes are mentioned in each workpackage header with their participant identification number.
- **Nodes** participate in the events and receive information and services from the Network. A Node can apply to be upgraded as a Key Node and participate actively in the tasks of the workpackages.

Every institution with goals and activities which are related to EUNITE can apply to become a Node or a Key Node. All Nodes are represented by contact persons. An applying Node should complete a questionnaire related to its competencies in intelligent technologies and smart adaptive systems, a description of his institution as well as a summary of the work performed in the area of EUNITE and its choice and motivation to join a EUNITE group. Key Nodes applications and upgrades from Nodes to Key Nodes are approved by the Steering Committee taking under consideration the advice of the relevant group. As industrial representation is important, a minimum ratio of 1:3 between industry and university is planned.

Means to acquire new, additional Nodes will be:

- Events in the area organised by EUNITE or other institutions
- Publication of press releases and activities of EUNITE
- Direct communication to potential new Nodes of high relevance for EUNITE
- Actions of research partners in EUNITE to motivate their (industrial) contacts to enter the network
- Common Activities with potential nodes from close research areas like computational logic and qualitative reasoning.

Rights and Duties	Nodes	Key Nodes
Pay membership fees	NO	NO
Sign a membership agreement with ELITE -the prime contractor of EUNITE- in order to join the Network	YES	YES
Be assigned to at least one group	NO	YES
Upgrade to Key Node	YES	N/A
Eligible to elect and be elected as a member of a Group Committee or represent the Group in the Steering Committee	NO	YES
Obligation to accomplish the tasks in workpackage of your group and receive the corresponding financial support	NO	YES
Right to access EUNITE's databank system free of charge and active support by the Service Center	YES	YES
Receive discount in EUNITE related events or conferences	YES	YES
Apply to form a Task Force ³	YES	YES
Be 'active' in EUNITE by (at least one activity per year): <ul style="list-style-type: none"> • delivering reports • delivering case studies • participating in projects which have been initiated within EUNITE or are related to it • organising EUNITE events • contributing to the Newsletter • increasing industrial participation (e.g. bringing new industrial partners to EUNITE) 	YES	YES

² For the Key Nodes as in the beginning of the Network see the Participant list

³ The decision is made in the Steering Committee

The principal contractor of EUNITE and administrative coordinator is ELITE foundation represented by Karl LIEVEN.

The scientific leadership of EUNITE has the University of Oulu represented by Prof. Professor Kauko LEIVISKÄ.

All members of the Network have to sign a membership agreement with the principal contractor (ELITE).

The administration of the Network depends on committees which are formed by the Key-Nodes who participate in a common Network group.

EUNITE nodes will be assigned to one or more of three main groups (see Figure 1 Structure of EUNITE) This triangular structure aims to interconnect theory and application in an effective scheme: The **Research Theory & Development (RTD)** group will deal with theoretical aspects of the integration of Intelligent Technologies for Smart Adaptive Systems, the **Industrial Business Application (IBA)** group with the relevant applications and the **Technology Transfer and Education (TTE)** group will provide the necessary information flow and education in order to promote the area and enlarge the domain of potential users.

The **Service Center** will support the network administration and activities, including financial management. The **RTD** group will comprise the Integration of the Methods (**RTD IM**) subgroup which will explore the potential of hybrid systems and the **RTD SAS** subgroup which will foster methods for pursuing the development of Smart Adaptive Systems.

The **TTE** group will be subdivided into two groups: one for **Technology Transfer TT** and one for **Training and Education TE**.

Their role will be crucial in the information flow not only from theory to application but in both directions. Past experience has shown that there is a need for feedback from the end-user in order to direct research towards his important problems.

Finally, the **IBA** group will be divided into five sub-groups according to activity sectors of business and industry:

- IBA A** Production Industry
- IBA B** Transportation
- IBA C** Telecommunication and Multimedia
- IBA D** Human, Medical and Healthcare
- IBA E** Finance, Trade and Services

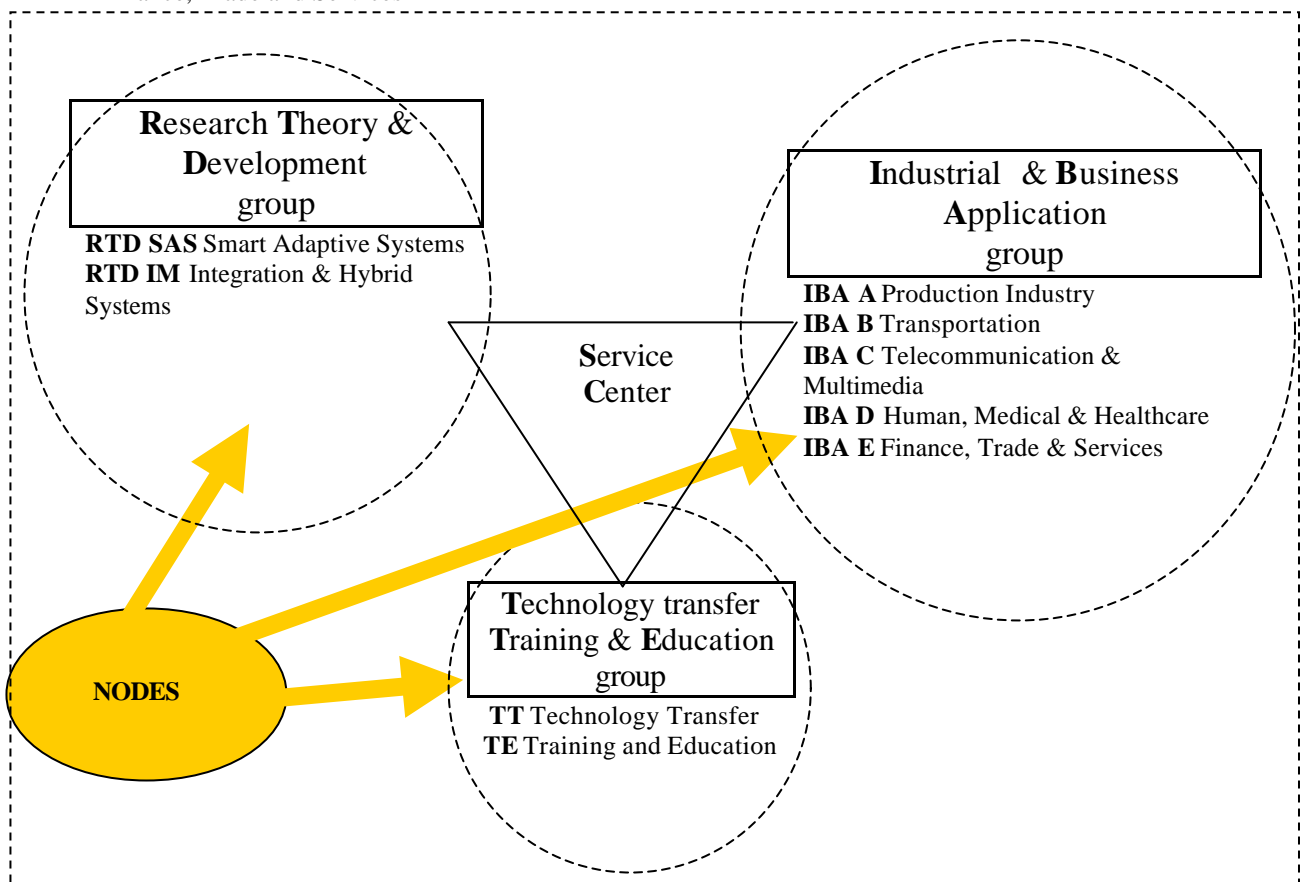


Figure 1 Structure of EUNITE

6. Community added value and contribution to EU policies

EUNITE will contribute to the following activities that are inevitably European wide and increase the competitiveness of Europe as a whole:

- help the co-operation of separate research communities and highlight research areas which are important for new applications in industry
- identify industrial applications and collect success stories and best practice information
- initiate actions to increase the skills of potential users
- develop Roadmap activities to provide the state-of-the-art and the vision for the future

As mentioned before, one objective of EUNITE is to join research communities on Intelligent Technologies that are already operating at European level. This requires European wide activity and also the results, benefits and achievements will be achieved at European level. No national organisation has the necessary critical mass for this kind of operation.

Industry knows no borders and industrial co-operation covers the whole of Europe. The main objective of EUNITE is to launch and to support new applications and disseminate "best practices" of Intelligent Technology focused on Smart Adaptive Systems within the respective European industry.

EUNITE will foster training courses and exchange of people. The courses are for students in universities as well as industrial employees. The exchange of people will be university-university and university-industry related. Also the network will focus on Open and Distance Learning (ODL) courses that can be accessible from remote European areas. The objectives are:

- to develop a teaching framework,
- to pool the resources of teaching institutions,
- to create and update databases of existing European training courses
- to develop and distribute Internet training courses
- to encourage the use of the European Credit Transfer System.

Least but not last, EUNITE will provide a Roadmap of the medium term and long term technological developments and applications in the coming years. Such deliverables can be useful to a wide range of potential users and can be used as an indicator for future directions.

7. Contribution to Community social objectives.

EUNITE will try to foster activities that develop skills in areas that influence quality of life, health and safety. Such areas have developed in the recent past and often cut across the lines of the sectors of the economy. They have turned out to be important to economic success and are attractive areas for the application of Intelligent Technologies. Examples can be found in:

- *Life Sciences*
- *Ecological and Environmental Modelling*
- *Ecological and Nuclear Risk Management*
- *Urban and Regional Planning*

The Network is expected to contribute with specific actions to skill development through educational and training activities within the project

Less favoured regions can benefit from technology transfer that will be disseminated through the network. Researcher's mobility initiated from the Network can improve social cross-fertilization and stimulate employment directly in the area of Intelligent Technologies and indirectly from the impact that such hi-tech technologies have to growth and business dexterity.

8. Economic development and S&T prospects

The network is formed around the key European players in intelligent technologies for smart adaptive systems. In particular, the structure of the IBA-groups is directed to the dissemination and exploitation of existing and well-identified results into the respective sector of economy. The IBA groups cover a wide range of applications in :

- Production Industry
- Transportation
- Telecommunication and Multimedia
- Human, Medical and Healthcare
- Finance, Trade and Services

High interaction from academia and industry through the technology transfer schemes, can help to improve competitiveness of the late one in the aforementioned areas. In addition to those activities of the IBA-committees, the electronically-supported education and training material is one of the most effective way to disseminate the technology to newcomers from application and research. Demonstrators of different solutions for various applications, which are already available by network members or which should be developed, can show the benefit and the technical excellence of the considered technology. This will be provided by the information available on the networks web page and well-prepared brochures for decision makers in industry describing potential applications and their benefits. This should lead to communication to potential customers of the “technology”, who wish to enhance their actual products/services. This would then be followed again by improvement in their competitiveness within their market.

Participation in industrial events and trade fairs as well as the organization of the annually planned symposia will promote the network activities and therefore support dissemination of technological achievements. All of these activities are open to the public and will be promoted beyond the members of the network.

Existing user groups and mailing lists in the area of the network will be included in the information flow and should be involved in the network activities (e.g. symposia, training courses, etc.).

9. Workplan

9.1 General description

The EUNITE workplan consists of seven workpackages, each of which contains a series of tasks linked to specific deliverables. Workpackage 2 is generically described for the IBA groups, but will be executed by each IBA committee separately with comparable deliverables and milestones. The appropriate key-nodes in the respective committees are responsible for the implementation of the work. In the following paragraphs these responsibilities and the content of the workpackages are described.

The work performed by the network is difficult to assign to specific phases or milestones of the project. Most of the work will be continuously over the duration of the project. Nevertheless, for management and progress review of the project, an attempt to represent the expected achievements of some key deliverables is made below. Most of the project tasks do not provide a final deliverable, as in a report, but progress should be seen as ongoing over a three year period and all the work performed per year will be summarised in an annual progress report, where all the activities of the network will be described.

9.2 Workpackage list

Work-package No	Workpackage title	Leading key nodes No	Person - months	Start month	End month	Phase	Deliverable No
WP 1.1	Tasks for RTD SAS	4	12	1	36	N/A	D1.1-1- D1.1-5
WP 1.2	Tasks for IM RTD	6	12	1	36	N/A	D1.2-1- D1.2-6
WP 2	Tasks for IBA	33, 25, 6, 21, 3	15	1	36	N/A	D2-1 – D2-4
WP 3	Technology Transfer	40	8	1	36	N/A	D3-1 – D3-5
WP 4	Training & Education	37	12	1	36	N/A	D4-1 – D4-6
WP 5	Roadmap	2	15	1	36	N/A	D5
WP 6	Steering Committee	2	6	1	36	N/A	D6-1 – D6-3
WP 7	Support Services	1	54	1	36	N/A	D7-1 – D7-5

9.3 Workpackage descriptions

Workpackage 1: Tasks for the Research Theory and Development Group on Smart Adaptive Systems (RTD SAS)

Leading Key node: Austrian Research Institute for Artificial Intelligence (Austria) represented by Dr. Georg DORFFNER.

Workpackage number	1.1					
Participant number¹:	4	11	16	19	28	42

Objectives

In general to advance theory on Smart Adaptive Systems. Particularly:

- to focus research interest on finding solutions for adaptive systems that can perform even in the presence of non-stationary environments
- to improve *portability* of Intelligent Technologies in other environments
- to identify novel directions of research on algorithms and methods with respect to their applicability in industry
- to promote co-operation and fruitful interchange of ideas and lift barriers and isolation among all Intelligent Technology areas through common actions.

Description of work

1. Contribution to the network's Roadmap

The RTD SAS group is responsible to provide contributions for the Network's Roadmap. Specifically, it should mainly contribute to the parts referring to the state-of-the-art and expected new directions in Smart Adaptive Systems. The group should monitor the latest evolutions and update the relevant parts of the Roadmap yearly.

2. Conferences-Symposia-Workshops

The RTD SAS group will be responsible for organising scientific events (i.e. conferences, symposia, workshops) which promote excellence in its domain. Furthermore, interdisciplinary events involving more than one scientific area have an important role in EUNITE as they will be used as fora for co-operation and interchange of new ideas.

3. Contribution to scientific e-archives

The RTD SAS group has an obligation to create and enrich the e-archives of EUNITE relating to its scientific excellence. In particular, the group has to enrich and help categorising citations in bibliographical data base and provide input for creating an electronic archive of scientific papers. Also, each RTD group is responsible to enrich and update its virtual electronic area in EUNITE WWW site by submitting relevant material.

4. Contribution to Dictionary-Definitions

RTD groups should contribute to the creation of the scientific dictionary-definitions that will be created by the TTE group. Particularly, they should contribute definitions and examples specially on ambiguous terms spanning into other Intelligent Technologies.

5. Editing and dissemination of scientific excellence via publications

EUNITE should exploit the potential for disseminating the scientific excellence in the RTD committees by publishing in both hardcopy (book) and electronic form (WWW) the most important contributions that occurred in the particular events. Part or the whole of these publications can be material from the Roadmap or from the annual activities of EUNITE (conferences, symposia etc.)

6. Scientific co-authoring

The RTD groups, as they are mostly research-oriented, are the ideal environment where researchers can author joint articles. An effective way of disseminating this joint activity can be by contributing to the scientific e-archives.

7. Annual executive summaries

Brainstorm meetings will be organised concerning the important issues that the committee has identified in scientific problems that are related to the group. During these brainstorm meetings the participants should identify, describe and diffuse (in public annual reports) the open scientific problems along with actions that the group, or even the Network as a body, should undertake for solving them by using its scientific potential. These reports will be used at the same time

¹ The participant number of leading key-node of the workpackage is printed in bold.

to monitor the achievements and contribution of the committee at a scientific level.

Deliverables

- *Conferences-Symposia-Workshops: organise at least one event per annum*
- *Roadmap contribution: annual input for the state-of-the-art and the expected new directions in the area of Smart Adaptive Systems*
- *Scientific e-archives contribution: papers (in electronic version for facilitating dissemination) and citations relevant to the RTD committee area of expertise*
- *Contribution to Dictionary-Definitions: on demand by the TTE committee*
- *Publications: An annual publication of the major theoretical contributions of the RTD SAS events*
- *An annual executive summary of the committee's achievements*

Milestones and expected result

Month 3:	Call for publications.
Month 6:	First output for Roadmap.
Month 9:	Organise an event (Conference, Symposium, Workshop).
Month 12:	Deliver annual draft for Roadmap; contribute papers-citations area for the WWW site; deliver annual executive summary.
Month 15:	Hardcopy and WWW with major publications; call for papers for the next issue.
Month 18:	Organise an event (Conference, Symposium, Workshop).
Month 20:	Deliver input for dictionary.
Month 21:	Organise an event; Hardcopy and WWW Publication; Call for next publications.
Month 24:	Deliver annual update for Roadmap; enrich papers-citations area in the WWW site; deliver annual executive summary.
Month 30:	Organise an interdisciplinary event.
Month 33:	Hardcopy and WWW with major publications; Call for next publications; enrich papers-citations area in the WWW site.
Month 34:	Deliver contribution for the final draft for Roadmap; Hardcopy and WWW with major publications.
Month 36:	Self assessment report; deliver annual executive summary.

**Workpackage 1: Tasks for the Research Theory & Development group on Integration of Methods
(RTD IM)**

Leading Key node: Intelligent System Research Group from British Telecommunications Labs (United Kingdom) represented by Dr. Detlef NAUCK

Workpackage number	1.2						
Participant number¹:	6	15	26,27	35	48	49	62

Objectives

- To deliver a common platform to discuss and exchange research results and to define a common terminology.
- To develop a methodology for optimal selection of techniques for problem solving.
- To advance hybrid approaches and reveal possible new research topics or potential synergies with closely related areas like qualitative reasoning and computational logic in the existing scientific domains.
- To focus research interest on finding solutions in the problem of adaptivity and portability of Intelligent Systems
- To stimulate cross-talk between the communities.

Description of work

The work is a continuation of work started and performed in the previous Cluster of Networks of Excellence namely CoIL for the technologies covered by this network (Machine learning, Neural Networks, Fuzzy Logic, Evolutionary Computing).

1. Contribution to the Roadmap

[Similar to task described in workpackage 1.1]

This group is mainly responsible for providing the part of the Roadmap dealing with hybrid approaches and methods of selecting and comparing techniques. It will also explore and report the impact of advances in other areas (statistics, mathematics, computational logic) and suggest better ways of collaboration. Specifically it should provide indices (if existing) on the added value that hybrid systems deliver in the issues of adaptivity and portability.

2. Joint case studies

A number of applications (delivered by TT group) will be selected and nodes representing different communities of Intelligent Technologies (i.e. Fuzzy Systems, Neural Nets, Machine Learning Evolutionary Computing) and closely related scientific areas (i.e. qualitative reasoning and computational logic) will deliver solutions. In joint meetings, a presentation and discussion of the solution procedure will be produced as a major basis for the methodology and will be published in reports. The core issues again will be the quest for real adaptive systems that survive severe environment at changes.

3. "Best Methodology" task force

The group will initiate a task force in order to provide "best practice guideline for selection of techniques" and "best combination of methods in terms of achieving adaptivity"

4. Contribution to Dictionary-Definitions (terminology)

[Similar to task described in workpackage 1.1]

5. Editing and dissemination of scientific excellence via publications

[Similar to task described in workpackage 1.1 Task]

6. Annual executive summaries

[Similar to task described in workpackage 1.1 Task]

7. Communication and education

The committee will be responsible for organising events (i.e. conferences, symposia, workshops) and interdisciplinary working groups that promote excellence in its domain. Furthermore, interdisciplinary events involving more than one scientific area have an important role in EUNITE as they will be used as fora for cooperation and interchange of new ideas. In collaboration with the TE committee a plan (and if needed educational task forces) will be initiated in order to improve the knowledge of each member of the network for the areas in which it has no expertise.

¹ The participant number of leading key-node of the workpackage is printed in bold.

8. *Best paper award*

The IM RTD will be responsible for a yearly award to the best paper integrating the methods

Deliverables

[As in workpackage 1.1]

- *Annual Joint Case Studies Report*
- *Guidelines for best methodology*

Milestones and expected result

[As in workpackage 1.1]

Month 12: Deliver annual Joint Case study report
Month 24: Deliver annual Joint Case study report; first draft for Guidelines for best methodology
Month 36: Deliver annual Joint Case study report; final Guidelines for best methodology

Workpackage 2: Tasks for the Industrial & Business Application Groups

Each IBA group will have similar tasks focusing of course in its area of expertise. The Leading Key nodes are:

IBA A Production Industry, Siemens Building Technologies, Cerberus Division, Switzerland Dr. Marc THUILLARD

IBA B Transportation, Momatec GmbH, Germany, Dr. Heribert KIRSCHFINK

IBA C Telecommunication and Multimedia, British Telecom Advanced Communications Research, UK, Dr. Behnam AZVINE

IBA D Human, Medical and Healthcare, University of Sheffield, UK, Professor Derek Arthur LINKENS

IBA E Finance, Trade and Services, Abo Akademi University, Finland, Prof. Christer CARLSSON,

Workpackage number	2 (common for all IBA groups)						
Participant number¹ IBA A	2	8	17	31	33	46	47
Participant number¹ IBA B	7	18	22	25	34	39	41
Participant number¹ IBA C	6	20	27	50			
Participant number¹ IBA D	9	10	21	36	45		
Participant number¹ IBA E	1	3	14	24	30	32	51

Objectives

- To direct researchers towards unresolved practical problems from the user's point of view with special focus on the important aspects of adaptive systems.
- To reveal the potential of Intelligent Technology techniques in resolving industrial and business problems
- To give practical information to end-users and group them according to their interest through common actions and consortia

Description of work

The segmentation into applications according to sectors of economy provides each IBA group with a common working environment dedicated to solving similar application problems. This segmentation is expected to be more attractive for industrial nodes as they identify better with a specific sector-focused group than in a theory-oriented one.

1. Conferences-Symposia-Workshops

Each IBA group will be responsible for organising events (i.e. conferences, symposia, workshops) which present well established or promising solutions in its domain and to set up interdisciplinary working groups that focus on specific problems and create recommendations for solutions. The output of these working groups will be public (WWW). These events should be strongly oriented to end-users giving a clear outcome to exploitation aspects. On the other hand they should gather from the end-users the important unresolved problems and make the scientific community aware of them.

2. Contribution to the Roadmap

The IBA groups are responsible to provide the main contribution for the part of the Roadmap dealing with applications of Smart Adaptive Systems based on Intelligent Technologies. In particular, they should compile comprehensive lists of industrial applications with specific needs for smart adaptivity. This will result in a systematic overview of adaptivity as needed by industry.

3. Monitoring of smart adaptive systems in use

The task of a special monitoring group will be to collect experiences and results from smart adaptive systems actually in use, based on a selected list of case studies provided by industrial nodes. The goal will be to arrive at guidelines with respect to the successes, limits and weaknesses of existing adaptive approaches.

4. Special action with respect to SMEs

Due to the high risks behind research on smart adaptive systems, a special focus must be put on SMEs and their potential to make use of the expected research results. Therefore, IBAs should focus on the facilities and capabilities of SME to invest in high-risk research on adaptive systems, and compile guidelines with respect to future technology transfer.

5. Help young researchers to get connected with the market

The IBA groups should encourage young researchers involved in Intelligent Technologies who wish to focus on Smart Adaptive Systems and Hybrid Applications to get involved in industrial and business projects and/or find vacant

¹ The participant number of leading key-node of the workpackage is printed in bold.

business or industrial posts. For this reason they should establish a "Job market" where vacant posts for young researchers will be posted. Also, young researchers involved already in projects using Intelligent Technologies should be identified (with their CVs and brief descriptions of their contribution in the project) so that potential employers can identify, contact and recruit young researchers.

Deliverables

- *Conferences-Symposia-Workshops: at least one event per committee and per annum; at least 1/4 of actions to address special issues for SMEs; public reports of the working groups*
- *Roadmap contribution: one deliverable for the application part*
- *Young researchers promotion: "Job market" data base*
- *Publications: Contribution to the annual publication with the major application and "success stories" of EUNITE events.*

Milestones and expected result

Month 6:	Give first output for Roadmap;
Month 9 :	Organise an event
Month 12:	Deliver annual draft for Roadmap
Month 15:	Input for publications
Month 18:	Build "Job market data base"
Month 21:	Organise an event
Month 24:	Deliver annual draft for Roadmap
Month 30:	Organise an event
Month 33:	Job Market Database
Month 36:	Deliver annual draft for Roadmap

Technology Transfer and Technology and Education group activities are separated in two workpackages.

Workpackage 3: Technology Transfer

Leading Key node: Technische Universität Clausthal, represented by Dr. Ing. Jens STRACKELJAN

Workpackage number	3				
Participant number¹:	5	40	38	23	13

Objectives

- To support potential users of Intelligent Technologies, promote Smart Adaptive Systems and motivate nodes to join the network.
- To facilitate the communication between the RTD and IBA groups
- To raise awareness among end-users with respect to the potential, limits and open questions of existing smart adaptive systems
- To initiate the monitoring of case studies involving adaptive solutions (as needed in the IBA committee)
- To develop strategies to overcome the hurdles based on the high risks of smart adaptive systems, which currently make their application difficult
- To help nodes with respect to patenting and benchmarking technologies for adaptive systems
- To promote success stories of portable applications and enlarge the potential user base

Description of work

1. Develop strategy and actions for missing links in the community

The committee should consider actions that will promote the internal (in the Network) and external (between the network and the society) technology transfer. It should deliver a strategy for promoting EUNITE's scientific excellence to the end-users and an efficient way to deliver problems from the end-users to the scientific community. An example of such actions is the development of a "Problem Solving Process" framework where the group will try to codify the practical procedure for solving a real problem and then stress the interest of the scientific and the end-users community to the weak and ill-defined tasks. The focus again will be to identifying those tasks that influence portability and enhance adaptivity. Also, later on the members of the NoE can decide efficient ways (for example in a virtual space in WWW) to "sell" competency to the ones that are interested to "buy" services in the field of Intelligent Technologies and Smart Adaptive Systems.

2. Patent guidelines-Patent Service

With the background of about 15,000 granted European patents on "software related inventions", most of them held by non European global players from the US or Japan, it is necessary to support small and medium size European companies in this important field. Many of them are high technology oriented using Intelligent Technologies for software developments or related applications, but don't have enough information and legal advice in the patentability of software inventions under national and European law. The Network will establish a set of patent guidelines with open access for all nodes. In particular, entrepreneurs should profit by this TTE activity. In a second step the network will offer with the help of a patent attorney an individual free of charge first advice for interested companies and developers. In addition, the guidelines will be updated via the use of current examples with related comments.

3. Benchmarking

The Network will organise competitions to raise awareness among problem holders of the existence of possible solutions and the community of solution providers by providing illustrative solutions to particular problems. Besides its external objectives, the Network will raise awareness of the Network community and its techniques among members of the network and permits comparison and benchmarking of different techniques on particular real-world problems. Typical problems that deal with unstable environments will be sent to the interested network nodes seeking solutions with adaptive behaviour. Besides the technology transfer, the competitions are also a useful addition to the educational objectives of TTE.

4. Feasibility studies - case studies

An important technology transfer tool is the dissemination of feasibility and case studies. The group should select and categorise representative cases and make them public in order to awaken the interest of potential industrial users.

Deliverables

- A practical "Problem Solving" guideline
- A set of patent guidelines for inventions in Intelligent Technologies on WWW which will contain current patent

¹ The participant number of leading key-node of the workpackage is printed in bold.

examples with related comments.

- An individual free-of-charge first advice for interested companies and developers
- Organisation of two competitions and the related events for presentation and publication.
- Participation in the annual EUNITE symposium for-face-to face information exchange.
- Publishing of at least 5 reports and case studies per year.

Milestones and expected result

Month 3:	publishing of the first report, meeting for strategies to attract additional nodes
Month 6:	first draft of the patent guidelines, definition of a competition task
Month 6:	support the organisation of a joint RTD and IBA workshop
Month 9:	announce competition, collect relevant patent examples, case study
Month 12:	presentation meeting of the first version of patent guidelines
Month 15:	presentation of the first final version of patent guidelines on the WEB. first draft of "Problem Solving Process" guideline
Month 15:	organisation of a workshop for the presentation of the competition results
Month 21:	start with the patent advice service, update of patent guidelines
Month 24:	organisation of a workshop on experiences with guidelines and advice service
Month 24:	organisation of the second competition
Month 30:	organisation of a workshop for the presentation of the competition results
Month 30:	establish the final version of patent guidelines and patent advice service
Month 33:	problem solving process guideline

We expect about 50 and 100 participants in both competitions and a number of 20 to 30 companies, researchers and entrepreneurs using our patent advice service during the first two years.

Workpackage 4: Training and Education
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Leading Key node: Technical University of Denmark, Department of Automation, represented by Prof. Jan JANTZEN

Workpackage number	4				
Participant number¹:	12	37	29	43	44

Objectives

- To coordinate the educational activities of the network.
- To represent the network externally in education related matters.
- To implement products and services that serve the network nodes and the general public.

Description of work

1. *The TTE server*

A common server for knowledge and education will be established. This is to facilitate information searches and provide overviews of, say, courses offered within the network. The server will contain educational material, as well as more volatile information (news, calendar).

2. *Learning Center*

Many EUNITE nodes are universities and higher educational institutions. This is the basis for building a learning center offering demonstrators, tutorials, courses, and a library of lecture notes. The learning center will be an electronic service operating from the TTE server; physical presence of the learner is not necessarily required. There will be at least one course which is accredited in the European Credit Transfer System. Members of the TTE committee will also travel to the home site of a class of students (university or company) to deliver lectures, utilising the products available on the TTE server. A course can be delivered in full, or in part and completed afterwards on the Internet. There will be a Web-based examination.

3. *Didactic methods*

In order to evaluate web-based learning methods, a didactic study will be performed. The integration of the Web influences the course contents, didactic method, and examination method. New didactic methods and organisation of the learning are required. Partnerships will be established between network nodes to perform experiments and develop web-based methods for learning and competence development. Experiences will be collected, processed and published in an educational journal.

4. *Dictionary*

Language can be a significant barrier for professionals wishing to exploit the potential of others' work. An electronic dictionary will be developed, containing translations of key terms of the profession in the languages of the network nodes (or at least German, English, Italian, French, and Danish). This will help to determine a basic terminology in each language.

5. *Definition list*

Another barrier for the transfer of knowledge is terminology. The committee will propose a list of key definitions of the subject area in English. It will be a working document, which network members and students can influence by suggesting additional or alternative definitions.

Deliverables

The committee will offer services and products that can be used by students as well as teachers delivering education.

- *Educational services:* lectures and courses.
- *Educational products:* demonstrators, tutorials, textbook material, guidelines, and a journal paper.

Milestones and expected result

Month 3:	hardware, systems software, and up-and-running didactic software
Month 12:	announce the educational services
Month 21:	announce electronic dictionary

¹ The participant number of leading key-node of the workpackage is printed in bold.

Month 30:	announce definition list, benchmark problems, and guidelines
Month 36:	publish didactic study

An expected outcome is to demonstrate examples of good practice. A goal is to issue 100 course certificates to students as a result of our course activities.

Workpackage 5: Roadmap

The Roadmap Workpackage will be supervised by Professor Kauko LEIVISKÄ, from the University of Oulu, Finland, Department of Process Engineering, Control Engineering Laboratory, with close assistance from the prime contractor of EUNITE, ELITE, Germany, represented by Dr. Georgios TSELENTIS. All members of the network are expected to contribute to this action.

Workpackage number	5		
Participant number¹:	2	1	all

Objectives

- To reflect the global vision of the network, as an entity, on the development of technology, markets, education and the way to influence it.
- To focus research interest on finding solutions for important problems related to adaptive systems and which can significantly influence the quality of everyday life
- To recommend possible target areas and technological challenges for research.
- To analyse the business trends on a global scale from the viewpoint of the future scope and impact of the integration of Intelligent Technologies and the applications of Smart Adaptive Systems.
- To provide also a practical guideline for the non-expert which he can consult regarding what Intelligent Technology (or combination of them) is appropriate for his problem.

Description of work

The Roadmap document is a collaborative work of EUNITE.

Each committee should provide the part that is relevant to its expertise. Especially:

1. Research Challenges

The RTD committees should deliver for this part of the Roadmap a brief “state of the art” for the Intelligent Technologies providing links to recent bibliography and publications. This should describe what are the current theoretical issues that the scientific community is engaged and justify the reasons for it. Most important in this part, however, is to point towards new directions of science that are believed to be important and will have a significant impact on the society.

2. Technology penetration

The IBA committees should mainly contribute to this part of the Roadmap. This part should demonstrate important applications of Smart Adaptive Systems that are already established in the market as well as innovative ones recently appearing but with great potential. Special care should be given in the part of the Roadmap describing applications that have impact in everyday life problems as described in actions of the VFP. Also, an important issue is to describe open problems seeking solutions and thus guide theoreticians towards this direction.

3. Education

Mainly responsible for this part is the TE committee. The objective in this part is to observe what is being taught in higher education concerning Computational Intelligence and examine if possible, whether it is in accordance with the needs of society and the requirements of the market, suggesting guidelines for necessary changes in the training programs.

4. Dissemination/communication

Mainly responsible for this part is the TT committee. This part should describe who are the major players and what are the major events in Intelligent Technologies by clustering them according to their area of expertise. Also, it should give a practical guide on available software tools by describing the potential solutions and practical or theoretical problems they can confront. At the end, bibliography sources should be given so that the reader can look for further information.

Inside all Roadmap parts there should also be a comparative analysis of the corresponding progress made by the leading non-European workers in Intelligent Technologies, especially in US and Japan.

Deliverable

- *Roadmap document (in both paper and electronic versions):* An annual deliverable with a clear content structure meeting the objectives

¹ The participant number of leading key-node of the workpackage is printed in bold.

Milestones and expected result

Month 6:	First input to Roadmap from the committees
Month 9:	Editing and feedback with the committees
Month 15:	Deliver annual draft for Roadmap
before month 18:	Editing and feedback from EUNITE
Month 18:	1 st Roadmap deliverable; second input to Roadmap from the committees
Month 21 :	Editing and feedback with the committees
Month 27:	Deliver annual draft for Roadmap
before month 30:	Editing and feedback from EUNITE
Month 30:	2 nd Roadmap deliverable; Third input to Roadmap from the committees concerning updates
before month 36:	Editing and feedback from EUNITE
Month 36:	Updated version of 2 nd Roadmap deliverable

Workpackage 6: Steering Committee

This Workpackage deals with the administration from the Steering Committee and the leader is Professor Kauko LEIVISKÄ, from the University of Oulu, Finland, supported by the Leading Key nodes of the other Workpackages. The main activities are the co-ordination, monitoring, assessment and the strategy of the network activities.

Workpackage number	6				
Participant number¹:	2	1, 37, 40,	4, 21, 3,	33, 25,	6 (Azvine), 6 (Nauck)

Objectives

- To approve the tentative budget based on scheduled actions suggested by the committees and task forces.
- To co-ordinate the activities of the whole network.
- To assess the activities performed by the nodes
- Especially to co-ordinate and provide guidance for Roadmap activity.
- To organise the annual symposium.
- To initiate activities in new directions (e.g. life sciences, environmental).
- To initiate activities in associated countries.
- To assure co-operation with other networks.

Description of work

The scientific manager and the Steering Committee will be responsible for the overall co-ordination of EUNITE. They will also assess the network activities and assign, when needed, specific tasks not anticipated in the Network's work-plan.

1. Overall co-ordination

Co-ordination and design activities are mainly decided in Steering Committee meetings that will take place three times each year. Committee Chairpersons are represented in the Steering Committee and it is also possible to invite specialists (e.g. people responsible for task forces) to participate. Committees or the Service Center will carry out the decisions of the Steering Committee.

2. Roadmap activity

The scientific manager and the Steering Committee will supervise and guide the Roadmap activity and decide on actions promoting its distribution and further use.

3. Annual Symposia

The Steering Committee supervises the arrangements for the annual symposium: It takes care of timing of these Symposia so that other joint events (committee meetings, publication of task force results, etc.) are possible at the same event.

4. Discussing new directions

Task forces will be approved to facilitate the usage of intelligent technology in new areas (e.g. life sciences, environmental questions, regional and urban planning). Task Forces will provide the Steering Committee with reports concerning the state-of-the-art of research and applications on these areas, training needs and further directions for EUNITE operations on each new area in question. This operation will continue during the whole period and also provide material for Roadmap.

5. Relations with associated and third countries

At the commencement of EUNITE, a strategy will be formulated on how Nodes from the EU associated States will be encouraged to join EUNITE. Also, the committee should examine collaboration with other (non-EU) third countries. The strategy and the necessary actions are decided by the Steering Committee.

6. Co-operation with other networks and research communities

Decisions on arranging common workshops and symposiums with other networks (e.g. Evolutionary Computing) and co-operation in scientific and application areas, and most important, in Roadmap activities will be done in annual meetings of co-ordinators of separate networks. At practical level, co-operation in communications, training activities and competitions will be consolidated. Also, actions for acquiring new nodes from close research areas like qualitative

¹ The participant number of leading key-node of the workpackage is printed in bold.

reasoning and computational logic will be initiated by the Steering committee in order to improve interaction and cross-fertilise the research communities.

7. Assessment and evaluation of the progress of the network

The Steering Committee should carefully monitor and assess the activities performed by the groups. This assessment will be based on assessment reports that the nodes are obliged to deliver per activity. Furthermore, the Steering Committee should monitor and assess the advancement of the network as an organisation based on the aims and targets set in Chapter 2. Project objectives and new directions that can emerge during the life of the network. This evaluation will take place yearly and conclude the annual assessment report submitted to the EC.

Deliverables

- *Project presentation*
- *Conferences-Symposia-Workshops general co-ordination and assessment*
- *Roadmap supervision and assessment*
- *Task Force supervision and assessment*
- *Final Network activities assessment*

Milestones and expected result

Month 3	Project presentation
Month 3/7/11/15/19/23/27/31/35:	Steering Committee meetings
Month 12:	Strategy for "third countries"
Month 3/15/27 :	Meetings with co-ordinators of other networks
Month 6/18/33:	Task Force reports
Month 12/24/36:	Network assessment report

See also milestones for "Symposia" in other workpackages and the "Roadmap" workpackage

Workpackage 7: Support Services

This Workpackage deals with the support that the Service Center located at ELITE -the prime contractor represented by Karl LIEVEN- will provide to all members of the Network.

Workpackage number	7
Start date or starting event:	Month 0
Participant number:	1

Objectives

- To provide a central contact point
- To ensure a good communication infrastructure which constantly offers access to many kinds of information
- To assist the administration of EUNITE.

Description of work

In this network, the Service Center, which will be located at the ELITE Foundation, will be the central information source. The Service Center will be responsible for the administration of the Network and for planning, implementing and maintaining its communication infrastructure. To enable an efficient and network-wide exchange of information, various web-based and paper-based means will be used. To achieve the objectives of the Network the Service Center will be responsible for different tasks that will be ongoing over the whole duration of the project and will be supported in a daily basis. They are structured according to so-called 'general services' and 'special tasks'. A detailed description can be found below:

1. General Purpose Services

The Service Center will serve as the **central administration contact point** for the persons strongly involved in the network (Key Nodes, committee chairpersons, etc.) and as the **central communication contact point** for all kinds of enquiries regarding the network and its areas. The most important general purpose services are the following:

Administration of the network

- General administration (membership handling, etc.)
- Financial administration
- Organisation/Preparation of Steering Committee Meetings
- Assistance in the organisation of meetings and events which are, in their content, organised by the different committees (booking of venue and accommodation, invitation, design and printing of flyers, mailings, registration, production of proceedings, assistance on site, etc.)
- General handling of other committee activities which are, in their content, organised by the different committees (design of brochures, mailings, etc.)
- Dealing with administrative enquiries by the members of the network

Information infrastructure

- Dealing with general enquiries (phone, fax, e-mail, direct & via Web registration forms).
- Promotion of the Network (acquisition of new members by different activities, i.e. mailings, meetings, exhibitions, etc.)
- Circulation of information to members (internal and external information)
- Providing information on existing applications and products
- Delivering case studies and state-of-the-art reports
- Disseminating of research results
- Giving information on available literature
- Informing about events (conferences, symposia, summer schools and industrial events)
- Providing useful contacts (researchers, consultants and other experts)
- Obtaining and maintaining up-to-date information about members and their activities

Co-operation

- Contact with other projects and institutions active in the specialisms of the network
- General organisation of co-operations with other institutions, projects and networks
- Circulation of information to European universities and industries

Promotion

- Edition and distribution of press releases
- Participation in conferences and exhibitions
- Acquisition of new Nodes

2. *WWW and databases*

A **WWW homepage** will be established and maintained. It will contain general and all other available information on the network and its activities. In detail, the WWW will have the following content and structure:

a) General Part

In this section, interested persons will be introduced to the network, get an overview of the different activities, and find the necessary information for joining EUNITE.

b) Administrative Part

This part will provide useful information for the Key Nodes and chairpersons of the network. For example, it will contain templates for preparing presentations, information on financial administration, etc.

c) Resources Database (Members, Events, and Literature)

A resources database will be implemented on the WWW to provide information on members, useful contacts and their activities. All Nodes of the Network will be asked to complete a questionnaire in this database before they become a member of the network. Additionally, it will contain a database with information on all events relating to the topics of the Network, as well as a literature database. The basis for this literature database will be CITE, which was implemented in ERUDIT.

d) Interactive Part

The interactive part will be structured according to different committees and task forces. It will contain all relevant information on the respective area and its activities, i.e. general information, on-line demonstrations, case studies, conference announcements, job offers, etc. For each area an '**electronic group**' will be formed to provide a forum for the exchange of all available information and knowledge between the Nodes. To make the communication of one group as simple as possible, the nodes will be able to send and receive emails, schedule meetings, share files or have 'virtual' meetings. Each electronic group will have the following components: mailing lists, calendar, documents, and a so-called "blackboard" to present and discuss topics virtually on the respective areas.

The implementation of the homepage will be carried out over the first quarter by the web assistant at the Service Center. Maintenance and continuous updating will be ongoing over the three years to provide useful information. New features, e.g. on-line demonstrations, case studies, conference announcements and job offers will be added continuously.

3. *Newsletter*

The Newsletter will be published three times a year to disseminate information on new applications and research results, technology transfer and other activities of the network. The Newsletter will be available electronically on the Internet and in paper form.

4. *Symposium*

A symposium on new applications and research results will be organized yearly by the Service Center in co-operation with the TTE, the RTD, and the IBA committees.

5. *CD-ROM*

Once a year a CD-ROM will be produced in connection with the yearly symposium. This CD-ROM will contain the proceedings of the symposium as well as the resources database.

Deliverables

- WWW pages including general information, resources database (members, events, and literature), administrative database and an interactive part
- CD-ROMs
- Newsletters

Milestones and expected result*1. General Services*

- Month 0 - 36: Most of the tasks described under 1. General Services will be ongoing over the whole duration of the network or are dependent on the activities (events, etc.) organised by the different committees of the network.
- Month 12/24/36: Editing of the periodic progress reports and the financial reports

2. WWW and databases

- Month 0 - 3: Collection of general information on the Network; Design and implementation of the WWW homepage
- Month 3: Release of the first draft of the WWW homepage including general information and the administrative part
- Month 3 - 9: Collection of information for the resources and events database, design and implementation
- Month 9: Release of the resources and events database
- Month 0 - 36: Maintenance and continuous updating of the WWW pages and the database

3. Newsletter

- Month 6/10/14/18/
22 /26/30/34: Publication of the Newsletters

4. Symposium

- Month 9/21/33: Organisation of the annual symposium

5. CD-ROM

- Month 9/21/33: CD-ROM with the proceedings of the symposium as well as the resources database

9.4 Deliverables list

The following list describes all the deliverables of EUNITE per committee and activity planned. For the activities which involve more than one committee (i.e. roadmap, e-archives, etc.) intermediate deliverables will be for internal use. Only the deliverables in **bold** are official deliverables to the commission. All the other deliverables will be integrated in the periodic progress report. This periodic progress report will be an exhaustive description of all the activities per year of the project and will be the main deliverable.

Deliverables list

Del. no.	Deliverable name	WP no.	Lead participant	Estimated person-months	Del. type ⁴	Security ⁵	Delivery ⁶ (proj. month)
D1.1-1	EUNITE-Roadmap input	WP1.1	4	3	R	RE	6, 12, 24, 34
D1.1-2	Scientific e-archives	WP1.1	4	3	O	RE	12, 24, 36
D1.1-3	Dictionary-Thesaurus-Definitions	WP1.1	4	3	O	RE	20
D1.1-4	Executive summaries	WP1.1	4	2	R	PU	12, 24, 36
D1.1-5	Proceedings/Minutes of meetings	WP1.1	4	1	R	PU	9, 18, 21, 30
D1.2-1	EUNITE-Roadmap input	WP1.2	6	3	R	RE	6, 12, 24, 34
D1.2-2	Scientific e-archives	WP1.2	6	2	O	RE	12, 24, 36
D1.2-3	Dictionary-Thesaurus-Definitions	WP1.2	6	2	O	RE	20
D1.2-4	Executive summaries	WP1.2	6	2	R	PU	12, 24, 36
D1.2-5	Proceedings/Minutes of meetings	WP1.2	6	1	R	PU	9, 18, 21, 30
D1.2-6	Guidelines for best methodology	WP1.2	6	2	R	PU	24, 36
D2-1	EUNITE-Roadmap input	WP2	33, 25, 6, 21, 3	1 (5)	R	RE	6, 12, 24, 36

⁴ **R** = Report, **P** = Prototype, **D** = Demonstrator, **O** = Other

⁵ **PU** = Public

PP = Restricted to other programme participants (including the Commission Services).

RE = Restricted to a group specified by the consortium (including the Commission Services).

CO = Confidential, only for members of the consortium (including the Commission Services).

⁶ Including intermediate stage of the deliverable

D2-2	Proceedings/Minutes of meetings	WP2	33, 25, 6, 21, 3	0,5 (2,5)	R	PU	9, 21, 30
D2-3	Input for Job market data base	WP2	33, 25, 6, 21, 3	0,5 (2,5)	R	RE	18, 33
D3-1	Guidelines for communication policy and identification of target groups	WP3	40	1	R	RE	3
D3-2	Patent guideline and advice service	WP3	40	3	R/O	PU	6, 15, 21, 30
D3-3	EUNITE Competition	WP3	40	1	O	PU	15, 30
D3-4	Guideline Problem solving process	WP3	40	2	R	PU	15, 33
D4-1	TTE server set-up	WP4	37	0,3	O	RE	3
D4-2	Learning Center	WP4	37	8	D	PU	12
D4-3	Electronic dictionary	WP4	37	2	O	PU	21
D4-4	Definition list	WP4	37	0,3	O	PU	30
D4-5	Publication didactic study	WP4	37	0,4	R	PU	36
D5	Roadmap	WP5	2	15	R	RE	9, 15, 27, 36
D6-1	Task Force reports	WP6	2	5	O	PU	6, 18, 33
D6-2	Report on common activities with other networks	WP6	2	0,5	O	RE	3, 15, 27
D6-3	Report on internal Network assessment	WP6	2	0,5	R	CO	12, 24, 36
D6-4	Project presentation	WP6	2	0	D	PU	3
D7-1	Newsletter	WP7	1	4	O	PU	6, 10, 14, 18, 22, 26, 30, 34
D7-2	WWW site	WP7	1	12	O	PU	3, 9, 15, 36
D7-3	EUNITE Symposium	WP7	1	4	O	PU	9, 21, 33
D7-4	EUNITE CD ROM	WP7	1	2	O	PU	9, 21, 33
D7-5	Periodic Progress Reports/Financial report	WP7	1	26	R	CO	12, 24, 36

9.5 Project planning and timetable

The work performed by a network is very difficult to assign to specific phases or milestones of the project. Most of the work will be continuously over the duration of the project. Nevertheless, for management and progress review of the project, an attempt to represent the expected achievements of some key deliverables is made below. Most of the project tasks do not provide a final deliverable, as in a report, but progress should be seen as ongoing over a three year period. All the work performed per year will be summarised in an annual progress report, where all the activities of the network will be described.

The deliverables given in the following table are due at the end of the respective month of the project duration mentioned and are referenced in the workpackages and the deliverables. For workpackage 2 there will be a deliverable per committee if it is mentioned in the following list.

WP	Month											
	3	6	9	12	15	18	21	24	27	30	33	36
WP 1.1		D1.1-1	D1.1-5	D1.1-1 D1.1-2 D1.1-4		D1.1-5	D1.1-3 D1.1-5	D1.1-1 D1.1-2 D1.1-4		D1.1-5		D1.1-1 D1.1-2 D1.1-4
WP 1.2		D1.2-1	D1.2-5	D1.2-1 D1.2-2 D1.2-4		D1.2-5	D1.2-3 D1.2-5	D1.2-1 D1.2-2 D1.2-4 D1.2-6		D1.2-5		D1.2-1 D1.2-2 D1.2-4 D1.2-6
WP 2		D2-1	D2-2	D2-1		D2-3	D2-2	D2-1		D2-2	D2-3	D2-1
WP 3	D3-1	D3-2			D3-2 D3-3 D3-4		D3-2			D3-2 D3-3	D3-4	
WP 4	D4-1			D4-2			D4-3			D4-4		D4-5
WP 5			D5		D5				D5			D5
WP 6	D6-2 D6-4	D6-1		D6-3	D6-2	D6-1		D6-3	D6-2		D6-1	D6-3
WP 7	D7-2	D7-1	D7-1 D7-2 D7-3 D7-4	D7-5	D7-1 D7-2	D7-1	D7-1 D7-3 D7-4	D7-1 D7-5		D7-1	D7-1 D7-3 D7-4	D7-2 D7-5

9.6 Project management

The management structure is shown in the diagram below:

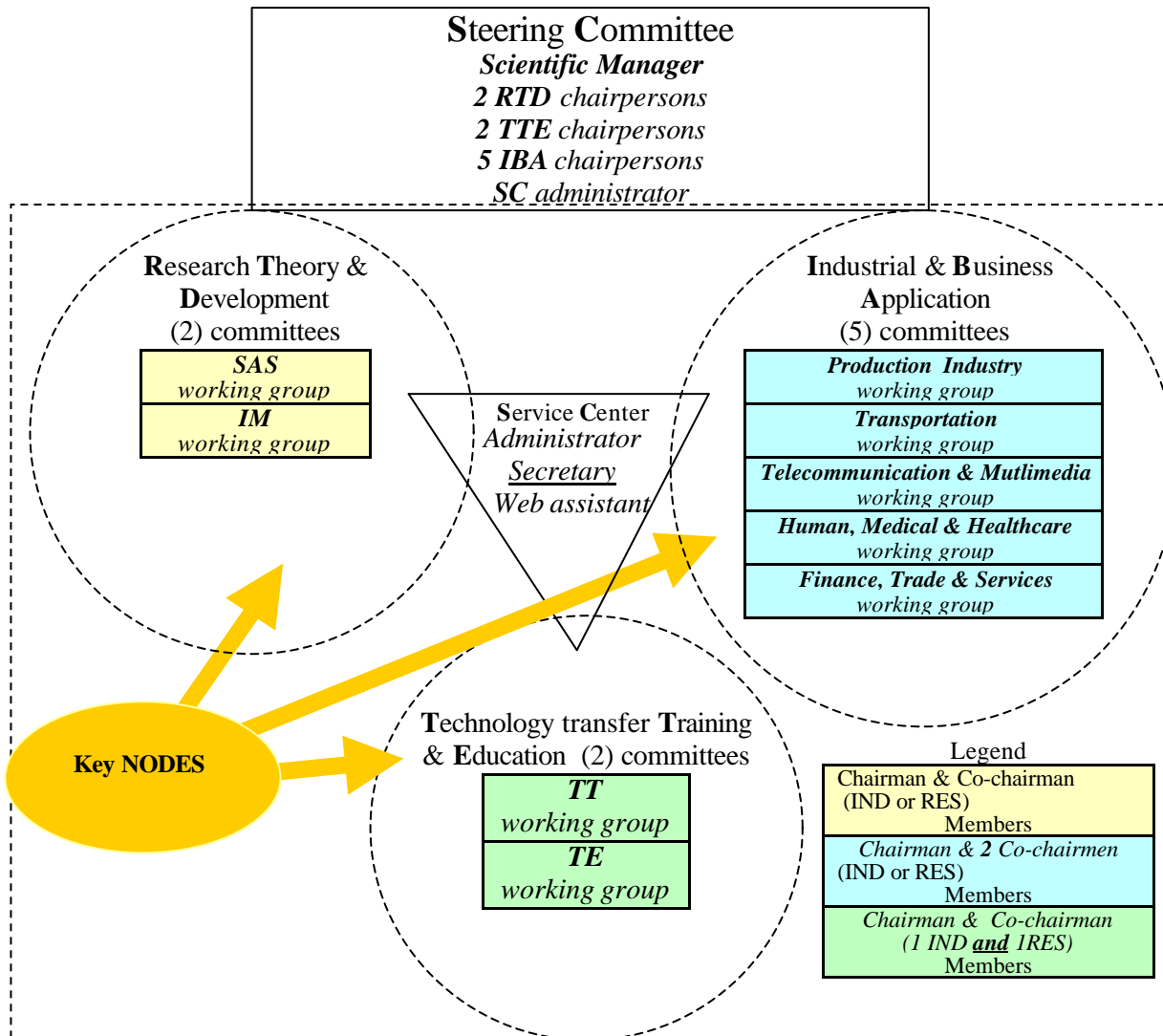


Figure II Management structure of EUNITE

Chairpersons are from either Industry/Commerce (IND) or from Academia/Research Institutes (RES). Especially for the IBA committees a balance between the IND and the RES is required in order to achieve optimum collaboration between researchers and practitioners. Also, an overall balanced representation from the Computational Intelligence Communities is anticipated.

To assure a successful progression of the network the work must be monitored and status reports for CEC must be submitted. All this is carried out by the Steering Committee. The **Steering Committee** consists of the Scientific Manager, 2 RTD chairpersons, 2 TTE chairpersons, 5 IBA chairpersons and the administrator of the network. It will decide strategies and activities of the network. For the first year the chairman of the Steering Committee will be the Scientific Manager. Further on the chairman of the Steering Committee will be elected yearly by the members of the Steering Committee with simple majority. At the Steering Committee meetings, which will take place at least twice a year, the progress of the network will be reviewed and decisions for future actions will be made. All decisions on the budget for planned and future activities, especially for general activities and cross network tasks, will be made by the Steering Committee.

The Scientific Manager of the Network will be **Prof. Dr. Kauko Leiviskä** from the Control Engineering Laboratory of the University of Oulu, Finland. The Scientific Manager is responsible for the management of the network activities. The prime contractor for the network is the ELITE-Foundation (Aachen, Germany)

represented by **Karl Lieven**. All network administration, including financial management, cost-monitoring and punctual submission of deliverables to the CEC, will be the responsibility of the **Service Centre**, which will be affiliated to the ELITE Foundation.

In summary the Steering Committee is responsible for the following activities

- Setup of new task forces
- Monitoring of activities in the committees and task forces
- Set the strategies along which task forces will be initiated
- Organise the annual EUNITE meeting and a General Assembly meeting
- Set the strategy for acquisition of new Nodes
- Assess performance of members and evaluation of membership applications
- Evaluate the progress of the network and take corrective actions in the event of problems
- Reporting to the Commission / Approval of report to the commission
- Approval of all officially sponsored EUNITE activities
- Monitor budget

The **Research Theory & Development Committees (RTD)** will concentrate on common theories and methods without any limitations on industrial or economy sectors. They will seek co-operation with each other through common actions and will submit proposals for funding within the range of their budget to the Steering Committee for approval. Actions that are accomplished will be reported and assessed also by the Steering Committee.

Close connection with the end-users will be ensured by the industry oriented structure of the **Industrial & Business Application Committees (IBA)**. They will be organised according to the different sectors of business and industry and will provide an assessment for the research actions. To ensure the interdisciplinary nature of the committee all technologies should be represented.

Each committee will be led by (two) chairpersons, preferably one from industry and the other from university or from a research organisation, to guarantee the continuous dialogue between industry and academia. They will be nominated initially for one year and then elected yearly.

The **Technology Transfer and Education Committees (TTE)** will provide the necessary information flow to promote the specialisms and enlarge the domain of potential users. There will be strong co-operation with both IBA and RTD to ensure good communication flow between them.

All Key Nodes of the network will be assigned to one or more committees. To identify the need and the possible deliverables of the Nodes, a database with the description of each Node will be set up.

The RTD, IBA and TTE committees are responsible to co-ordinate the activities which are relevant to them and allocate their appropriate budget under the overall management and auditing of the Steering Committee. In addition to these committees, there are cross network tasks which will be established and decided by the Steering Committee. The Service Center will support the execution of these tasks which will include the roadmap, interdisciplinary task forces on special areas of interest for a time limited period as well as special activities (e.g. round table discussions, workshops, publications) to strengthen the interdisciplinary approach between the different technologies as well as different application areas involved.

Besides face to face communication in meetings (conferences, symposia, seminars and workshops) organised by the network committees, different media will be used to strengthen the information flow as follows:

1. Newsletter

The Newsletter will be published three times a year to disseminate information on new applications and research results, technology transfer and other activities of the network. The Newsletter will be available electronically on the Internet and in paper form.

2. CD-ROM

A CD-Rom containing general information on the network, its different activities, and the descriptions of the Nodes will be produced.

3. Databases

Different databases will be published and maintained on WWW. These will include the database with detailed descriptions of the Nodes (which was already mentioned above) as well as events and a literature database.

4. *WWW with interactive parts*

A WWW site with information on all network activities and an interactive part will be set up and maintained.

In all the above mentioned topics the managers of the network at the ELITE Foundation already have a 5-years experience (e.g. Network of Excellence, ERUDIT) to provide a good management capability.

Conflict Resolution

In case of conflicts between two or more partners/network members on matters concerning the network, the steering committee is informed. The co-ordinator immediately initiates a one-month negotiation phase, and arranges that a Steering committee member be elected as convening negotiator to help resolve the conflict. If negotiations fail and no solution is found within the one month period, the conflict is solved by a vote among the Steering Committee. In the situation of a tie the vote of the co-ordinator determines the final decision.

Assessment and Evaluation

Assessment is continuous and per activity of the Network. The general idea behind the monitoring-assessment of activities is as follows:

All EUNITE activities should have a first level of self assessment from the nodes which are already involved and initiate them. For example before initiating an event (conference, summer school, task force etc.) the implicated nodes should clearly set tangible targets (to whom and how many we address the event, which is the criterion of success etc.) and prepare standard forms for the assessment (e.g. related questionnaire and statistics). Possible risks or opportunities should be defined at an early stage preferably before initiating the activity. After the event an assessment report stating *what was the target and what was achieved* is forwarded along with the related budget to the Steering Committee where approval is decided. The SC should carefully monitor whether the result coincides with the target set and make comparisons in order to praise or criticise relevant activities. Summary of these assessment procedures will be part of the periodical reports that the NoE has to submit to the EC.

Assessment material should be created and collected as a natural part of each activity and reporters should strive for easily understandable numerical information. It is expected that with this procedure the effort for further possible external assessment and control from external auditors will be facilitated.

9.7 Tentative Budget

Cost categories	Description	Year 1 (Euros)	Year 2 (Euros)	Year 3 (Euros)	TOTAL (Euros)
WP 1: RTD Committees (2)					
	Tasks for SAS and IM RTD overall	28970	35515	35515	100000
Other cost (Travel and subsistence for nodes)	Committee meetings, workshop speaker	11960	10000	10000	31960
Other cost (Personnel cost for nodes, see Note 1)	Editing of Roadmap contribution, e-archives, dictionary, guidelines, case studies	17010	25515	25515	68040
WP 2: IBA Committees (5)					
	Tasks for IBA committees overall	63875	80250	80875	225000
Other cost (Travel and subsistence for nodes)	Committee meetings, workshop speaker, industrial visits	40000	55000	55000	150000
Other cost (Personnel cost for different nodes, see Note 2)	Editing of Roadmap contribution, case studies, meeting preparations	16875	16875	16875	50625
Other cost	conference rooms, mailing cost, printing	7000	8375	9000	24375
WP 3: Technology Transfer					
	Tasks for Technology Transfer overall	18340	14670	16990	50000
Personnel cost (see Note 2)	Patent guideline, competition, case studies	10000	5000	5000	20000
Travel and subsistence	Committee meetings, workshop speaker	4000	2000	2000	8000
Other cost (Travel and subsistence for nodes)	Committee meetings, workshop speaker	2000	5000	7000	14000
Other cost	Case studies (labour), conference rooms, mailing cost, printing, competition award	2340	2670	2990	8000
WP 4: Training and Education					
	Tasks for Training and Education overall	33510	20005	21485	75000
Personnel cost (see Note 1)	TTE server, learning center, dictionary	12600	6300	6300	25200
Travel and subsistence	Committee meetings	2000	1000	1000	4000
Computing	Learning center	1500	1500	1500	4500

Other cost (Travel and subsistence for nodes)	Committee meetings	6000	7000	7980	20980
Other cost	hardware, software, student exchange	11410	4205	4705	20320
WP 5: Roadmap					
		16550	16575	16875	50000
Personnel cost (see Note 1)	Editing and completion of the roadmap	14175	14175	14175	42525
Travel and subsistence	Roadmap meetings (in addition to SC meetings)	2375	2400	2700	7475
WP 6: Steering committee					
	Overall	68466	90441	91093	250000
Personnel cost (see Note 1)	Coordination	8841	8841	10290	27972
Travel and subsistence	Coordination	9625	9600	8300	27525
Other cost (Travel and subsistence for nodes)	Committee meetings, meetings with other networks, task forces meetings, symposia	35000	50000	50000	135000
Other cost	conference rooms, mailing cost, printing, young scientist travel bursaries	15000	22000	22503	59503
WP 7: Support Services					
	Overall	90660	85660	86180	262500
Personnel cost (see Note 3)	network management, web pages, administration	69660	69660	69660	208980
Travel and subsistence		1000	1000	1000	3000
Other cost	conference rooms, mailing cost, printing, internet connection, hardware, software	20000	15000	15520	50520
Overall Cost					
Personnel cost		115276	103976	105425	324677
Travel and subsistence cost		19000	16000	15000	50000
Computing		1500	1500	1500	4500
Other cost (personnel cost nodes)		33885	42390	42390	118665
Other cost (travel and subsistence nodes)		94960	127000	129980	351940
Other cost		55750	52250	54718	162718
Overheads		64074,2	68623,2	69802,6	202500
Total cost		384445,2	411739,2	418815,6	1215000

1. This calculation is based on an hourly rate of 21 Euros and a monthly working time of 135 hours
2. This calculation is based on an hourly rate of 25 Euros and a monthly working time of 135 hours
3. This calculation is based on an hourly rate of 27 and 32 Euros and a monthly working time of 135

hours

10. Clustering

EUNITE will seek co-operation from networks and their nodes that are active in close research areas and particularly with :

1. NEuroNet Network of Excellence in Neural Networks
2. MLnet Network of Excellence in Machine Learning.
3. EVONET Network of Excellence in Evolutionary Computation.

EUNITE is the offspring of institutions participating in ERUDIT and the above mentioned networks to achieve the objectives already described in chapter 2. Therefore links are existing and expected to grow as the majority of their research community follow a similar path.

Synergies with other research areas contributing to the problem solving process in order to build smart adaptive systems can be also fostered with communities from the areas of Model Based Systems & Qualitative Reasoning (MONET) and of the computational logic area (COMPULOG).

It is planned to establish the co-operation by the following common activities:

- meetings of groups
- common events
 - symposia, conferences
 - debates
- common actions
 - competitions
 - joint proposals of members in research projects
 - brainstorm meetings in common problem areas
 - executive reports and papers

For the potential common activities EUNITE can provide its input based on the work foreseen in the workpackages .and like to stimulate such co-operations with other networks or research communities. EUNITE has already allocated a tentative budget for the platform of co-operation activities.

Also EUNITE will participate in the regular (approximately once a year) clustering and concertation meetings of initiatives that are related to its objectives (i.e. Neuroinformatics, Neurosciences etc.)

Appendix A - Consortium description

The consortium is interdisciplinary in many kinds. It consists of Nodes

- from universities, research laboratories, and industry,
- from many different countries in Europe,
- from different areas of technology.

In the first stage the consortium will consist of 54 so-called 'Key Nodes', which are complementary in the above mentioned points and are responsible for the setting up of the structure described in C5 and the organisation of the proposed activities (see workplan). Key Nodes are leading European research departments and the most relevant European companies active in the research topics of the network. Additionally, there are 21 Nodes, which have not been directly assigned to the committees, but like to participate in the network activities. The Key Nodes and the 21 additional Nodes have already signed the A6 participation form of EUNITE, resulting a total of 75 Nodes in the network.

The list of confirmed consortium members is as follows:

Role	Nr.	Organisation	Short Name	Contact	Activity Type*	Country
C	1	ELITE Foundation – European Laboratory for Intelligent Techniques Engineering	ELITE	Lieven, Tselentis	REC	Germany
MB-KN	2	University of Oulu	UOULU	Leiviskä	HES	Finland
MB-KN	3	Aabo Akademi University	Aabo Akademi	Carlsson	HES	Finland
MB-KN	4	Austrian Research Institute for Artificial Intelligence	OFAI	Dorffner	REC	Austria
MB-KN	5	BAE Systems Electronics Ltd.	BAE Systems	Cade	IND	United Kingdom
MB-KN MB-KN	6	British Telecommunications plc	BT	Azvine, Nauck	IND	United Kingdom
MB-KN	7	Cranfield University	Cranfield	Roy	HES	United Kingdom
MB-KN	8	Czech Technical University in Prague	CTU FEE	Stepankova	HES	Czech Republic
MB-KN	9	University of Vienna	UVI	Adlassnig	HES	Austria
MB-KN	10	Datamed S.A	DATAMED	Aravatinos	IND	Greece
MB-KN	11	De Montfort University	DeMontfort	John	HES	United Kingdom
MB-KN	12	Technische Universiteit Delft	DUT	Babuska	HES	The Netherlands
MB-KN	13	Ente Nuove Tecnologie, Energia e Ambiente	ENEA	Pizzuti	REC	Italy
MB-KN	14	Erasmus University Rotterdam	EUR	Kaymak	HES	The Netherlands
MB-KN	15	Faculty of Electrical Engineering and Computing in Zagreb	FEEC ZAGREB	Petrovic	HES	Croatia
MB-KN	16	Universitat de Girona	Girona	Vehi	HES	Spain
MB-KN	17	Stichting Neurale Netwerken	SNN	Heskes	REC	The Netherlands
MB-KN	18	Helsinki University of Technology	HUT	Niitymäki	HES	Finland
MB-KN	19	Istituto Dalle Molle di Studi sull'Intelligenza Artificiale	IDSIA-SUPSI	Schraudolph	REC	Switzerland
MB-KN	20	University of Ulster at Jordanstown	University of Ulster	Liu	HES	United Kingdom
MB-KN	21	The University of Sheffield	USFD	Linkens	HES	United Kingdom
MB-KN	22	Institut National de Recherche sur les Transports et leur Sécurité	INRETS	Semama	REC	France
MB-KN	23	King's College London	KCL	Plumbley	HES	United Kingdom
MB-KN	24	MIT - Management Intelligenter Technologien GmbH	MIT	Poloni	IND	Germany
MB-KN	25	Momatec GmbH	mmt	Kirschfink	IND	Germany
MB-KN	26	Université Paul Sabatier - Toulouse 3	U.P.S	Dubois	REC	France
MB-KN MB-KN MB-N	27	National Technical University of Athens	ICCS/NTUA	Tzafestas, Kollias, Bafas	HES	Greece

MB-KN	28	Polish Academy of Sciences	SRI PAS	Kacprzyk	HES	Poland
MB-KN	29	Politecnico di Bari - Dip. Elec Eng; Dip. di Architettura e Urbanistica	Poliba	Dotoli, Borri	HES	Italy
MB-KN	30	University of Economics Prague	UEP	Berka	HES	Czech Republic
MB-KN	31	Risoe National Laboratory	RISOE	Joergensen	REC	Denmark
MB-KN	32	Sentient Machine Research B.V.	SENTIENT	Van der Putten	IND	The Netherlands
MB-KN	33	Siemens Building Technologies AG	SBT	Thuillard	IND	Switzerland
MB-KN	34	Softeco Sismat SpA	SOFTECO	Boero	IND	Italy
MB-KN MB-N	35	Spanish Council for Scientific Research	CSIC	Garcia Alegre, Esteva	REC	Spain
MB-KN	36	University of the Aegean	AEGEAN	Dounias	HES	Greece
MB-KN	37	Technical University of Denmark	DTU	Jantzen	HES	Denmark
MB-KN	38	Technical University of Kosice	ICT (UVT-CIT) TU Kosice	Sincak	HES	Slovak Republic
MB-KN	39	Technical University of Madrid	UPM	Hernandez	HES	Spain
MB-KN	40	Technische Universität Clausthal	TU Clausthal	Strackeljan	HES	Germany
MB-KN	41	TSS - Transport Simulation Systems S. L.	TSS	Ferrer	INF	Spain
MB-KN	42	University of Genova - Department of Biophysical and Electronic Engineering	DIBE	Anguita	HES	Italy
MB-KN	43	Universität Dortmund	UNI DO	Morik	HES	Germany
MB-KN	44	Otto-von-Guericke Universität Magdeburg	UMD	Wrobel	HES	Germany
MB-KN	45	Universitätsklinikum RWTH Aachen	KLINIKUM RWTH	Graf von Keyserlingk	HES	Germany
MB-KN	46	Université Catholique de Louvain	UCL	Verleysen	HES	Belgium
MB-KN	47	The University of Bristol	UNIVBRIS	Martin	HES	United Kingdom
MB-KN	48	University of Chemical Technology and Metallurgy	UCTM	Hadjiski	HES	Bulgaria
MB-KN	49	Facultade de Ciencias e Tecnologia da Universidade de Coimbra	CISUC	Dourado Correia	HES	Portugal
MB-KN	50	University of Crete	UoC	Vasilakos	HES	Greece
MB-KN	51	DaimlerChrysler AG	DCAG	Grimmer	IND	Germany
MB-N	52	Rautaruukki Oy	RR	Ruha	IND	Finland
MB-N	53	DAEDALUS Informatics Ltd.	Daedalus	Mylonas	IND	Greece
MB-N	54	S.I. Vavilov State Optical Institute	SOI	Pavlov	REC	Russia
MB-N	55	University of Manchester Institute of Science and Technology	UMIST	Wolkenhauer	HES	United Kingdom
MB-N	56	Fundacion LBEIN	LBEIN	Los Arcos	REC	Spain
MB-N	57	Start Engineering JSCo.	START	Nikolov	IND	Bulgaria
MB-N	58	Hochschule für Technik, Wirtschaft und Sozialwesen Zittau/Görlitz	Zittau University	Hampel	HES	Germany
MB-N	59	University of Paris Dauphine XI	UPD	Tsoukias	HES	France
MB-N	60	Netherlands Energy Research Foundation	ECN	Kok	REC	The Netherlands
MB-N	61	University of Twente	UT	Poel	HES	The Netherlands
MB-KN	62	Asociacion para el Desarrollo de la Ingeniera Conocimiento	ADIC	Dorronsoro	REC	Spain
MB-N	63	University of Jyväskylä	JyU	Murgu	HES	Finland
MB-N	64	Coventry University	CU	Steele	HES	United Kingdom
MB-N	65	University of Valladolid	UVA	Gento Municio	HES	Spain
MB-N	66	Association pour la Recherche Scientifique	ARS	De la Vaissiere	REC	France

MB-N	67	ALLOGG AB	Allogg AB	Braban-Ledoux	IND	Sweden
MB-N	68	Universiteit Nyenrode Foundation	Nyenrode	Baets	HES	The Netherlands
MB-N	69	Institut National Polytechnique de Toulouse	INPT	Talou	HES	France
MB-N	70	Politecnico di Torino	POLITECNICO	Bona	HES	Italy

- * REC: Research (i.e. organisations only or mainly established for research purposes)
HES: Higher Education (i.e. organisations only or mainly established for higher education/training, e.g. universities, colleges)
IND: Industry
OTH: Others

Description of participants

ELITE Foundation, Aachen, Germany

ELITE was founded in Aachen in 1991 under the guidance of Professor Zimmermann of Aachen Institute of Technology (RWTH). Intensive technology transfer via seminars, user meetings and consultancy services provides a basis for project work. The ELITE consultancy center offers assistance to companies and individuals wishing to get involved professionally with fuzzy technologies, neural networks, and machine learning, by providing the comprehensive literature database CITE, individual consultancy, in-house training sessions tailored to specific company needs, and by demonstrating tools, independently of any particular manufacturer. Since 1995 ELITE has hosted the ERUDIT Service Center and is the Prime Contractor for the Network of Excellence ERUDIT (8193 and 26779) and since 1993 ELITE is organising the annual conference EUFIT.

In 1975 **H.-J. Zimmermann** started the "European Working Group for Fuzzy Sets" and in 1984 the "International Fuzzy Systems Association" (President 1984-1987). He is Scientific Director of ELITE. In 1984 he organised, with E. H. Mamdani, the First Symposium on Fuzzy Sets in Operations Research, Artificial Intelligence and Expert Systems in Cambridge (GB) and in 1985 the first World Congress of the International Fuzzy Systems Association in Palma de Mallorca. 14 of the 27 books and 97 of the 181 papers he has published are on the theory or applications of Fuzzy Set Theory, in particular, on Optimization, Fuzzy Control and Expert Systems. Since 1976 he has supervised approximately 15 PhD theses in the area of Fuzzy Set Theory, and since 1984 lectures in this area have been offered regularly to the students in Aachen in the programs of mathematics, business administration and computer sciences. He was editor-in-chief and founder of the International Journal for Fuzzy Sets and Systems, the largest and oldest (since 1978) international journal in this area.

Georgios Tselentis, born in 1965, received his PhD (1998) in the area of quality control with advanced data analysis and intelligent techniques, his Postgraduate Diploma(1994) in the area of fault detection in control systems and his University degree(1991) as production engineer, all from the Technical University of Crete (TUC), Greece. From 1996-1998 he worked as researcher- laboratory assistant in the Intelligent Systems laboratory of TUC, participating in research projects and assisting lecturing. On May 1998 he joined MITGmbH, Germany, as researcher-project engineer in industrial projects involving advanced data analysis and intelligent techniques. Since October 1999 he is with ELITE Foundation and responsible for activities related to the following networks of Excellence: CoIL (Computational Intelligence and Learning), NEuroNet (Neural Networks), ERUDIT (Fuzzy technology and uncertainty modelling). He's author or co-author of 20 publications in journals, books or proceedings of conferences relevant to Intelligent Technologies, co-editor of one book and member of the program or organising committee of relevant events (EUFIT,ESIT, COIL2000). In the past he also worked part time, as lecturer in the national institute for vocational training in Greece, as freelance consultant engineer and as S/W developer. His research interests include areas and applications of intelligent technologies like quality control, pattern recognition, financial decision support systems and medical diagnosis. Also he's a member of the Marie Curie Association after receiving a grant (SMT 4 97 -9021) for neurofuzzy methods evaluating the sensors of a quality control procedure in a washing-machine production line.

Karl Lieven studied mathematics and business administration at RWTH, Aachen. After an employment at the University of Aachen, considering Fuzzy Logic and Neural Networks with Prof. Zimmermann, Karl Lieven founded MIT GmbH in 1991, as a system and solution providing company. Together with Moeller Holding MIT founded the ELITE Foundation in 1991. He has many publications in the area of technical and business intelligence considering technical approaches of fuzzy logic and operations research. Especially modelling of uncertainty was the main topic.

Since 1991 he is the Managing Director of MIT, and heading a lot of other activities. He is also Administrative Director of ELITE-European Laboratory for Intelligent Techniques Engineering and ERUDIT, a Network of Excellence for Fuzzy Logic, established within the framework of ESPRIT. His main activities are in the areas fraud detection, creditworthiness evaluation and database marketing in business intelligence and process optimisation and quality control in technical applications. He has knowledge in uncertainty modelling, fuzzy logic, neural networks and machine learning.

University of Oulu, Finland

Control Engineering Laboratory

The Control Engineering Laboratory is working in the field of process automation. Its focus areas are:

- Applications of Intelligent Methods
- Hypermedia Applications
- Process Analysis and Modelling
- Process Measurements

The latest research has directed to the application of Intelligent Methods in process industries and on several application areas: process control, fault diagnosis, process design, managerial decision making, and production planning and scheduling. Applications are in pulp and paper, metallurgical, chemical, biochemical and also lately in electronics industries. On average 25 researchers have been employed by projects on Intelligent Methods during the last year, and the number of industrial projects is increasing all the time.

Technology has been developed in order to improve the tuning environment of fuzzy systems. Applications are based on this methodology and industrial experience. Both areas have also an essential role in our projects, which are included technological programs going on in Finland. Linguistic Equation approach provides a consistent method for developing control and expert systems for complex industrial processes. FuzzyCon is a general purpose fuzzy controller specially designed for adaptive tuning in process industry. FuzzyTune is a Windows program developed for the tuning of fuzzy logic controllers. The program is based on Linguistic Equation method.

Industrial Projects

Fuzzy control and its tuning in Finnish industry was done in co-operation with Technical Research Centre of Finland and the main financing came from Tekes (Technology Development Centre). Industrial partners were Imatran Voima Oy, Kaukas Oy, Kemira Oy, Rautaruukki New Technology Oy and Wisaforest Oy. In this project fuzzy logic controller was developed and tested in industry scale lime kiln at Wisaforest Pietarsaari mills. The lime kiln control has later been realised by using a linguistic equation controller and the system has been in operation for more than a year, now. Also a tuning system was developed in cooperation with Rautaruukki Oy New Technology (RNT) for an expert knowledge based fault classifier used for classifying defects on steel strips. The project Fuzzy Control for D0-stage in Pulp Bleaching Process was done in co-operation with Valmet Automation. A commercial product resulted. The project Fuzzy Control of Thermo-Mechanical Pulping was carried out with Tampere University of Technology, United Paper Mills, Sunds Defibrator and ABB. The first commercial system based on this research started in 1999 in Sweden. The project Modelling of Pulp Cooking Characteristics by using Neural Networks and Linguistic Equations is done in co-operation with ABB Industry Ltd. Several projects concerning the application of fuzzy logic in testing systems for electronics manufacturing have been done in co-operation with Nokia Telecommunications. Use of neural networks in blast furnace control was considered in a co-operative project with Rautaruukki Oy and Åbo Akademi University and the co-operation in sintering plant, blast furnace and smelter shop control is continuing. Control Engineering Laboratory was also co-ordinating a major national project TOOLMET - Environments, Tools and Methods for Intelligent Systems

International Projects

In managerial decision making and production scheduling, research has also been done in co-operation with the Decision Technologies Group, UMIST, England. On this research area, the Laboratory has been an active member in two ESPRIT working groups: FALCON - Fuzzy Algorithms for Control, and SiE - Simulation in Europe. It was actively involved in ERUDIT Network of Excellence (Membership in the Steering Committee). The laboratory participated to a TMR program co-ordinated by the Plataforma Solar de Almeria and in ALFA project "Robust Industrial Control" co-ordinated by INSA in Toulouse. Regular student/researcher exchange programs continue between several universities in Europe.

Professor Kauko Leiviskä was born in Pyhäntä, Finland, 1950. He received the Diploma Engineering degree in Process Engineering from the University of Oulu in 1975 and the Licentiate of Technology degree in Control Engineering from the same university in 1976. He received the Doctor of Technology degree in

Control Engineering from the University of Oulu in 1982 with the thesis on short term production scheduling of the pulp mill. He has been acting as assistant and head assistant in the Control Engineering Laboratory, University of Oulu during 1975-1985 and as Acting Professor of Systems Engineering 1985-1988 in the same University. He has been Professor of Control Engineering and Head of Control Engineering Laboratory in the same University since 1988.

He has been member of the IFAC-Systems Engineering Committee 1988-1992. He has been member of Program Committee for IFAC Conferences "Dynamics and Control of Chemical Reactors, Distillation Columns and Batch Processes". He was the vice-chairman and editor of IFAC Workshop "CIM in Process and Manufacturing Industries" in 1992 and member of IPC for IFAC Conference on Integrated Systems Engineering, Baden-Baden, Germany, September 27-29, 1994; and member of IPC in CONTROLO'98, Coimbra, Portugal. He has been chairman of Organising Committee for TOOLMET '96 and TOOLMET '97 Workshops and TOOLMET '98, TOOLMET '99 and TOOLMET2000 Symposiums arranged in Oulu, Finland. He was a member of IPC for European Symposium for Intelligent Techniques, Chania, Crete, 1999, member of IPC for EUFIT'99, Aachen, Germany, and chairman of IPC for IFAC Symposium ACE2003, Oulu, Finland. He was the NOC Chairman for IFAC MMM Workshop 2000 in Finland. He has been member of board in Finnish NMO for IFAC in 1988-1991, 1998- , and the IFAC contact person for Finnish NMO since 1998.

In University of Oulu, he is member of board of the Continuing Education Center since 1990, head of Process Engineering Department since 1991, a member of Faculty of Technology, 1991-1993, Vice-Dean of Technical Faculty since 1.1.2000, a member of board, Data System Management and Library, a member of board, Infotech Oulu, (1.1.1997-31.12.1999), and the chairman of Campus Futurum Steering Group (a group for planning a virtual campus) since 1.9.1999. He is also member in the programme board of management, International Ph.D. Programme in Pulp and Paper Science and Technology (1.1.1995-).

He was the coordinator of Comett II Cb-project "Training Materials for Process Automation" in 1990-1993, chairman of board for Comett II UETP "Northern Lights" 1992-1994 and member of board in the National Comett Center of Finland 1993-1994. He is member of Steering Committee and chairman of Technical Committee A (Primary and Process Industries) in ERUDIT Network of Excellence, 1.1.1997-.

A list of more than 200 publications of which he is (co)author is available. Recently his work concentrates on modelling and control of industrial processes, intelligent control methods, production scheduling and millwide control. He has also been consulting industry on control engineering and millwide control applications.

Abo Akademi University – IAMSR, Finland

IAMSR is a research institute with the objectives to study and develop the theory and applications of knowledge based systems in management. The research is carried out in co-operation with major Finnish companies, normally as several-year research contracts, which makes the research relevant and verifiable as to both the theoretical foundations and the usefulness of the systems technology developed.

The institute has research positions for research fellows, visiting scholars and project researchers; presently the personnel is 38 researchers working in research programs with several major Finnish corporations, which actually are multinationals. As part of the research programs IAMSR is carrying out theory-driven and applied research in strategic management, electronic commerce, knowledge based support systems, cognitive maps and hyperknowledge, interdependent MCDM, approximate reasoning and fuzzy logic, neural nets and software agents.

IAMSR is developing an active DSS technology in joint research and development programs with industrial partners and co-operating research institutions. These include *Smarter* (reducing fragmentation of working time with modern information technology), *EM-S Bullwhip* (eliminating demand fluctuations in the supply chain with fuzzy logic), *Waeno* (improving the productivity of capital in giga-investments using hyperknowledge), *Arvotek* (value scenarios as part of strategic planning programs), *Imagine21* (foresight of new telecom services using agent technology) and *Valentine* (electronic commerce technology in small and medium sized enterprises). The last two research programs are financed by ESPRIT IV and ESR, respectively.

IAMSR is involved in co-operation with two major international networks. The ERUDIT Network of

Excellence in fuzzy logic and information technology (funded through the ESPRIT program), and in the Berkeley Initiative in Soft Computing (BISC), which has been initiated by Prof Lotfi Zadeh at the UC Berkeley. The BISC-SIG on DA will work on a new theory base for decision analysis to anchor it in a real life decision making context and work out a conceptual modelling framework for better decision making with the help of soft computing technology. *Prof Christer Carlsson*, IAMSR, is the chairman of the BISC-SIG on DA.

Hyperknowledge, fuzzy logic and uncertainty modelling have been the scope of invited mini-tracks organised by IAMSR at the HICSS-28 to HICSS-33 conferences. The same theme has been the basis for invited clusters and sessions at the EUFIT conferences, the EURO conferences, the EMCSR conferences and at INFORMS conferences since 1992. Senior researchers at IAMSR have been invited to write and edit textbooks for Kluwer and Elsevier. Senior researchers are regularly giving plenary lectures at international conferences. Senior researchers serve on the editorial boards of several international journals.

IAMSR has since 1992 been running a number of research programs to introduce hyperknowledge support systems as strategic planning support environments for senior management. The support system offers an intuitive and effective strategic planning support with object-oriented expert systems elements and a hyperknowledge user interface. The programs have been carried out in the forest products, the forest machinery, the insurance, the telecommunications and the plastic pipe industries. The effectiveness and usefulness found with the hyperknowledge can be extended and enhanced with fuzzy logic and approximate reasoning. The software platform, which serves as a research instrument for the theoretical work, is Java 2.0 and Windows NT 4.0, which offer advanced capabilities for progressive support applications. Since 1997-98 the software platform has been rebuilt to include fuzzy logic, optimisation routines, software agents and filters for market data.

IAMSR is a partner in the TUCS Graduate School and is training its postgraduate students for careers in industry and business. The training has been successful and a number of graduates have been employed, mainly by major corporations such as Nokia, UPM Champion, Sonera, Ericsson, HP, etc.

Prof Christer Carlsson, Director of the Institute of Advanced Management Systems Research, and a professor of management science at Abo Akademi University is a member of the Steering Committee of ERUDIT, an ESPRIT Network of Excellence, and chairman of the BISC-SIG on Soft Decision Analysis. Professor Carlsson got his D Sc(BA) from Abo Akademi University in 1977, and has lectured extensively at various universities in Europe, in the U.S., in Asia and in Australia. Professor Carlsson has organised and managed several research programs in industry in his specific research areas: knowledge based systems, decision support systems and expert systems, and has carried out theoretical research work also in multiple criteria optimisation and decision making, fuzzy sets and fuzzy logic, and cybernetics and systems research. Some recent research programs, which include extensive industrial cooperation, include *Smarter* (reducing fragmentation of working time with modern information technology), *EM-S Bullwhip* (eliminating demand fluctuations in the supply chain with fuzzy logic), *Waeno* (improving the productivity of capital in giga-investments using hyperknowledge) and *Imagine21* (foresight of new telecom services using agent technology). He is on the editorial board of several journals including the EJOR, Fuzzy Sets and Systems, ITOR, Cybernetics and Systems, and Intelligent Systems in Accounting, Finance and Business. He is the author of 3 books, and an editor or co-editor of 5 special issues of international journals and 12 books, and has published more than 200 papers.

Austrian Research Institute for Artificial Intelligence (OFAI), Austria

The *Neural Network Research Group* at the OFAI is a research group experienced in time series processing, signal processing and pattern recognition. Their main expertise comprises techniques from neural computation, advanced statistics and machine learning. For the latter, they keep tight contacts with the Machine Learning group at the OFAI.

The research group consists of 5 staff and around 10 graduate students working on their master's theses or dissertations. The group has been involved in major European projects, such as the ESPRIT-II project NEUFODI (Neural Networks for Forecasting and Diagnosis Applications), the ESPRIT-IV project RADAR (High-performance Radar Image Processing), the BIOMED 1 concerted action ANNDEE (EEG processing with neural networks). Recently, they have been the co-ordinator of the EU Biomed-2 project SIESTA, aiming to develop a new computer-based system to analyse human sleep based on polysomnography. In addition, the group is managing node in the Network of Excellence NeuroNet and as been involved in

activities of the NoE cluster CoIL.

In recent years, the neural networks research group has broadened its focus to include general statistical data analysis, where it has specialised in time series and signal processing. The following are other finished or ongoing projects relevant to this project, carried out in co-operation with clinics and industry:

- alarm detection in cardiocograms (CTG) for fetal monitoring,
- Bayesian inference applied to automatic sleep staging based on EEG and EOG
- classification of EEG data in different psychiatric disorders
- risk analysis in the insurance business
- alarm detection in a steel cooling process
- forecasting of sales figures and in finance
- modelling stochastic processes in economics
- development of methods to model uncertainty in order to improve biosignal processing

The major research contributions with respect to smart adaptive systems are the following:

- stable and fast neural network learning
- localised basis functions (RBFN and ART neural networks)
- Bayesian inference
- rule injection and refinement in neural networks

Dr. Georg Dorffner is associate professor at the Dept. of Medical Cybernetics and Artificial Intelligence at the University of Vienna and heads the Neural Networks Research Group at the Austrian Research Institute for Artificial Intelligence. His main research activities are in non-linear statistical data analysis with an emphasis on time series and signal processing. He has authored or co-authored more than 100 scientific publications. His work is highly interdisciplinary including co-operations in the fields of artificial intelligence, biomedicine, statistics, and psychology. He has been the co-ordinator of several successful EU projects, among them the concerted action ANNDEE (Biomed-1) and the shared cost project SIESTA (Biomed-2). He has also been a consultant to industry and has supervised and co-ordinated several application-oriented projects on a national level.

Other personnel

Dr. Arthur Flexer: psychology, signal processing, clustering

Dr. Christian Schittenkopf: time series processing, finance, economics

Stefan Roiser: roadmap activities, internet technologies

BAE Systems Electronics Ltd., United Kingdom

is a world-scale prime contractor in the defence and aerospace sectors with particular expertise in naval platforms, military aircraft, electronics and related technologies. In addition to providing high technology systems solutions across the main defence sectors, BAE SYSTEMS also plays a major role in the civil aircraft market. The commercial practices and technologies employed in the civil aviation marketplace naturally feed through into the ever-changing defence sector; and conversely, many of the technology breakthroughs achieved in military programmes enable the development of leading edge solutions for the wide customer base of the civil sector.

BAE SYSTEMS is a leading prime contractor and systems integrator for air, land and sea defence market sectors. BAE SYSTEMS is

- The UK's largest exporter.
- The world's 2nd largest Defence contractor.
- The 3rd largest Aerospace Electronics company in the World.
- Europe's largest aerospace and defence company.
- Third largest aerospace and defence company in the world.
- An international company with 'home markets' in 9 countries: 60 UK sites and 39 in other European, North American and across the world countries
- A major engineering employer with over 100,000 employees (including those in several joint ventures with other European Companies).

The BAE SYSTEMS Research Centre has major research activities in non-linear systems theory, signal processing and control. Research into non-linear estimation as well as neural networks and fuzzy logic for control and classification form an important part of the mathematical research activity. This expertise can be called on as the requirements of the research programmes demand. It is however not the purpose of BAE SYSTEMS Research Centre to replicate academic research and a major role is to identify application areas which could benefit from novel methods and where there is a clear implementation path. BAE SYSTEMS Research Centre is a major participant in collaborative research projects on a national and international level, including ESPRIT and BRITE-EURAM.

Example Intelligent Techniques Projects

- The application simulated annealing optimisation to fuzzy logic position control.
- Differential Evolutionary Algorithms for systems level optimisation .
- Fuzzy control and signal location for a satellite antenna.
- NeuroFuzzy techniques for robust autopilot design.
- Neural networks for on-line process monitoring

Dr Neil Cade is a theoretical Condensed Matter Physicist with experience in magnetic materials, novel electronic devices and sensors (semiconductor, vacuum microelectronic and conducting polymer), Microsystems technologies and System Integration. His current work is focused on robust integration of multi-sensor systems with particular emphasis on adaptive algorithms.

BT Labs., Intelligent System Research Group, United Kingdom Advanced Communications Engineering

British Telecommunications plc is one of the world's leading providers of telecommunications services. With a market capitalisation of around £70 billion, it is one of the largest private sector companies in Europe. Its principal activities include local, long distance and international telecommunications services, mobile communications, Internet services and IT solutions. In the UK BT serves 28 million exchange lines and seven million mobile customers. International direct-dialled telephone service is available to more than 200 countries and other overseas territories - covering 99 per cent of the world's 800 million telephones.

BT is expanding its presence overseas rapidly and has operations in more than 30 countries worldwide, with ventures in the Republic of Ireland, France, Switzerland, Spain, Germany, Italy, the Netherlands, Sweden, New Zealand, Japan, Singapore, Malaysia, Korea, Latin America and India.

BT and AT&T have also created Concert, the leading global telecommunications company serving multi-national business customers, international carriers and Internet service providers worldwide. Concert provides customers with communications services on an unprecedented scale, scope and quality, with the industry's broadest portfolio of voice, data and Internet services. Concert's frame relay network reaches every major city in the United States and the United Kingdom, and extends to an additional 170 cities in 47 countries. Its global public network reaches directly 237 countries - more than any other existing network.

BT Laboratories based at Adastral Park is an internationally known research organisation which conducts short, medium and long term R&D for BT in a diverse range of topics such as network technologies and AI. A major function of research groups at BT Labs is to set up collaborative projects with academic institutions around the world to stimulate research in particular areas of interest to BT and participate in state of the art research projects.

The Intelligent Systems Research group is a part of BT Labs that carries out world-class AI technology R&D programmes. The aims of the BT ISR group are to research and develop novel intelligent software systems and technologies in order to: i) radically improve the way BT operates and employs its resources, and ii) technologically enable the provision and management of future broadband networks and services. The group is currently working closely with a number of UK and international universities such as UC Berkeley, MIT and Imperial College on collaborative R&D projects.

The technical bases of ISR's ambitious long term R&D programme are focused on: Intelligent resource scheduling and planning ([Dynamic Scheduler](http://www.informs.org/Press/Edelman1999c.html), <http://www.informs.org/Press/Edelman1999c.html>), Intelligent

Software Agents ([ZEUS](http://www.labs.bt.com/projects/agents/) agent building toolkit, <http://www.labs.bt.com/projects/agents/>), and Soft (i.e., Fuzzy & Neural) Computing ([Intelligent Personal Assistant](http://www.bcs.org.uk/awards/medal-98/list98.htm), <http://www.bcs.org.uk/awards/medal-98/list98.htm>). ISR's world class research status is evidenced by its 4 International and National IT innovation awards, 9 BT technical excellence awards, 30 patents granted/filed, and well over 100 external publications. The group has also been very active in exploitation of AI technology and has been turning the results of its innovative AI R&D programme into major business benefits for BT.

Dr. Behnam Azvine holds a BSc in Mechanical Engineering, a MSc and a PhD in Control Systems all from the University of Manchester. After a number of academic appointments he joined BT Labs in 1995 to set up and lead a research programme in Intelligent systems and soft computing and is currently a principal research scientist in the Intelligent Systems Research Group at Adastral Park. He holds the British Computer Society medal for IT for his team's work on the digital personal assistant project and is a visiting fellow at the Department of Engineering Mathematics of Bristol University. He has contributed to more than 30 publications, has 9 international patents and regularly gives presentations in international conferences and workshops on the application of AI in Telecommunications. He has been the chairman of the telecom committee of ERUDIT for the last three years. His research interests include the application of Soft Computing and AI techniques to human-centred computing and adaptive software systems.

Dr. Detlef Nauck received a master degree in Computer Science in 1990 and a PhD in Computer Science in 1994 both from the University of Braunschweig. Until 1999 he was a Senior Research Fellow and Senior Lecturer at the University of Magdeburg, where he recently submitted his habilitation thesis on neuro-fuzzy data analysis. Currently he is a Senior Research Scientist at BT Labs in Martlesham Heath, UK where he is working in intelligent systems research. Detlef Nauck is the first author of a book on neuro-fuzzy systems and he has published a large number of journal and conference papers. He has been a member of the program committees of several large international conferences on fuzzy systems and neural networks. He also worked in several industrial projects on data analysis. Since 1998 Detlef Nauck is a co-chairman of the ERUDIT committee on Future Research and Advanced Technology Developments.

Cranfield University, United Kingdom

Department of Enterprise Integration, School of Industrial and Manufacturing Science

The Department of Enterprise Integration at Cranfield is a department within the School of Industrial and Manufacturing Science. The School received a grade 5 rating in the 1996 Research Assessment Exercise and has recently been awarded 22 out of 24 points for Teaching Activities. The department has a strong track record in product development, intelligent manufacturing systems, information management and knowledge capture within the manufacturing environment. Some relevant current or recently completed projects from the department include:

- EPSRC, "DREAM", GR/M43470, Defining Knowledge Models for Reconfiguration and Modification Processes in Aerospace . Marshall Aerospace.
- EPSRC, GR/M 71473, Flexible Optimisation with the CAD/CAM Environment. Nissan European Technology Centre and SDRC.
- EPSRC/IMI "UKLAI", UK Lean Aerospace Initiative. Partners: SBAC, Univ of Warwick, Univ of Bath, Univ of Nottingham.
- EPSRC, "INDEMAND", GR/K/95758, Integrated Design and Manufacturing Knowledge in an Extended Enterprise, Partners: BAe Airbus, BAe Aerostructures, Trefn Engineering.
- EPSRC, IMI "AEROEXTEN", GR/L/31159, Concurrent Engineering in the Extended Enterprise, Partners: Luton University, Matra BAe Dynamics, BAe Aerostructures, Bellhouse, Hartwell.
- BRITE EURAM, "AMBITE", Project No: 7094, 'Advanced Manufacturing Business Integration Tool for Europe', - Programme to link business strategy and investment opportunities in advanced manufacturing programmes and technologies. Partners in five countries.
- ESPRIT, "SCOPES", Project No: 6562, 'Systematic Concurrent Design of Products Equipment and Control Systems', - The development of specifications and concepts for future design systems, integrating product and assembly process design. Partners in five countries.
- EPSRC, "FAST CE", GR/J/57735, Rapid implementation process for world class best practice in concurrent engineering. Partners: Computervision.
- EPSRC, "Engineering Process Performance", GR/J/95300, Fusion of economic performance measures for the engineering process. Partners: BAe Defence, BAe Cranfield Manufacturing Centre.

In addition, DEI has also been one of the pioneers of the Online World Conference on Soft Computing (WSC). It has hosted a number of these events including WSC2, WSC3, WSC4 and WSC5. Please visit: <http://www.cranfield.ac.uk/wsc5> for the latest conference.

We would be very interested to utilise our experience in developing a 'Virtual Conference Centre' to cater for annual European conference for the network, organise discussion forums, hosting Webcasting etc.

Dr. Rajkumar Roy is a Lecturer in the Department of Enterprise Integration at the School of Industrial and Manufacturing Science, Cranfield University. He has a strong academic, research, and industrial background in design and manufacturing. Some of his previous research was with Rolls Royce, applying Soft Computing (Fuzzy Logic and Genetic Algorithms) for decision support in the preliminary design of turbine blade cooling systems. The research developed techniques to integrate the manufacturing knowledge in the design optimisation process. After joining Cranfield University in 1996, Dr. Roy has been working in the Genetic Algorithms, Fuzzy Logic and knowledge capture areas for last four years. In the soft computing area, he has already supervised a large contract research with industry (Corus), has completed five MSc student research supervisions and is currently supervising three PhD student on the application of Soft Computing Techniques for Real Life problems. Furthermore, he is supervising three PhD students, and has completed supervision of two MSc students on design and manufacturing knowledge capture and reuse. He has also contributed to EPSRC funded INDEMAND and AEROEXTEN projects in knowledge capture and decision support areas. He has also prepared a book on 'Industrial Knowledge Management - A Micro Level Approach' to be published by Springer-Verlag, London, in September 2000. The proposed research is identified as a result of the recent studies on 'Soft Computing Application to Real Life Problems', and is a continuation from the ongoing research at the university. He is also Chairing a Workshop on 'Real Life Design Optimisation' in the PPSN2000 Conference. He is also supervising a Post Doctoral student on 'Optimisation in Qualitative Search Space'.

Dr. Roy has also published his work extensively in International conferences and journals, and has co-edited three books in Soft Computing Application in Design and Manufacturing area. Dr. Roy is the principal investigator of an EPSRC Grant (GR/M 71473) on 'Flexible Design Optimisation within the CAD/CAM Environment'. Nissan European Technology Centre and SDRC have industrially sponsored the project. He is also the Principle Investigator of another EPSRC funded project on "Developing an Integrated Costing Approach for Conceptual Design Evaluation (ICOST)" (EPSRC Grant No: GR/N 21321). He is a Chartered Engineer, and member of IEEE, IED, INNS, Computer Society of India, and The Institution of Engineers (India). He has recently chaired two international conferences on 'soft computing in design and manufacturing'. Currently he is an associate editor of the 'International Journal of Advanced Manufacturing Systems' and the 'International Journal of Agile Manufacturing'.

Czech Technical University in Prague (CTU), Czech Republic **The Gerstner Laboratory for Intelligent Decision Making and Control**

The Czech Technical University in Prague (CTU) founded in 1707, is the most important technical university in the Czech Republic. CTU with its 1300 members of academic staff is also one of the largest research institutions in the Czech Republic. The GERSTNER LABORATORY for Intelligent Decision Making and Control (<http://cyber.felk.cvut.cz/gerstner/>) is a vital part of the Department of Cybernetics at CTU. This research and technology transfer laboratory (19 researchers, 18 Ph.D. students) was founded in 1996 as an extension of the Joint Research Centre of CTU Prague and [FAW Linz](#). The research focus covers the areas of Distributed Artificial Intelligence, Multi-Agent Systems, Machine Learning and System Diagnostics, Datawarehousing & Data Mining and Evolutionary Computing with main application areas in Intelligent Robotics, Computer Integrated Manufacturing, Software Testing and Software Diagnostics. Adaptive systems have been actively studied at the department since 1980 when the former department head, Prof. Emeritus Kotek, published the first Czech book on this topic. Recently, specific attention has been given to the problems of multi-agent systems, data-warehouses and KDD systems. The laboratory co-operates extensively with industry (e.g. Rockwell Automation, Vitatron, Grundfos, U.S. Air Force Research Lab.) and it is currently involved in the following relevant EU projects: *ILPNET2* (INCO 977102): Inductive Logic Programming Network of Excellence, *Sol-EU-Net* (IST-1999-11495): Data Mining and Decision Support for Business Competitiveness, *GOAL* (INCO-Copernicus 977091). *MIRACLE* - Centre of Excellence project (ICA1-1999-75029) and *ExPlanTech* project (IST-1999-20171) are to be signed soon.

Prof. Vladimír Marik graduated from the Czech Technical University in Prague (CTU) in 1975, obtained

Ph.D. and DrSc. degree at CTU in 1979 and 1989, respectively. He was appointed Full Professor of Technical Cybernetics at CTU in 1990. Prof. Marík is the Head of the Department of Cybernetics at CTU, and director of the Gerstner Laboratory for Intelligent Decision Making and Control. During the last 9 years, he acted as a co-ordinator or a local co-ordinator of several international R&D projects in the field of AI (Tempus, INCO COPERNICUS, EUREKA). He was the General Chair of the DEXA'93 Conf. (Prague), DEXA'97 (Toulouse) and IEEE/IFIP Conf. BASYS'98 (Prague). His main professional interests include distributed AI, knowledge based systems, multi-agent systems, machine learning, planning and scheduling for manufacturing etc. He is (co-) author of 4 monographs, 8 textbooks, a co-editor of 4 books published by Springer Verlag and a book by Kluwer Academic, Boston, co-author of more than 80 papers at international conferences, 12 papers in reviewed journals, etc.

Prof. Dr. Olga Stepankova obtained Master degree in mathematics (theoretical cybernetics) at Charles University (Prague) in 1973 and Ph.D. degree in Mathematical Logic in 1981. Since 1987 she is a member of the Artificial Intelligence group at CTU. In 1991 she was appointed the Associated Professor in Technical Cybernetics and in 1999 the Full Professor. She is the head of the AI group at CTU, a representative of the Czech Society for Cybernetics and Informatics in ECCAI, honorary member of the Association for Logical Programming and a member of the editorial board of *Kybernetika*. She is (co-) author of about 70 papers, 4 textbooks and co-editor of 3 proceedings published by Springer Verlag. She has been the project leader of a number of local and international R&D projects (e.g. ESPRIT, INCO-Copernicus). Her main research interests are distributed AI, machine learning, logic programming, ILP, knowledge-based systems and qualitative reasoning.

Dr. Jiri Lazansky graduated from Czech Technical University in Computer Science in 1970. He received the PhD. degree in 1982 and since 1984 he has been the Associate Professor in Technical Cybernetics at CTU. His lecturing activities concentrate on real-time operating systems, selected topics in applied artificial intelligence (oriented especially on planning applications and genetic algorithms) and CIM. He is member of the editorial board of *Journal of Microcomputer Applications* (Academic Press) and a member of programme committees of the international conferences DEXA (since 1993). He is also an author (or co-author) of about 90 publications in artificial intelligence, software engineering, evolutionary computing, production planning and CIM. He has been involved in a number of local and international projects (e.g. Tempus, INCO-Copernicus, TEN etc.) and in industrial co-operation in the area of multi-agent systems.

Dr. Petr Horacek is Associate Professor at the Department of Control Engineering, Faculty of Electrical Engineering, Czech Technical University of Prague. He lectures courses on Optimal & Adaptive Control Systems, Modelling & Identification, Operations Scheduling, Fuzzy Modelling & Control. He was the principal builder of the Control Theory Lab. He was also a visiting professor at the INPG Laboratoire d'Automatique de Grenoble (1994-96) where he read courses on Scheduling Theory and Fuzzy Control. In research he focuses on Digital Control Systems Theory and Applications, Fuzzy Control and Systems Modelling Techniques. He conducted large European Project TEMPUS Higher Education in Control Engineering (1991-1993) and has intensive co-operation with industrial partners in control and automation, e.g. Honeywell, Boeing, Rockwell Automation and many Czech companies.

University of Vienna, Austria

Department of Medical Computer Sciences

The Department of Medical Computer Sciences, Section on Medical Expert and Knowledge-Based Systems, has as its goal research in algorithmic and programming methods and development of practical systems for computer-assisted medical decision making in the hospital and the physician's office. Medical expert and knowledge-based systems are designed to give expert-level, problem-specific advice in the areas of medical data interpretation, patient monitoring, disease diagnosis, treatment selection, prognosis, and patient management. They capture and make available the knowledge of experts and - by applying that knowledge to patient data - emulate and assist in the decision making behavior of medical and administrative personnel.

Research in medical expert and knowledge-based systems and the development of such systems is most significant to the broad realm of quality assurance and cost containment in medicine. The work of our group covers methodological research, interdisciplinary clinical projects, teaching, and technical and operational services for the departments of the University of Vienna Medical Schools as well as local, national, and international collaborations. The subject matter of this scientific and, to an increasing extent, practical focus of medical computer science is the basic research, practical development and clinical application of methods and systems for processing medical knowledge in the course of interpreting medical findings, providing

diagnostic support and therapy advice, giving hints for disease prognosis, guiding patient management, and monitoring hospital and patient's medical data and costs.

The results of these research activities have impacted a large number of computer applications in medicine:

- Clinical Patient Management
- Laboratory Medicine
- Anesthesia and Intensive Care
- Internal Medicine
- Image Generating and Processing Medicine

The Section on Medical Expert and Knowledge-Based Systems comprises the carrying-out of methodological research, interdisciplinary clinical projects as well as education, training, and consulting services for the wards and institutes of the University of Vienna Medical School, Austria. Furthermore, the Section on Medical Expert and Knowledge-Based Systems cooperates with institutions of the public sector and commercial partners to transfer its developed prototypes—usually after having been tested practically and studied extensively at the Vienna General Hospital—to other medical institutions.

Klaus-Peter Adlassnig received his M. Sc. degree in computer science from the Technical University of Dresden, Germany, in 1974. He joined the Department of Medical Computer Sciences of the University of Vienna Medical School, Austria, in 1976. He obtained his Ph. D. degree in computer sciences from the Technical University of Vienna, Austria, in 1983.

Dr. Adlassnig was a postdoctoral research fellow with Professor Lotfi A. Zadeh at the Computer Science Division at the Department of Electrical Engineering and Computer Sciences of the University of California at Berkeley from 1984–86. He received his *Venia docendi* for Medical Informatics from the University of Vienna in 1988 and became Associate Professor in 1992. Since 1988, he has been head of the Section on Medical Expert and Knowledge-Based Systems at the Department of Medical Computer Sciences of the University of Vienna Medical School. Dr. Adlassnig was a Visiting Associate Professor at the Department of Medicine, Section on Medical Informatics, at the Stanford University Medical Center in summer 1993, a Guest Professor at the Department of Electrical and Biomedical Engineering at the Technical University of Graz in 1998, 1999, and 2000, and a Visiting Scholar at the Department of Electrical Engineering and Computer Sciences, Computer Science Division, Berkeley Initiative in Soft Computing (BISC), University of California, Berkeley/U.S.A. in summer 2000.

His research interests focus on medical informatics and computer applications in medicine, especially medical expert and knowledge-based systems, medical information systems, and mathematical theories of uncertainty with emphasis on fuzzy set theory. He is equally interested in the theoretical and practical aspects of computer systems in medicine.

Datamed S.A., Greece

DATAMED S.A., being part of the ALTEC Group - one of the most dominant groups in the IT and Telecommunications sector- is a company established in 1999, which was set up to specialize in sales, installation, integration, and support of large-scale IT projects in the healthcare sector. The primary objective of DATAMED S.A is to take advantage of the vast possibilities offered by high technology, in order to upgrade the level of provided services in the health care sector; improve citizen's quality of life; and, to render the know-how produced in Greece into a fully competitive and exportable product.

DATAMED S.A is committed to **provide turnkey solutions** to its customers using the latest technology, and applying advanced methods of design, implementation and project management.

Some of the **core activities and services** of DATAMED S.A offered to its customers are:

- Analysis, Design, Installation, Integration and Support of Healthcare IS
- Development, Production, Distribution and Marketing of Hi Tech Products
- Development & Implementation of Hospital Information Systems
- Development of Smart Card Systems
- Development & Implementation of Telemedicine and Home Monitoring Applications
- Strategic & Feasibility Studies of Healthcare IS
- Preparation, submission, and implementation of shared-cost EU research projects
- Participation in International Tenders

- Communication & Digital Network Integration
- Consulting & Project Management Services
- Medical Data Statistical Processing & Presentation Systems
- Educational Multimedia Applications Development and Marketing

The company has rapidly established an excellent reputation in the IT market and has been able to substantially differentiate from the competition by focusing on the continuous **introduction of innovative products and services** in the field of IT in the Healthcare sector.

DATAMED S.A successes in delivering technologically optimized products and services is achieved by placing a strong emphasis on:

- Pioneer Research
- Human Oriented Design
- Exploitation of State-of-the-art Technologies
- Provision of Healthcare Products and Services
- Flexible Company Organization
- Human Resources Expertise
- Business Goal Fulfillment

The continuous evaluation of the Greek and European market enables the company to focus on the development of custom-built applications and information systems designed to meet a wide variety of needs in all fields and levels of the Healthcare sector.

DATAMED S.A does have the competitive advantage to develop its commercial activities throughout the entire range of a vertical market covering the demands of the most decentralised user to the most centralised organisation. In addition, the active participation of medical experts in the design, development and integration of applications ensures the medical oriented nature of the turnkey solutions offered by DATAMED S.A.

The four strategic innovative products being currently promoted by DATAMED S.A and covering the entire spectrum of the Healthcare IT market are:

- *Health Smart Card*
- *Physician's Office Software*
- *Telemedicine Systems*
- *Medico Plus*, an integrated Hospital Information System produced by DATAMED S.A. More specifically, Medico Plus is the enhanced version of Medico//s, a product of the well-known American company **Shared Medical Systems (SMS)**, which is exclusively distributed in Greece by DATAMED S.A.

The set-up of an international network of co-operation and communication is of major strategic importance. The international orientation of DATAMED S.A is further reinforced by the well-planned development of international business. The strengthening of relationships and the maintenance of ongoing co-operation have resulted into the promotion of the company's activities beyond the Greek borders. High level international contacts and relations with well-known companies and groups have already been established.

DATAMED S.A through its participation in state-of-the-art information technology projects, foresees the collaboration with key players in the information society, the active participation in innovative actions, the reinforcement of the R&D activities, and the design of advanced solutions and products for the following decade.

The R&D department of DATAMED S.A is responsible for the preparation, submission, and implementation of shared-cost EU research projects, while it co-ordinates and guides the relevant R&D departments of all ALTEC Group companies in the area of EU funded projects. Through this activity, DATAMED S.A actively participates in European consortia consisting of dominant IT key actors and co-operates with them on large-scale IT European projects

The rapid growth of DATAMED S.A, both nationally and internationally, is a realistic expectation and will soon be a reality. An important factor for the company's dynamic development is the highly-qualified and experienced personnel forming a flexible organizational structure. Undoubtedly, DATAMED S.A is in the position to successfully aim, reach, and achieve its short and long-term goals.

Alexander Berler was born in Lausanne, Switzerland in 1969. He received the degree in Electrical Engineering from Aristotle University of Thessaloniki, Greece in 1995 and the M.Sc. degree in Biomedical Engineering from National Technical University of Athens (NTUA), Greece, in 1997. He has been with the Department of Electrical Engineering, NTUA, from 1996 to 1998, as a Research Postgraduate Student, working in the areas of biomedical engineering and medical informatics. He is currently working at DATAMED S.A. as a Biomedical & Software Engineer. Mr. Berler is a member of the Hellenic Society of Biomedical Engineering since 1997 and of the IEEE Computer Society, the IEEE Engineering in Medicine and Biology Society, the Association for Computing Machinery and the European Society for Engineering in Medicine since 1998.

Pavlos Aravantinos was born in Athens, Greece in 1972. He received his degree in Electronic Engineering from the University of Central England (UK), in 1994, and his MSc in Medical Electronics in 1995 from the University of Wales college of Cardiff. He has worked as research Engineer, for medical technology applications, in the Business Development Department of ERGO S.A. from 1997 to 1999. Since 1999 he is working as Research Engineer and Senior project manager in the International Business department of DATAMED S.A.. His expertise is on innovative telematic applications for health and medical device development and has participated in numerous European and National research projects.

De Montfort University, United Kingdom **The Centre for Computational Intelligence**

The *Centre for Computational Intelligence* was formed in 1996, is led by Dr. C. Czarnecki and has 5 members of staff and 7 full-time PhD students. The Centre conducts application driven basic research in the three fundamental components of Computational Intelligence – evolutionary computation, fuzzy logic and artificial neural networks. We aim to provide theoretically sound solutions to real world problems primarily in *Intelligent Medical Systems* and *Intelligent Robots*, and a particular strength of ours is the exploitation of the synergy between the three components.

In fuzzy logic, our work has concentrated on the development of fuzzy logic for knowledge representation, with a particular focus on extending the theory of type-2 fuzzy logic to enable improved representation of expertise. The majority of the applications of our fuzzy logic work are in the field of medicine. In collaboration with a local clinic we have used type-1 fuzzy sets to assist in radiographic image classification of shin injuries. The results of this work instigated our developments in type-2 theory for use in the classification of the images by preprocessing the consultants' perceptions of the image and injury for input to unsupervised artificial neural networks. To solve the problem of membership function generation in type-2 systems we developed the Adaptive Fuzzy Perception Learner (AFPL).

Another project has been investigating the problem of diagnosing confusable diseases with time-dependent symptoms. To solve this, a new process for modelling dynamic fuzzy terms has been developed. Another major project has been to provide validation and interpretation of umbilical cord blood from newborn infants, initially resulting in development of a crisp expert system. Thorough evaluation of the crisp system led to its commercial exploitation and it is now employed in over 25 hospitals within the United Kingdom. Subsequent work highlighted the requirement for uncertainty handling to better match human expert performance and the system was extended to incorporate fuzzy logic. Research in this area led to a novel method for using simulated annealing for the fine tuning of fuzzy models to best represent expert opinion.

In the field of intelligent robotics we have investigated and developed modular approaches to autonomous competence acquisition for mobile robot systems. We expressed some foundational concerns regarding the behaviour-based approach to developing adaptive autonomous robots and introduced the concept of "embedding in time" as a first step towards overcoming the short-comings. A novel second order recurrent neural network architecture has been proposed which provides, we believe, a better long term foundation for achieving true autonomy. Complimentary to this work we have considered evolutionary approaches to competence acquisition and successfully shown that the ability to communicate amongst a group of robots can be automatically acquired.

We have also recognised the strengths of the behaviour-based approach for adaptive autonomous systems leading us to integrate the architecture into semi-autonomous robot systems. Our work here has focused on developing a generic architecture (GCAT) and associated computational algorithms for the autonomous and

semi-autonomous control of telerobots. This work has been supported by DERA (3 separate projects) who also donated a £150K bomb disposal robot for practical work. We have formalised the behaviour-based design approach and proposed a pattern methodology for behaviour-based robotics with a particular emphasis on man-machine interaction.

The theory of genetic algorithms has been revolutionised in the last decade by exact rigorous mathematical descriptions of the algorithms. We have made contributions to this theory such as an investigation into many properties of the fixed-points of genetic algorithms (viewed as dynamical systems) in relation to both static and dynamic environments. The new theory has been generalised: introducing coarse-grained levels of description; defining an abstract space of “genetic operators” (thus introducing the tools of functional analysis); and using group theory to show how the algorithm exploits symmetries in the search space. We have also applied parallelised versions of genetic algorithms to neural network design and medical informatics.

Chris Czarnecki is the Director of the Centre for Computational Intelligence and a principal lecturer in the Department of Computer Science at De Montfort University. His research interests include: autonomous agents, mobile robots, mechatronics, realtime systems, object-oriented technology, and software engineering. Current projects are *The Wheelbarrow* - a teleoperated bomb disposal robot and *DAVe* - Distributed Autonomous Vehicles. He teaches in areas of data communications and computer networks, operating systems, programming (C,C++, Visual C++ and Java), and artificial intelligence. He has been on the programme committee for a number of international conferences on Mobile Robots and was an invited speaker at the EuroConference on Focused Aspects of Mechatronics: Configuration and Control Aspects of Mechatronics in 1997.

Jon Garibaldi is a senior lecturer in the Department of Computer Science at De Montfort University, having joined in 1999. His main research interest is in using intelligent techniques to model human reasoning in medical applications. Current projects include evaluating the fuzzy expert system for umbilical cord blood analysis through involvement in a Swedish based pan-European multi-centre trial, and investigating a novel application of fuzzy logic to cervical cancer screening. He teaches in areas of computer hardware and software, programming in 'C', operating systems and artificial intelligence. Dr Garibaldi will be the local co-ordinator of the CCI's membership as a key node of EUNITE.

Bob John is a principal lecturer in the Department of Computer Science at De Montfort University. His main interests lie in the area of fuzzy logic, particularly in type 2 fuzzy sets and the role they play in knowledge representation and inferencing. Current projects include *Adaptive Fuzzy Perception Learner* - an adaptive system that learns perceptions by the use of type-2 fuzzy sets, and *ELVIL* (European Legislative Virtual Library), using fuzzy logic and user modelling techniques to improve the usability of the internet search engine, funded through the European Commission. He has refereed papers for FUZZ-IEEE conferences, IEEE Transactions on Fuzzy Systems, Journal of the Operational Research Society, and Information Sciences. He is the current local co-ordinator of the ERUDIT node.

Peter Innocent is a principal lecturer in the Department of Computer Science at De Montfort University. His work has been in applying artificial intelligence research to solve medical problems alongside European collaboration on HCI standards. Among his recently completed research is the successful application of neural networks to medical image processing which has involved collaboration with colleagues in Poland, and using fuzzy approaches to the early diagnosis of confusable diseases. His research interests include: neural networks, fuzzy logic, medical imaging, and medical diagnosis. Current projects are to extend the *Early Diagnosis of Confusable Diseases*, and in discovering methods to extend fuzzy cognitive maps to include type-2 fuzzy sets.

John Rowe joined the University in 1994 and is a Senior Research Fellow in the Department of Computer and Information Sciences at De Montfort University. His main research interest is in the theory of genetic algorithms and current projects include using group theory to illustrate how genetic algorithms exploit symmetries in the search space. He has been on the programme committee for a number of international conferences on Genetic Algorithms and was the invited guest lecturer at EU funded Evonet Summer School on “Theoretical Aspects of Evolutionary Computing” in 1998.

Delft University of Technology - DUT, The Netherlands
Systems and Control Engineering (SCE) Laboratory, Faculty of Information Technology and Systems

The staff of the Systems and Control Engineering (SCE) Laboratory, Faculty of Information Technology and Systems, Delft University of Technology comprises two full professors, five associate professors, one assistant professor, five postdocs and 11 PhD students. The research activities of SCE are concentrated around four main themes:

- Analysis and control of nonlinear systems: nonlinear predictive control, sliding mode control, feedback linearization, model and controller order reduction techniques.
- Intelligent modeling, control and decision making: fuzzy logic and neural network techniques for black-box and gray-box modeling, knowledge-based control design and decision support.
- Distributed, hierarchical, and hybrid systems and control: design of hierarchical control strategies for selected classes of hybrid systems continuous-variables interacting with discrete-event systems).
- Physical modeling and control: Lagrangian and Hamiltonian frameworks for the modeling of physical systems, energy-based control switching electrical networks, autonomous robots and telemanipulators.

The laboratory participates in two inter-faculty research programmes at the DUT, four major Dutch industrial projects, three European research projects (Esprit and Brite Euram) and two European networks of excellence. The SCE is a member of two research schools, the Dutch Institute of Systems and Control (DISC) and in the Inter-University Research Institute for Transport, Infrastructure and Logistics (TRAIL). The yearly scientific output of the laboratory includes on average three PhD dissertations, one book, about 30 papers in archived journals and 50 Reviewed conference papers. About 20 MSc students graduate from the laboratory every year. Researchers of DUT will contribute in the area of control, modeling, identification, fault detection, isolation and reconfiguration using fuzzy logic and neural network techniques. The SCE laboratory is internationally recognized as one of the leading research institutions in this field.

The responsible will be **Dr. Robert Babuska**, associate professor at the SCE laboratory. His main research interests include multiple-model approaches to nonlinear modeling, control and fault detection, data-driven construction of fuzzy systems and neural networks, use of a priori knowledge in system identification, nonlinear predictive and adaptive control for partly unknown systems. He is the author of one research monograph, co-editor of two books, co-author of 16 chapters in books, 18 articles in archived journals, and more than 80 conference papers. He serves as an associate editor of three archived international journals. Currently, he is leading a group of six researchers in the area of fuzzy logic and neural networks. He has extensive experience with international research projects. He has been involved in three European projects, in two of them he is responsible for the DUT contribution, he was the co-proposer and co-organizer of an EC-sponsored TMR International School on Fuzzy Control and he is the co-chairman of the 'Future Research and Advanced Technologies' committee of the European Esprit Network of Excellence 'Erudit'.

E.N.E.A. - Casaccia R.C., Italy

ENEA is the Italian government agency responsible for the areas of new technology, energy and environment. Its two fundamental tasks are to conduct research in these areas and to diffuse the results.

In particular ENEA's activities involve: research, development and testing of innovative technology and equipment, transfer of innovations to industry and agriculture; development of technologies, equipment and components designed to exploit renewable energy sources and to save energy.

In this context the "Diagnostic & Control" laboratory is deeply involved in carrying out new *intelligent* methodologies and *adaptive* systems. In particular we are focussed on soft computing, chaos theory, artificial life and complexity and we apply them to industrial energy problems processes following the philosophy of eco-sustainability.

In the recent past (1996-1998) the group was the leader of a C.E. Thermie project OG/0143/94 "Monitoring and diagnostic system, based on expert system technology, for multiphase transportation processes". The task of this project was to carry out a system for the diagnostics of multiphase process based on innovative instrumental complexes, a decisional system, a process simulator and a series of diagnostic modules. In particular the goals were: accurate measurement of the three phase flow (oil, gas, water), monitoring and diagnostics of the plant, slugging phenomena detection, prediction of the line state. During these years many innovative methodologies (mainly fuzzy logic, neural network and chaos) have been studied and successfully applied. The final system gave excellent results and it was installed on a real AGIP oil field in Italy.

At present research is focussed on the creation of *techniques which adapt and develop intelligence* based on the approach of the artificial life and soft computing methodologies. In the *artificial society* the individuals can reproduce, evolve, adapt and fight increasing continuously the performance of the solution for the problem we want to solve. The goal in the control application is to achieve the best strategy, by following the evolution of the environment and continuously adapting to them, in the process management in order to increase the energetic efficiency and decrease the impact on the environment. Such technologies can find natural application in different production fields like information networks, communication and industrial design.

The Laboratory collaborates with many international research institutions and industries.

Dr. Stefano Pizzuti, Master degree in Computer Science in 1996. Performing research activity since 1997 at the Diagnostics and Control Lab of E.N.E.A. at the "Casaccia" R.C. in the fields of soft computing and adaptive systems, chaos theory, artificial life and complexity applied to energy related problems. Author of many national and international publications.

Mauro Annunziato, Director of the Diagnostics and Control Laboratory of the Energy Dept., Engineering Branch of ENEA. Master degree in Nuclear Engineering in 1983. The main field of research was the data analysis and process control. The research involved the following areas: image analysis, pattern recognition, neural networks, fuzzy logic, chaos and complexity theory, expert systems. These studies have been mostly applied in three main fields: nuclear reactors (83-88), multiphase flow (86-99) and combustion (92-99).. Author of 4 international patents and more than 100 publications on national and internal conference proceedings and reviews. In 91-94 he has been technical responsible for ENEA of a Thermie EU project and in 94-98 he has been the Technical Co-ordinator of the OG/0143/94 EU Thermie Project.

Ilaria Bertini, Master degree in Electronic Engineering in 1992. She performs research activities to ENEA since 1992. Involved in: design and development of a diagnostic system for the monitoring and controlling of industrial processes (traffic, industrial burners etc.); development of methodologies based on image analysis based on neural network, fuzzy logic applied in combustion processes; realisation of an expert system for the control of oil plant in the EU Project THERMIE OG/0143/94. Author of several national and international publications.

Erasmus University Rotterdam, The Netherlands

Department of Computer Science

Erasmus University Rotterdam in the Netherlands has a reputation of being a practically-oriented university, which provides studies in law, economics, management, social sciences and medicine. The education and research programs combine a problem-solving oriented, interdisciplinary approach with international scope and cooperation. The Faculty of Economics functions as a knowledge-center for the Mainport Rotterdam, one of the largest ports in the world. The faculty is active in the renowned Tinbergen Institute for Economics, and conducts research covering European and world markets, finance and banking, trade and transport, logistics and distribution, information systems and telematics. It provides education for over 4000 students.

The Department of Computer Science specializes in information systems and telematics for business, finance and marketing. It provides the study "Informatics and Economics" for 150 students. Further, the department participates in the international Global E-commerce Masters (GEM) program in cooperation with seven different universities. The research program has traditionally focused on the fundamentals of computer science and software engineering for successful applications in business problems. In recent years, the emphasis has been on the applications of modern computer technology and intelligent systems in business and finance. The efforts of the group fall under two headings: Intelligent business economics and Business simulation and modeling.

Intelligent business economics group studies the benefits of intelligent technologies and intelligent information systems for finance, business and marketing. Knowledge discovery in large data sets, learning of exceptional patterns and problem solving using intelligent agents are several topics of interest. The techniques applied include neural networks, fuzzy logic, genetic algorithms, logical analysis of data, decision trees, rough sets and association rules.

The Department of Computer Science leads the following research projects on intelligent technologies:

- Knowledge discovery in business economic data.

- Strategic decision making using intelligent agents in electronic marketing.
- Data mining for marketing.

The Department of Computer Science participates in the following partnerships:

- Erasmus Research Institute on Management (ERIM).
- Dutch School on Information and Knowledge Systems (SIKS).
- Dutch Research School for Transport, Infrastructure and Logistics (TRAIL).
- European Network in Uncertainty Techniques Developments for use in Information Technology (ERUDIT).
- European Human Capital and Mobility project on Solving Combinatorial Optimization Problems in Parallel (SCOOP).

J. C. Bioch is associate professor at Erasmus University Rotterdam and the project leader of the intelligent business economics group. He has a wide experience with artificial/computational intelligence techniques and has (co-)authored numerous articles in these fields. He has been a visiting professor at various institutes such as Academia Sinica, Beijing, China, Kyoto University, Japan and Rutgers University, USA. He has also been the chairman of Benelearn'94 and NAIC'95 conferences and is a member of the program committee of both conferences since 1992. He is a member of the Erasmus Institute on Management, the Dutch School for Information and Knowledge Systems, and the Dutch Research School for Transport, Infrastructure and Logistics.

U. Kaymak is assistant professor at Erasmus University Rotterdam, the Netherlands. He holds a Ph.D. degree from Delft University of Technology in the Netherlands for his work on fuzzy decision making and control. Between 1997 and 2000 he worked at the R&D department of Shell International Exploration and Production. Part of his Ph.D. work was done within the scope of FALCON (Fuzzy algorithms for control) working group under the umbrella of the EC program to stimulate intelligent technologies. He has (co-)authored more than 50 scientific publications, especially in the fields of soft computing and computational intelligence. He is a member of the IEEE, the Royal Institute of Engineers, The Netherlands, and an associate member of the Dutch School for Information and Knowledge Systems.

Faculty of Electrical Engineering and Computing - FEEC, Zagreb, Croatia

At present the Faculty of Electrical Engineering and Computing (<http://www.fer.hr>) – FEEC in short – as a part of University of Zagreb, has its roots in the Technical Faculty Zagreb founded in 1919, which evolved into the Faculty of Electrical Engineering in 1956 and was upgraded into the Faculty of Electrical Engineering and Computing in 1994. Due to the increasing progress and advances in electrical and electronic engineering as well as in computer sciences and information technologies, FEEC becomes the largest technical faculty and the leading educational and R&D institution in the fields of electrical engineering and computing in Croatia.

The present educational staff comprises 100 professors and 150 teaching assistants and researchers operating in more than 50 laboratories and in the area of more than 35000 sqm. More than 10000 graduate students, more than 2000 postgraduate students who received Master degree and more than 500 students with Ph.D. degree, are today's total numbers, which highlights our highly spirited activities in teaching. Additional to this number are also 3300 undergraduate students as well as about 400 graduates each year.

In the last twenty five years, scientific and professional work at the Faculty has been carried out on projects promoted and funded by the Ministry of Science and Technology in the fields of applied physics and mathematics and in the fields of electrical engineering and computing. The Faculty has developed valuable international co-operation with various scientific institutions in the world, either directly or through inter-university co-operation. The Faculty has a large central library and departmental libraries with about 60,000 titles and is subscribed to 400 foreign and 50 domestic magazines.

The Information Support Center provides computing and communication facilities for education, research and development. The computer equipment of the Faculty may be briefly described as a complex distributed computing system, consisting of more than sixty servers and more than 300 clients, connected to 12 subnetworks and the common local network of the Faculty. The local network is connected to the Croatian Academic and Research Network - CARNet and through it to the global network Internet. Today, the Faculty network is based on ATM - Asynchronous Transfer Mode, which accelerates data transfer capabilities and thus provides multimedia communication.

The Department of Control and Computer Engineering in Automation (<http://www.rasip.fer.hr>) will be

responsible for collaboration on proposed projects. The key persons will be Asst. Professor Ivan Petrovic and Professor Nedjeljko Peric. They gathered more than 10 young researchers and organized them in a team for research of advanced control systems. The research work of the team is particularly intensive in the following areas:

- application of fuzzy logic, neural networks and genetic algorithms in the design of advanced control systems, i.e. predictive control, sliding mode control and robust adaptive critic based control;
- intelligent measurement systems, sensor data fusion and autonomous sensor-based systems.

More info about the team and its activities can be found on web site <http://www.rasip.fer.hr/act>.

Ivan Petrovic, Ph.D. (1961) is currently an Assistant Professor at the Department of Control and Computer Engineering in Automation at the Faculty of Electrical Engineering and Computing, University of Zagreb, Croatia. He had been working for 10 years at Institute of Electrical Engineering of the company Koncar as an R&D engineer for the control of industrial plants. His current research interests include methodology of neural networks and fuzzy logic and their applications to complex control systems and to multisensor data fusion systems. He is the author or co-author of 7 journal papers and more than 30 conference papers. He actively participated in 10 research and development projects which were financially supported by state institutions as well as by commercial companies. Until now he hasn't participated in any EC project because for scientists from Croatia it was not allowed.

Nedjeljko Peric, Ph.D. (1950) is a Full Professor at the Department of Control and Computer Engineering in Automation at the Faculty of Electrical Engineering and Computing, University of Zagreb, Croatia. Since 1998 he has been Vice Dean of the Faculty. Professor Peric is also a Fellow of Croatian Academy of Engineering. He is the author or co-author of more than 100 journal and conference papers. In his activities he dealt with a wide range of problems related to research, development and application of complex control systems of a variety of plants and processes. He was in charge of 16 major research and development projects which were financially supported by state institutions as well as by commercial companies. Until now he hasn't participated in any EC project because for scientists from Croatia it was not allowed. However, he is appointed as the co-ordinator of a pending TEMPUS project.

University of Girona, Spain

Department of Electronics, Computer Science and Control (EIA) Control Engineering and Intelligent Systems Group (EXIT)

The Control Engineering and Intelligent Systems Group (EXIT), within the Department of Electronics, Computer Science and Control (EIA) is directed by Dr. Josep Lluís de la Rosa. The group is designated a consolidated research group by the Government of Catalonia. It is part of the Institute on Computer Science and Applications (IIIA). Most of the members of the group are lecturers on Systems Engineering, Control and Electric and Electronics Engineering.

The main research lines of the group are:

- Application of modal intervals to the simulation and the robustness analysis of systems with parameters uncertainty. Symbolic and numeric computation are combined into Modal Interval Analysis. The goals are the design of robust controllers into a parameter space and the interval simulation of systems with parametric uncertainties.
- Expert supervision of industrial processes. Artificial Intelligence applied to the supervision of industrial processes. Creation and evaluation of tools to abstract information starting from the measured variables. Integration of tools for the design of structures of supervision. Different applications are slow industrial processes, electrical machines and applications to mobile robotics.
- Development of applications based on agents. Application of modularization and ability of representation of this field of Artificial Intelligence to control and supervision systems. Examples are centred on the experimentation platform MIROSOT (Micro-Robot World Cup Soccer Tournament) and RoboCup, in which teams of 3 to 5 robots co-operate in order to win, for scientific purpose, a competition.

Projects

Currently the group is involved in the European project Eureka E! 2146: "Euroagri-Indrycha: Design of an intelligent drying chamber (IDC) for the curing of hams and sausages" about automation of drying chambers. In the past, the group has been involved in the Esprit II project number 2428: "IPCES: Intelligent Process Control by means of Expert Systems" (1988-1993). Some members of the group have been involved in the Esprit III project number 6862: "TIGER : Real-Time Situation Assessment of Dynamic, Hard to Measure

Systems" (1992-1995).

Josep Vehí obtained a degree in Sciences at the Autonomous University of Barcelona (Spain) in 1987. He got the Ph.D. degree in Engineering by the University of Girona in 1997. In September 1987 he joined the Technical University of Catalunya. Since 1991 he has been working at the University of Girona (Spain), ascribed to the Institute of Informatics and Applications (IiA). He is member of ARCA (Spanish group on Automation of Qualitative Reasoning and its Applications) and founder member of IAC (Spanish group in Applications of Intervals to Systems and Control). His present research interests include interval methods applied to robust control and interval simulation applied to fault diagnosis. Applications fields range from food and process industries to robot control and structural control. He has published more than 50 International Journal/Conference papers. He is member of IEEE, IFAC and ACM.

Joan Colomer obtained a degree in Sciences at the Autonomous University of Barcelona (Spain) in 1990 and the Ph.D. degree in Engineering by the University of Girona in 1998. Since 1992 he has been working at the University of Girona (Spain). He is member of the IiA (Institute of Computer Science and Applications) of the UdG since its foundation and member of ARCA (Spanish group on Automation of Qualitative Reasoning and its Applications). His main research interests are on knowledge based techniques for fault detection, diagnosis and supervision of industrial processes, specially on obtaining qualitative representation of signals for these purposes. He has been working in several national research projects. He has several publications in international journals and conferences.

Joaquim Meléndez received a degree in engineering at the Universitat Politècnica de Catalunya (Spain) in 1991 and PhD degree at the University of Girona in 1998 where he is a lecturer since 1999. He is member of the IiA (Institute of Computer Science and Applications) of the UdG since its foundation and member of ARCA (Spanish group on Automation of Qualitative Reasoning and its Applications). His research interests are on the integration of model based approaches (qualitative and numeric) with knowledge based techniques for supervision of industrial processes. He worked in the BRITE/EURAM1 project BREU0119 entitled "Multisensor Visual Inspection in High Speed Garment Production" and also in several national research projects. He has several international publications.

Josep Lluís de la Rosa i Esteva received his M.S. and Ph.D. degrees in Electronics Engineering from the Autonomous University of Barcelona (UAB), Barcelona, in 1989 and 1993, respectively. In 1989 he was a technical research assistant in the department of Natural Language of the Siemens Software Development Centre (CDS) in Barcelona, and participated in the long-term intern METAL project of Siemens. In 1991 he joined the Laboratoire d'Architecture et d'Analyse des Systèmes of the French National Foundation for Scientific Research (LAAS-CNRS) in Toulouse (France) and participated in the IPCES European Esprit project for Philips. In 1993 joined as assistant professor to the Autonomous University of Barcelona (UAB) till he moved to the University of Girona (UdG) in 1994, ascribed to the Institute of Informatics and Applications (IiA). In 1998 he spent a post-doc at the LAAS-CNRS. From 1999 he is the head of the Electronics, Informatics and Automatic Control Department and responsible for eXiT research group (Control Engineering and Intelligent Systems). His present research interests include artificial intelligence, especially dynamical physical multi-agent systems, applied to supervisory control and continuous process control. He currently is member of the AgentLink European Network of Excellence Project. As for practical applications, he focuses on food industry, especially meat and bread industry. He has published more than 50 International Journal/Conference papers. He is member of IEEE, IFAC and ACIA (ECCAI).

University of Nijmegen, The Netherlands

The Dutch Foundation for Neural Networks - SNN

SNN stands for the Dutch Foundation for Neural Networks. SNN is coordinated by Prof. dr. C.C.A.M. Gielen and Dr. H.J. Kappen from the department of Medical Physics and Biophysics at the University of Nijmegen, The Netherlands. SNN's main objectives are to coordinate research into neural networks, to explore new fields of industrial application, and stimulate knowledge transfer to industry. These objectives underlie all SNN's activities.

SNN frequently (co)organizes conferences and symposia, aiming at researchers as well as people from industry. In 1993, SNN organized ICANN, Europe's main conference on neural networks. SNN's conference in 1997 showed several case studies of real working neural network applications, collected in the proceedings "Neural networks: best practice in Europe". This year, SNN coorganized a mini symposium called "Adaptive Solutions" in collaboration with the Dutch Technology Foundation STW, presenting many application-

oriented projects on neural networks and related techniques.

SNN is and has been involved in several projects promoting the development and dissemination of neural network technology. SNN Nijmegen is a managing node of NEuroNet. Furthermore, SNN took part in SIENA, another ESPRIT initiative, which ended in 1996. Its main deliverables were a white paper on neural network technology in Europe and a collection of case studies of successful applications.

SNN's research activities range from strongly theoretical to purely applicative. Applications have been built, among others, for medical diagnosis, predicting consumer behavior, musical rhythm quantization, and process control (for the paper industry). SNN closely collaborates with the company SMART Research BV on the commercialization of these and other applications.

SNN has organized several symposia and conferences on neural networks, most notably ICANN, Europe's major conference on neural networks, in 1993 and "Neural Networks" Best Practice in Europe" in 1997 presenting real-world applications. SNN has been involved in the Esprit project SIENA and the Network of Excellence NEuroNet (both I and II) ranging from the organization of conferences to the participation in European projects for knowledge dissemination. Funding comes from research grants and sponsoring companies.

As can be seen from the list of industrial contacts, many companies have already used the services of SNN. SNN researchers can offer consultancy, provide courses, and carry out pilot studies. Especially for innovative projects, SNN is the ideal partner. Research by SNN has resulted in several new commercial products, some of which are further developed and brought to the market by the spin-off companies SMART Research BV and IMPACTS.

Prof. dr. C.C.A.M. Gielen

The main field of research involves experimental and theoretical approaches to study neuronal information processing. His expertise in theoretical studies of networks with spiky neurons and in artificial neural networks, and in behavioral and electrophysiological studies in primates, primarily focussing on perception, sensor-fusion, and motor control. His group has been involved in many European projects in the past (ESPRIT, Human Capital and Mobility). At present his group participates in the European TMR project "Principled Hybrid Systems: Theory and Applications. Prof. Gielen is member of the board of many international organizations, such as the Council of Scientists of the Human Frontier Science Program, and the Japanese Real-World Computing Program. He is on the editorial board of 7 international scientific journals.

Dr Tom Heskes received both the M.Sc. and the Ph.D. degrees in physics from the University of Nijmegen, The Netherlands, in 1989 and 1993, respectively. After a year postdoctoral work at the Beckman Institute in Champaign-Urbana, Illinois, he (re)joined the Dutch Foundation for Neural Networks (SNN) in 1994. Starting from 1997, he runs the company SMART Research BV. He is a member of the editorial board of Neurocomputing and served as a referee for many international journals on neural networks. His research interests include theoretical and practical aspects of neural networks and related techniques, with an open eye towards applications.

Dr Wim Wiegerinck received the M.Sc. degree from the University of Amsterdam, The Netherlands in 1988. From 1988 to 1990 he worked at the Royal Netherlands Meteorological Institute. Subsequently he worked at the Department of Medical Physics and Biophysics of the University of Nijmegen, The Netherlands, where he received the Ph.D. degree in 1996. Since 1995, he worked for SNN as a postdoctoral researcher. From 1995 to 1996, he was mainly involved in the SIENA (Stimulation Initiative European for Neural Applications) ESPRIT project. Currently his main activities are in research in theory and applications of probabilistic networks. Partially he is involved in NEuroNet II, which is funded by the Fourth Framework Program of the European Union.

Dr Bert Kappen studied particle physics in Groningen, the Netherlands and completed his PhD in this field in 1987 at the Rockefeller University in New York. From 1987 until 1989 he worked as a scientist at the Philips Research Laboratories in Eindhoven, the Netherlands. Since 1989, he is conducting research on neural networks at the laboratory for biophysics of the University of Nijmegen, the Netherlands. Since 1997 he is associate professor at this university. His group consists of 10 people and is involved in research on stochastic processes, Boltzmann Machines, bootstrapping, probabilistic reasoning and several applications in collaboration with industry. His research was recently awarded a prestigious national research subsidy. He is vice-director of the Dutch Foundation for Neural Networks (SNN), which coordinates research on neural networks in the Netherlands. He organized 4 national conferences and ICANN'93. He is author of approximately 50 publications and editor of 3 conference proceedings.

Helsinki University of Technology, Finland
Transportation Engineering

The emphasis of the current research activities in the laboratory of transportation engineering (25 employees) are simulation of traffic control and traffic flow, traffic demand models and forecasts, fuzzy logic, neural networks and genetic algorithms in transportation engineering, traffic flow characteristics and measurement techniques, logistics and freight transport, and telematics in transportation.

Concerning this project, HUTSIM – an object oriented microlevel simulation program for traffic simulation has been developed since 1989. The traffic model has been calibrated and validated with a large amount of field measurements. The calibration of roundabouts is going on. HUTSIM has successfully been used to evaluate systems like area control with public transport priorities and self-optimising signals. Research of the environmental effects of signal control was started in 1996, both on national and European Union level. The use of simulation in the evaluation of telematics in transportation is a new field of laboratory research. The pilot study was made in 1996. The Laboratory of Transportation Engineering has been involved in several European projects in 1990's.

Jarkko Niittymäki, Dr.Eng. is Research Group Leader in Transportation Engineering at the Helsinki University of Technology, his recent research areas are: Traffic measurements, traffic signal control, capacity of intersections, fuzzy models in transportation, simulation of traffic flow, impacts of environmental aspects, artificial intelligence in transportation engineering and public transport. He has over 50 publications, articles and conference papers in this field in 1990's.

IDSIA - Istituto Dalle Molle di Studi sull'Intelligenza Artificiale, Switzerland

IDSIA was established in 1988 to conduct basic AI research and to contribute to the advancement of the scientific and technological culture of Italian-speaking Switzerland. As of January 1st, 2000, IDSIA became a joint institute of the of the University of Lugano (USI) and the University for Applied Sciences of Southern Switzerland (SUPSI). Business Week magazine ranked IDSIA among the world's top five labs in biologically inspired AI, and among the top ten in general AI (<http://www.businessweek.com/1997/25/b353222.htm>).

IDSIA is active in the following research and application areas:

Artificial neural networks: We are particularly interested in efficient online training of networks, recurrent networks with time-varying inputs, and networks with high generalization ability that are simple in the information-theoretic sense. In each of these areas we have developed algorithms that have advanced the state of the art. Our applications include forecasting, temporal coding, sequence processing, speech analysis based on prosodic features, modeling aerodynamic flow, unsupervised learning and redundancy reduction in general, and independent component analysis.

Reinforcement learning: particularly online learning by situated agents in realistic, partially observable environments, where our algorithms are helping define the current state of the art. Applications include multi-agent learning, adaptive artificial soccer teams, micro-robotics and reinforcement learning (using Kheperas), container flow scheduling, turbulence suppression, and drag minimization.

Evolutionary computation: We have developed several novel methods for evolving goal-directed programs, with applications including multi-agent learning, learning to play soccer, flow optimization through superior vehicle shapes, and neuromorphics (leave major aspects of computation to physics). General question: how much can you achieve with how little.

Meta-heuristics: We are studying different meta-heuristic approaches to solve complex combinatorial optimization problems. In particular we are applying artificial ants (inspired by the pheromone trails left by real ants) and tabu search to solve Quadratic Assignment Problems, Sequential Ordering Problems, Vehicle Routing Problems and Flexible Job Shop Problems. In these domains we have been able to compute the best known solutions for many benchmark instances, as reported in Nature (July 6, 2000) and Scientific American (March 2000).

Modeling, simulation and optimization: We are active in many research and applied projects concerning modeling, simulation and optimization in the transport field. In particular we have studied resource

allocation, container scheduling, simulation models, and flow prediction in different intermodal terminals.

IDSIA has participated in the DG VII project "Platform – computer controlled freight platforms for a time-tabled rail transport system", and is a member of the FP-5 research network "Metaheuristics". At the national level, IDSIA leads a number of research projects funded by the Swiss National Science Foundation and the Swiss Commission for Technology and Innovation.

Juergen Schmidhuber (PD Dr. habil. in Computer Science from the Technical University of Munich) is codirector of IDSIA since 1995. Over the past decade he has published roughly 100 scientific papers in machine learning, feedforward and recurrent artificial neural networks, minimal description length, Kolmogorov complexity, independent component analysis, reinforcement learning in partially observable environments, adaptive subgoal generation, multi-agent learning, probabilistic program evolution, self-modifying policies, meta-learning, and low-complexity art. He leads several national research projects in the above-mentioned fields.

Nicol N. Schraudolph is Senior Research Scientist at IDSIA. He studied neural networks under Prof. Sejnowski at the Salk Institute for Biological Studies in San Diego (USA), where he is a fellow of the McDonnell-Pew Center for Cognitive Neuroscience, and received a Ph.D. in Cognitive Science and Computer Science from the University of California in 1995. He has made significant contributions in the areas of genetic algorithms, neural networks, reinforcement learning, function approximation, and information-theoretic approaches to unsupervised learning. His current focus is the development of efficient gradient descent methods for online learning, where he leads a national research project.

Luca Maria Gambardella is codirector of IDSIA. His major research interests are in the area of learning, adaptation, simulation and optimization applied to academic and practical problems. He was the first to create artificial ant algorithms that outperformed other optimization techniques on widely used benchmarks. He has led several research and industrial projects at both national and EU level.

University of Ulster at Jordanstown, United Kingdom

Faculty of Informatics

The University of Ulster is a large multi-campus University located on four campuses spread across Northern Ireland: Coleraine, Jordanstown, Magee College, and Belfast. It has an outstanding record of collaboration at national and international level. This is reflected in its many joint research projects with leading research centres overseas and the award of nearly £20 million in European Union funds for research over the past five years. The University's commitment to technology and knowledge transfer is exemplified by its ten applied research centres, ranging from biotechnology, bio-engineering and diet and health to energy, sustainable technologies, advanced material and knowledge based systems.

The University of Ulster's Faculty of Informatics comprises staff from areas of Mathematics, Statistics and Computer Science. It is the largest such group in the UK, achieving a rating of 3A in Computer Science for 42 staff in the 1996 RAE; this corresponds to an overall research power ranking of 11th amongst all UK Computer Science units of assessments. Research in the Faculty is concentrated on the following areas: Artificial Intelligence, Data and Knowledge Engineering, Medical Informatics, Image Processing, Computer Graphics and Multimedia, and Software Engineering. In addition we have substantial research strengths in Informatics Education, Technology Transfer, and Statistics and Operational Research. There are two schools in the Faculty of Informatics, namely Information and Software Engineering, and Computing and Mathematical Sciences. The Faculty continues to generate substantial research funding mainly from the highly prestigious Engineering and Physical Sciences Research Council, the European Union and local industrial sources. In the last three years the Faculty has attracted nearly £7 million in research funding to the University of Ulster. There are currently 22 funded prospects in the Faculty which have brought in a total of more than £4 million to the University of Ulster.

Professor Sally McClean took her first degree at Oxford University, then a M.Sc. at Cardiff University followed by a D.Phil. at the University of Ulster. She has been at the University of Ulster for 28 years, with the exception of periods of sabbatical leave at Cornell, Princeton, Utah State and Vienna Universities. She has over 100 publications including the book "Statistical Techniques for Manpower Planning" which is a classic in its field and numerous publications in statistical methods for databases, data mining etc. She is a grant holder on ESPRIT projects IDARESA (ESPRIT project no. 20478) and ADDSIA (ESPRIT project no. 22950) which are concerned with the development of Statistical Information System. In the last two years she has been

invited to present papers in the USA, China, Australia and numerous venues in Europe. She is currently President of the Irish Statistical Association.

Dr. Bryan Scotney is currently a Senior Lecturer in Mathematics in the School of Information and Software Engineering at the University of Ulster. Dr. Scotney has a B.Sc. in Mathematics from the University of Durham. His Ph.D. in Mathematics from the University of Reading was for a thesis on optimal error analyst for Petrov-Galerkin finite element methods. His research interests are in Numerical Analysis, Mathematical Modelling, and the application of Mathematics to Computer Science, including Database Technology and Image Processing. He has co-authored one book and published over 50 research papers on statistical methods for Database Technology, on Knowledge Discovery in Databases and Data Mining, and on reasoning under uncertainty. He is currently a grant holder on ESPRIT project ADDSIA (ESPRIT project no. 22950).

Dr. Weiru Liu is currently a Lecturer in Computer Science in the School of Information and Software Engineering at the University of Ulster. Dr. Liu obtained her B.Sc and M.Sc degrees in Computer Science from Jilin University, P.R.China, and her D.Phil in Artificial Intelligence, from the University of Edinburgh. Her research interests are in Knowledge Representation and Reasoning, Reasoning under Uncertainty, Parallel techniques for Reasoning, Bayesian network Learning, and the integration of AI and databases. She has published over 30 research papers on these subjects, and is currently finishing a book on *The Integration of Numerical and Symbolic Approaches for Reasoning under Uncertainty (Physica-Verlag)*. She is organizing a workshop on *Applying Soft Computing Techniques in Multiple Research areas: Machine Learning and Data Mining, Telecommunications, Medical Informatics, Agents, and Robotics*, which is going to be held at University of Ulster in September, 2000.

Professor David Bell obtained his BSc in Pure Maths, MSc in Computer Science from Queens University of Belfast and PhD in Computer Science University of Ulster. His main research interests are in various aspects of multi-media, distributed databases, object oriented databases and database performance (health, industry, transport applications), reasoning under uncertainty, AI, software systems, and data mining. He has published over 200 research papers on these issues and three books in distributed databases and evidential reasoning. He has been a member of program committee of VLDB conference several times and numerous other international conferences and a member of several international journals. He has been the grant holder of many projects supported by the European Union, including ESIS (European Satellite Information Services) (EC PRISMA), LYNX (ESPRIT), projects IDARESA (ESPRIT project no. 20478) and ADDSIA (ESPRIT project no. 22950).

Professor Jolm Hughes obtained his BSc and PhD degrees from the Queens University of Belfast. He is Dean of the Faculty of Informatics and Director of the Northern Ireland Knowledge Engineering Laboratory (NIKEL) at the University of Ulster. He is a Director of MINEIT Software Ltd. and of Synergy Centres Ltd. He has more than 15 years' experience in the areas of object-oriented databases, artificial intelligence and knowledge engineering and has published two books and over one hundred research papers in these areas. He has many years' experience of research and consultancy and has been involved in a wide variety of large-scale research and development projects in commerce and industry. Professor Hughes is a Fellow of the British Computer Society and was elected by the Society as IT Professional of the Year in 1997. He is a grant holder of MIMIC (EU ESPRIT) and CERENA (EU IST 5FP).

Sarabjot Singh Anand, BA, MSc, is the research Director of MINEIT Software Ltd. He has over 6 years research and consultancy experience in data mining, knowledge-based systems, medical informatics, and database design and implementation. He has developed a number of systems within areas, including cross-sales for the financial sector, prognostic and diagnostic modelling in medicine, fault-diagnosis in manufacturing, propensity modelling in retail and property valuation, property rent accounting, and waiting list database systems within the public sector. In addition to the development of these models, Sarabjot has also developed methodologies for successfully implementing such projects in industry. He has published over 30 research papers in data mining and has co-authored a Financial Times Management book on the use of data mining for decision support. He is currently authoring another book on data mining for Addison-Wesley Longman. He is a grant holder of MIMIC (EU ESPRIT) and CERENA (EU IST 5FP).

University of Sheffield, United Kingdom

Department of Automatic Control & Systems Engineering

The University of Sheffield is over 100 years old, having its roots in a Medical School and a Technical College which related initially to the needs of steelmaking industries for which the City of Sheffield is

famous. The Faculty of Engineering has always been a major section of the University, having currently over 2,000 students at undergraduate and postgraduate levels. The Faculty comprises 8 departments, devoted to Automatic Control & Systems Engineering, Chemical and Process Engineering, Civil & Structural Engineering, Computer Science (joint with the Faculty of Science), Electronic & Electrical Engineering, Engineering Materials, Mechanical Engineering, and Medical Physics and Clinical Engineering (joint with the Faculty of Medicine). In the recent Research Assessment Exercise, the Faculty of Engineering was near the top of ratings for UK universities.

Intelligent Systems Laboratory:

The University of Sheffield is almost unique in the UK in having an individual department devoted to the discipline of automatic control and systems engineering. The Department was established over 25 years ago and currently has 13 Faculty staff, including 4 Full Professors. It is well-known for its strong postgraduate community. It houses a number of specialised research laboratories, of which the Intelligent Systems Laboratory (ISL) is one.

ISL currently comprises 15 researchers, 6 of whom are research fellows funded by government and industrial contracts and 9 are research students registered on PhD programmes. The Laboratory is headed by Professor D A Linkens and is actively pursuing research into many strands of intelligent systems engineering and their application into both industry and the life sciences. Research programmes include fuzzy logic control relating to muscle relaxation control and unconsciousness management in operating theatres, and the management of shock in intensive therapy units. Further applications of fuzzy logic involve scheduling for train transportation, model predictive control of chemical processes and power system regulation. Neural networks are being used in a range of applications ranging from anaesthesia to materials process engineering. Synergy between fuzzy and neural systems is being realised in a multi-disciplinary approach, again spanning the life sciences and aero-engine control. Included in this latter research is further integration of intelligent paradigms via the incorporation of evolutionary computing to genetic reinforcement learning into fuzzy neural control strategies. Qualitative Reasoning is another branch of Artificial Intelligence in which ISL is making innovative contributions based on a merging of qualitative modelling and bond graph techniques. This is being utilised both for detailed physiological modelling studies and the control of electro-fluid systems. Recognising that intelligent systems of the future are likely to include synergetic coupling of several paradigms, research is being undertaken into open architectures for the management of knowledge-based systems. The case study being used for this study is that of cryogenics control and optical material manufacturing. Other strands of interest include the use of wavelet transforms for signal processing of non-stationary EEG signals, chaos modelling of the brain, and hybrid modelling of complex steel making processes. ISL publishes about 25 refereed conference and learned society journal papers per year. In addition, a number of books have been produced in recent years as follows:

"CAD for Control Systems" (1993) Linkens D A (editor), Marcel Dekker, New York.

"Intelligent Control in Biomedicine" (1994) Linkens D A (editor), Taylor & Francis, London. [This contains 14 chapters contributed by researchers in ISL].

"Fuzzy-Neural Control: Principles, Algorithms & Applications", (1995) Junhong Nie & Linkens D A, Prentice, Hall, UK.

"Intelligent Supervisory Control: a Qualitative Bond Graph Reasoning Approach" (1996) Hang Wang & Linkens D A, World Scientific, Singapore.

"Generalised Predictive Control with application to medicine" (1998), Mahfouf M & Linkens D A, Taylor & Francis, London.

Professor D A Linkens has been active in bioengineering research for 20 years, and has published over 400 papers in numerous systems engineering fields. Six of these papers have been awarded prizes, and in 1994 he was awarded the Sir Harold Hartley medal for contributions to the technology of measurement and control of outstanding merit. Currently, he is a Research Professor, having previously been Dean of the Faculty of Engineering and Head of the Department of Automatic Control and Systems Engineering. He has been the Chairman of the ERUDIT Technical Committee on Human, Medical and Healthcare programme areas since its inception.

Dr Mahfouf has been active in the field of Modelling, Identification and Control for over 14 years with over 35 published papers and 6 internal research reports concentrating on these disciplines. He has 3 chapters in 3 edited books and has recently published a research monograph. The work has led to two IEE Prize awards for journal and conference publications. The work undertaken recently focused on the integration of the basic GPC architecture with Intelligent Systems paradigms such as Fuzzy Logic, Neural Networks and Genetic

Algorithms. His research in modelling and control was awarded the Cybernetics Society prize at the IEE International Conference CONTROL'91, held in Edinburgh, March 1991. The 1992 Hartree Premium was also given for an outstanding paper in the IEE Proceedings PhD. He is the current chairman organiser of the Series of UK Workshops on Fuzzy Systems.

INRETS French National Institute for Transport and Safety Research, France

The French National Institute for Transport and Safety Research (INRETS) was created by interministerial decree on September 18th, 1985. INRETS is a state-financed scientific and technological body under the dual administrative supervision of the Ministry of Research and the Ministry of Transport. INRETS has the following tasks:

- to organise, execute and assess technological research and developments concerned with the improvement of the means and systems of transport and of traffic from technical, economic and social viewpoint;
- to carry out evaluative and advisory studies within these domains;
- to promote the results of these research and study programmes, to contribute to the dissemination of scientific knowledge, and participate in training by and on transport research both in France and abroad.

INRETS is administered by a board of Directors composed of nine representatives of the transport professions (manufacturers and operators), eight representatives of the concerned Ministries and four representatives of INRETS personnel. For the orientation, co-ordination and diffusion of the research programmes, the General Director is assisted by two Deputy General Directors, three Regional Directors, the General Secretary and the board of Directors who act as advisors to the seventeen Research Units of the Institute. These Research Units are located in for regions (Paris, Nord-Pas de Calais, Rhone-Alpes and Provence-Alpes-Cote d'Azur).

At INRETS there is a total staff of 411 people: 186 researchers, 160 technicians and assistants, 65 administrative and management personnel. Two thirds of the research which is executed at INRETS deal with the physical sciences, and one third with the social sciences. The activities of the Institute involve diverse fields such as economics, sociology, psychology, physiology, ergonomics, bio-mechanics, acoustics, mechanics, mathematics, computer sciences, electronics. The diversity of approach used to carry out the different research programmes gives a multidisciplinary characteristic to the INRETS research teams, which corresponds to their methods.

The main European co-operative activities of INRETS:

- strong participation in the 4th Framework Programme (55 projects), mainly in transport (DG VII), transport telematics (DG XIII), industrial technologies and material (DG XII);
- multilateral co-operative activities Federation of European Road Safety Institutes (FERSI), European Committee for Experimental Vehicle (CEVE);
- bilateral co-operative activities Franco-German (DEUFRAKO), Franco-Portuguese; with Central and Eastern Europe contribution to transportation planning.
- INRETS carries out also extra-European co-operation activities in international organisations (OECD, World Bank, ...), with North America (TRB, ITS America, ...), with countries of Asia Pacific (Japan, South Korea, Australia) and with developing or emerging countries (Africa, Latin America, Asia)

Three Research Department of INRETS will be involved in the project: The **GRETIA** research laboratory aims to design Advanced Transport Network System. Us researches concern both

- the development of generic components for network interpretation, modeling, simulation, control and evaluation based on Mathematics, Automatics, Computer Science and Artificial Intelligence techniques,
- and new applications for all transport modes (road, public and freight transport, maritime) with main focus concerning spatial, temporal and multi-modal integration.

Three domain activities are been investigated:

- Information Technology for the development of new multi-modal and inter-modal systems
- Intelligent Transport System for network management (Data interpretation and prediction, Intersection and Network control, Incident and congestion management, fleet management)
- Transport Network Software Engineering (data modeling, architecture and algorithm components)

Gerard Seemama, is Research director, Head of the Transport Network and Advanced Software Engineering Research Laboratory GRETIA of INRETS (French National Research Institute of Transport). He is presently member of the scientific committee of the ZELT traffic experimental area in France. He is responsible of a special course on «Information technology and Transport» in the IT-master at the ENPC school (Ecole Nationale des Ponts et Chaussées).

His areas of special interest are Advanced Software engineering in Transport, Artificial Intelligence in

Transportation Engineering, Information technology, Transportation planning, Traffic management, Traffic control, Congestion control.

Sophie Midenet works as researcher in the French National Institute for Transport and Safety Research (INRETS) in the Transport Network and Advanced Software Engineering (GRETIA) laboratory. She got her diploma in Engineering Sciences in 1988 at Telecom Paris (ENST), where she later got a Doctorate degree (Ph.D) in 1991 in artificial intelligence (AI) and cognitive sciences. She held a post-doctoral position at IBM East Fishkill, N.Y. before joining INRETS in 1994. Since then she has been working on traffic engineering applications using AI techniques. Her main contributions deal with urban junctions management systems. She studies video sensors measure interpretation for junction analysis, and investigates junction diagnosis from several points of view fluidity, pollutant emission, security. Her main interests in AI concern neural networks, hybrid systems and self-organizing maps.

King's College, United Kingdom

King's College London is one of the two founding Colleges of the University of London: an international, multi-faculty institution in the heart of London, with some 12,400 undergraduate students and over 4,100 postgraduates in nine Schools of Study. The College is among the UK's top four higher education institutions for the number of highest-rated subject-areas for research quality, and in the top group of five for research earnings.

Following a PhD and RA position in neural networks at Cambridge University Engineering Department, **Dr Marc Plumbley** joined the Centre for Neural Networks at King's College London in 1991. In 1995 he became a Lecturer in the Department of Electronic Engineering. He is Joint Coordinator of the the EC-funded NEuroNet Network of Excellence in Neural Networks, and represents NEuroNet on the CoIL (Computational Intelligence and Learning) cluster of networks. Dr Plumbley is a Member of the IEEE, an Associate of the IEE, and a Fellow of the Cambridge Philosophical Society.

MIT – Management Intelligenter Technologien GmbH, Germany

MIT is a data mining system integrator, providing data mining services comprising consultancy and training plus a number of standard and solution-oriented products. MIT's DataEngine data mining tool is a well established data mining product, with a significant user base in continental Europe, and a growing interest in the USA. MIT - Management Intelligenter Technologien GmbH has been working in the area of data mining since its foundation in 1991.

Employing data mining speeds up the development process - delivering cost and resource savings. As a direct result, our customers have better control on their processes (production or business) and have improved their "return on investment".

They come from various industrial sectors like steel, chemical, car and glass, as well as from business sectors like finance and trade.

MIT has three main business divisions:

- **Business Intelligence:** Solutions in the database marketing and controlling areas, with a focus on the finance industry
- **Technical Intelligence:** Solutions for process optimisation and quality control, with a focus on the production of paper, glass and rubber
- **Software Tool Development:** The DataEngine product family for data mining

In order to meet the market requirements of certain industrial sectors and different nations MIT cooperates with national and international partners like National Instruments and Mathsoft.

Marco Poloni received the PhD degree in System Engineering from the University of Rome "La Sapienza", Italy. He currently manages the Sales and Marketing Department at MIT GmbH, Germany. A particular focus of its activity is the definition of new products and offerings for the Business Intelligence area. His previous experience includes work in industry/university cooperative research and development projects (Knowledge Management, Data Mining) at the European level and consultancy in the Data Warehouse and Database Marketing areas.

Momatec GmbH, Germany

Momatec was founded in January 2000. Momatec means mobility, management and technology. Momatec has the focus on consultant-services with relation to traffic information management, transport telematics services and traffic prediction systems. Beyond this, Momatec develops and offers innovative and efficient data analysis methods and prediction models. An important activity of Momatec is the derivation and maintenance of mobility basic data. These are traffic engineering attributes of digital maps that can be used for diverse traffic management tasks.

Dr. rer. nat. **Heribert Kirschfink** was Project manager for projects on Traffic Control at Heusch/Boesefeldt GmbH, Aachen from 1989 – 1994 and Head of the Department „Verkehrsleittechnik“ (Traffic Control) at Heusch/Boesefeldt GmbH, Aachen from 1995 – 1997. From 1997 - 1999 he established and headed the Profit Center „Content Providing“ at debis Traffic. Since January 2000 he is President of Momatec GmbH.

University Paul Sabatier, France**Institut de Recherche en Informatique de Toulouse (IRIT) / Equipe**

IRIT (Institut de Recherche en Informatique de Toulouse) was founded in 1990. It is the main research laboratory in Toulouse solely devoted to Computer Science. It is part of University Paul Sabatier, and is also affiliated to CNRS (the main French public research organization), and the Polytechnic Institute of Toulouse. It involves more than 300 researchers, faculty members, Ph. D Student and clerical and technical staff. Research at IRIT covers most of the fields in advanced computer and informationsciences, whether in its core, ranging from computer architecture to software engineering and computer networks, or in its most recent developments like artificial intelligence and cognitive systems, multimedia man-machine interaction, image interpretation and synthesis.

The department of artificial intelligence and cognitive systems, involved in EUNITE, includes more than 40 researchers, faculty members and engineers. It is one of the largest research entity in France mainly devoted to the formal modeling and automation of human mental tasks such as reasoning, decision-making and communication, with applications to knowledge engineering. The activities of this department range from formal issues to the development of algorithms and software, with applications to failure diagnosis, information fusion, scheduling and planning, intelligent interfaces and the interactions between perception and language. Research in the department is organized along two main directions: reasoning and decision sciences, and cognitive systems respectively. The team involved in EUNITE works in the first direction, and is specialized in the areas of uncertainty modeling, fuzzy logic and possibility theory, commonsense reasoning, belief revision, flexible constraint-based problem-solving and qualitative decision theory.

The group has taken part to the ESPRIT Basic Research Actions DRUMS (1989-1992), DRUMS-II (1992-1995) on Defeasible Reasoning and Uncertainty Management Systems and to the Working group FALCON (1992-1995) on Fuzzy Algorithms for Control.

Didier Dubois is a Research Advisor at IRIT, the Computer Science Department of Paul Sabatier University in Toulouse, France and belongs to the French National Centre for Scientific Research (CNRS). He holds a Doctorate in Engineering from ENSAE, Toulouse (1977), a Doctorat d'Etat from Grenoble University (1983) and an Honorary Doctorate from the Faculté Polytechnique de Mons, Belgium (1997). He is the co-author, with Henri Prade of two books on fuzzy sets and possibility theory, and several edited volumes, among which the recent book Fuzzy Information Engineering with R. Yager and H. Prade (J. Wiley, New York, 1997). With Henri Prade he has coordinated the HANDBOOK of FUZZY SETS series published by Kluwer (7 volumes, 1998-2000, 2 of which he as co-edited). He has contributed more than 100 technical journal papers on uncertainty theories and applications. He has been an Associate Editor of the IEEE Transactions on Fuzzy Systems, of which he is now an Advisory Editor. He is a member of the Editorial Board of several technical journals, such as International Journal on Approximate Reasoning, and Information Sciences among others. Since January 1, 1999, he has been co-Editor in Chief of Fuzzy Sets and Systems. He is a former president of the International Fuzzy Systems Association (1995-1997). His topics of interest range from Artificial Intelligence to Operations Research and Decision Sciences, with emphasis on the modelling, representation and processing of imprecise and uncertain information in problem solving tasks.

National Technical University of Athens (NTUA), Greece
Department of Electrical and Computer Engineering & Institute of Communication and Computer Systems, Intelligent Robotics and Automation Laboratory

The **National Technical University of Athens (NTUA)** is the oldest and most prestigious educational institution of Greece in the field of technology, and has contributed unceasingly to the country's scientific, technical and economic development since its foundation in 1836. Research is carried out in about 100 laboratories belonging to the various Departments. The annual budget of NTUA is approximately EUR 15 million. In addition R&D funded programs are administrated by the Research Committee with an annual budget of more than EUR 20 million. NTUA employs about 1,800 researchers in more than 700 R&D projects supported by National and European Union funds. The Institute of Communication and Computer Systems (ICCS) is a private law body associated with NTUA, established in 1989.

The **Intelligent Robotics and Automation Laboratory (IRAL)** of NTUA was founded in 1985. The teaching and research activity of IRAL is pursued along four axes :

- *Intelligent Systems* : Artificial intelligence, knowledge-based systems, soft computing/computational intelligence.
- *Control* : Digital, adaptive, robust, predictive, fuzzy, neural, neurofuzzy and expert control.
- *Robotics* : Kinematic/dynamic modelling, path/task planning, sensor-based control, mobile robots and teleoperators.
- *Automation* : Automated fault diagnosis/restoration, supervision, task scheduling, DES, CIM, production planning/control and decision/managerial systems.

The courses offered by IRAL are :

- *Undergraduate courses* : Control system design, Robotics : Analysis and Control, Expert systems and Applications, and Intelligent Neural and Fuzzy Control.
- *Postgraduate courses* : Robust and adaptive control, Hierarchical and decentralized control, Advanced topics of industrial artificial intelligence, and Intelligent control of robotic systems.

IRAL is active in national and European research projects. Some of them are the following :

- *INTELROBOT* : Integrated Sensor Based Intelligent Robotic System (ESPRIT I, 1985-88)
- *CMSO* : CIM for Multi-supplier Operations (ESPRIT II, 1989-92)
- *NEUROBOT* : Neural Network Based Robot for Disassembly and Recycling of Automotive Products (ESPRIT III, 1994-97)
- *SENARIO* : Sensor-Aided Intelligent Wheel Chair Navigation (TIDE, 1994-97)
- *IFS* : Intelligent Forecasting Systems for Refineries and Power Systems (BRITE EURAM II, 1998-2000)
- *ICIMS-NOE* : Network of Excellence in Intelligent Control and Integrated Manufacturing Systems (CIM/IMS 1994-2001)
- *XTASKPLAN* : Expert Task Planning for Robotic Assembly and Welding Cells (Natl. R&T Program EPET, 1991-93)
- *HELLASPIQ* : Hellenic Automation Systems for Product Increased Quality (STRIDE HELLAS, 1992-94)
- *ARTEMIS* : Action for Real Time Embedded Information Systems (STRIDE HELLAS, 1992-94)
- *IWM* : Integrated System for Intelligent Warehouse Management (Ind. Res. Program, 1996-98)
- *ODIGOS/NAVIGATOR* : Integrated Navigation System for Powered Wheel Chairs (Natl. R&T Program EPET, 1999-2000)
- *IGIROBOT/HEALTHROBOT* : Navigation and Control of a Mobile Robotic Manipulator for Health Care Services (Natl. R&T Program PENED, 1999-2001)

Since 1985 IRAL has published over 250 journal and 200 conference research papers. IRAL has developed several systems that are currently in operation (IFEC, BIOEXP, FLEXNET, ENGEXP, OPASSEQ, VBWELD, FUZZY PRICE, GENETOPT, GENETEXP etc.). Fifteen Ph.D. theses and over 70 Diploma/Master theses have been carried out in IRAL.

Tzafestas S.G. - full professor , Director of the Institute of Communication and Computer Systems (ICCS) and the Intelligent Robotics and Automation Laboratory (IRAL) of the National Technical University of Athens (NTUA). Holder of Ph.D. and D.Sc. in Control and Automation. Recipient of Honorary Doctorates of the International University (D.Sc. (Hon.)) and the Technical University of Munich (Dr.-Ing. E.h.) . Fellow of IEEE (N.Y.) and IEE (London) ; Member of ASME (N.Y.) , New York Academy of Sciences ,

IMACS (Rutgers, N.J.) and SIRES (Brussels). Member of IFAC SECOM and MIM TCs. Project evaluator of national european and international projects (USA, Canada, Hong Kong, Japan). Project coordinator of national and EU projects in the fields of robotics , CIM and IT (ESPRIT , BRITE-EURAM , TIDE, INTAS , SOCRATES , EUREKA, etc.) . Publications : 30 research books , 60 book chapters , over 500 journal and conference technical papers . Editor-in-Chief of the Journal of Intelligent and Robotic Systems and the book series “Microprocessor-Based and Intelligent Systems Engineering “ (Kluwer) . Organizer of several international conferences (IEEE, IFAC , IMACS , IASTED, SIRES etc.) . Current interests include : computational intelligence , soft computing, control , robotics and CIM .

Rigatos G.G.- Dr. Received a Diploma in Electrical and Computer Engineering and a Ph.D. in Intelligent Automatic Control, both from the National Technical University of Athens , Greece. His research interests include artificial intelligence and knowledge-based techniques (fuzzy logic, neural networks , genetic algorithms and automata) for the modeling , control and optimization of robotic systems , industrial processes and communication systems . He has published over 20 journal and conference papers and has participated in several EU and national funded projects.

Image, Video and Multimedia Systems Lab (IVML)

The **Image, Video and Multimedia Systems Lab (IVML)** of the ICCS/NTUA was established in 1989. Since then it has been gradually equipped with the necessary computer and general software/hardware for the analysis and processing of images and video. Most of the equipment was acquired on the basis of national and European Union funding as a result of the successful participation of the Lab to a series of competitive R&D programs. Recently, the Greek Secretariat of Research and Technology (GSRT) selected IVML, as a Service Providing Lab in its field, to be funded in order to acquire and install professional audiovisual equipment and to implement its ISO-9001 quality management plans.

The academic staff of IVML, headed by Prof. S. Kollias, includes three professors, four post-doctoral researchers, fifteen highly qualified electrical engineers working towards their Ph.D, as well as administrative and technical support staff.

The most important areas of R&D activities performed or supported by IVML related to the project include

- Image and Video processing and analysis
- Embedding of synthetic/virtual reality functions to multimedia applications
- Storage and content-based retrieval of still and moving images
- Use of neural and fuzzy networks for implementation of intelligent HCI/agents
- Natural - Synthetic Hybrid Coding systems
- 3-D reconstruction and visualization systems

IVML has been involved in thirty-eight (38) R&D projects. Eighteen (18) of them are/were funded by the European Union (under the framework of EUREKA, ESPRIT (5), RACE, BIOMED-1, TELEMATICS, G7, TMR, EDUCATIONAL MULTIMEDIA, HCM (2), TEMPUS (2), SMT, INCO-DC). The rest of them have been funded by the GSRT and Greek organizations or industrial companies. Twenty-seven (27) of them have been finished while eleven (11) are in progress.

IVML participated in the European consortium for the development of MPEG-2 [EUREKA 625: Digital Television, 1990-95] and is also developing MPEG-2 based systems in Greece [SYN-96: Video on Demand, 1998-2000].

IVML was a pioneer in the development of systems for the transmission of MPEG-1 video over computer networks [G7 Meeting, 1995 / SYN-92: Video though LAN, 1994-95 / RACE 2120, 1994-95] as well as high quality medical video handling/processing [EPET2-504, 1995-97 / TELEMATICS Ambulance, 1996-1998].

IVML participates in the design and implementation of object oriented video coding such as MPEG-4, MPEG-7, [COST 211-quarter, 1998-2002 / EDUCATIONAL MULTIMEDIA Modulates, 1998-2000 / ESPRIT M-CUBE, 1996-99]. Related applications include (a) video transmission over low bit-rate channels and the Internet, (b) man/machine communication, (c) exchange of audiovisual information in multimedia environments and (d) synthetic or virtual reality applications. It has developed a pilot archive of historical multimedia data for the Ministry of Press and Mass Media and is currently leading a project for developing the AV archive of the Greek National Broadcasting Company and the Greek Film Archive. IVML has also been leading a TMR project on principled hybrid systems, dealing with the development of hybrid systems using symbolic techniques from the artificial intelligence field and sub-symbolic techniques from the computational intelligence field. The last decade, they have also led or participated in a variety of projects

related to theory and applications of neural networks and intelligent techniques, being a management node of the NeuroNet Network of Excellence.

IVML is equipped with high-end computer stations and modern audiovisual units (including MPEG 1 and MPEG 2 codecs, Professional tape-to-disk video recorders, professional video players/recorders) as well as image and video processing software and 3D animation production tools. The members of the Lab are active members of the research community having published over 110 journal articles, more than 190 international conference contributions having been reviewers of more than 30 international journals and having participated in more than 60 conference scientific committees in the field of the proposal.

Stefanos Kollias was born in Athens in 1956. He obtained his Diploma from NTUA in 1979, his M.Sc. in Communication Engineering in 1980 from UMIST in England and his Ph.D in Signal Processing from the Computer Science Division of NTUA. He is with the Electrical Engineering Department of NTUA since 1986 where he serves now as a Professor. Since 1990 he is Director of the Image, Video and Multimedia Systems Laboratory of NTUA. He has published more than 120 papers in the above fields, 50 of which in international journals. He has been a member of the Technical or Advisory Committee or invited speaker in 40 International Conferences. He is a reviewer of 10 IEEE Transactions and of 10 other journals. Ten graduate students have completed their Doctorate under his supervision, while other ten are currently performing their Ph.D. thesis. He and his team have been participating in 38 European and National projects.

Andreas-Georgios N. Stafylopatis was born in Athens, Greece in 1956. He received the Diploma degree in electrical and electronics engineering in 1979 from the National Technical University of Athens and the Docteur Ingenieur degree in computer science in 1982 from the University of Paris-Sud, Orsay, France. Since 1984 he has been with the Department of Electrical and Computer Engineering at the National Technical University of Athens, where he is currently a Full Professor. His research interests include neural networks, computational intelligence, parallel processing and high-performance computing. His current research involves use of hybrid intelligent systems in biomedical and multimedia applications. He has participated as leader or key researcher in numerous national and European Union funded research projects and is the author or coauthor of about 100 refereed papers. Prof. Stafylopatis is a member of the IEEE Computer Society, the IEEE Systems, Man, and Cybernetics Society, the Association for Computing Machinery, the European Neural Network Society and the International Neural Network Society.

Giorgos Stamou was born in Athens in 1971. He obtained the Diploma Degree in Electrical and Computer Engineering from the National Technical University of Athens (NTUA) in 1994 and the PhD in Computational Intelligence from the Computer Science Division of NTUA in 1998. He is currently a researcher of the ICCS-NTUA. His research interests include fuzzy set theory, fuzzy system modelling and decision making, neural networks, hybrid intelligent systems, human computer interaction and image processing. Dr Stamou has published over 30 papers in international journals and proceedings of international conferences.

Chemical Engineering Department, Laboratory of Automatic Process Control & Informatics

The Laboratory of Automatic Process Control & Informatics is part of the Chemical Engineering Department in the National Technical University of Athens. Its main activities include education, research and co-operation with the industry in the technical fields of design and analysis of automatic process control systems and digital signal processing.

The Automatic Process Control and Informatics Laboratory offers the following undergraduate courses :

- Automatic process control (6th semester)
- Advanced process control (9th semester)
- Simulation and process control (9th semester)
- Technical Drawing (1st semester)
- Elements of Mechanical Hardware (4th semester)

The current main research activities of the Laboratory are:

- Simulation and Design of Linear and Non-linear Automatic Control Systems
- Neural Networks – Applications
- Fuzzy Logic – Applications
- Digital Signal Processing – Wavelets
- Wire and Wireless Digital Communication Technique

- Pattern Recognition
- Development of Software Tools for Industrial Processes
- Computer Integrated Manufacturing (CIM)
- Stability Analysis of Distributed Parameter Systems

The Laboratory also offers consulting services to third parties. In particular the Laboratory participates in a number of projects in co-operation with the industry, in the following areas:

- Development of automatic process control and information systems
- Development of CIM systems
- Development of digital signal processing and pattern recognition systems for industrial processes
- Investment and technical-economical studies

The Laboratory supports Diploma and Doctoral theses, which cover the above research areas.

George Bafas was born in Arta, Greece on February 13, 1942. He graduated from the Herder Institut of Leipzig University in 1964. He holds a Diploma in Automatic Control Engineering and Informatics from the Technical University of Dresden. In 1975 he received his PhD degree (Dr. Rer. Nat.) from the German Academy of Sciences in Berlin.

In 1977 he joined the National Technical University of Athens. Since 1983 he has been Professor in the area of Automatic Process Control and Informatics in the Chemical Engineering Department. He has also been member of the Board of Directors and Chairman of the Board of Directors of many companies and organizations in Greece and abroad like "Intracom S.A.", "Hellenic Telecommunications Organization" etc. Prof. Bafas has authored or co-authored more than one hundred papers published in Greek and international conferences and journals, in the scientific areas of digital automatic control, wire and wireless digital communications technique and informatics.

Haralambos Sarimveis received his Diploma in Chemical Engineering from the National Technical University of Athens (NTUA) in 1990. He holds an M.Sc. degree and a Ph.D. degree both in Chemical Engineering from Texas A&M University. He now holds a lecturer position in the "Automatic Process Control and Informatics" laboratory of the Chemical Engineering Department at NTUA.

He has been working in the following technical fields: Process Control Methodologies (Dynamic Matrix Control, Internal Model Control, Optimal Control, Statistical Process Control, H_{∞} Control, Robust Control, Adaptive Control), Neural networks, Optimization (MINLP methodologies and Genetic Algorithms), Fuzzy Logic and Wavelets. He has considerable experience in the food and pulp and paper industry, where he has completed a number of system identification and process control projects.

Alex Alexandridis was born in Athens, Greece on June 21, 1976. In March 2000 he received his Diploma in Chemical Engineering from the Technical University of Athens. Since May 2000 he has been working on his PhD thesis at the Laboratory of Automatic Process Control and Informatics. Mr. Alexandridis also works as a technical consultant for "American Process Inc."

His scientific interests include among others the applications of neural networks and fuzzy logic in process control, the use of statistical methods (PLS, PCA) in process modelling and the digital analysis of signals using advanced processing tools (e.g. Wavelets).

Polish Academy of Sciences, Instytut Badan Systemowych Polskiej Akademii Nauk, Poland

Systems Research Institute of the Polish Academy of Sciences - SRI PAS

The Institute is a research organisation of public character, conducting fundamental and applied research in the domains of computer science, systems and control theory, operational research and management science. The research carried out concerns theory, methods, software, and their real-life applications in many domains, such as economy, environment, technology, medicine, financial markets, management, etc. The Institute is in existence since 1969, and employs now some 100 persons, with 10 full professors on the staff. The group of specialists from within the Institute, associated with the project, have deep knowledge and broad experience in fuzzy sets theory and its applications, advanced database techniques, Internet related issues, including distance education, quality control methods, data analysis, intelligent decision support, knowledge engineering and related domains.

The Institute has a very significant experience in organisation and running of interdisciplinary projects, in running of international meetings (conferences and workshops), and in publication activity (SRI PAS issues

its own English language quarterly quoted by ISI and other international reference services, as well as working papers and monographs). The Institute is capable of securing an adequate technical support for the whole publication process. The dense and well-equipped internal computer network of the Institute is serviced by the HP and SUN computers, and there is a high capacity fibre optic connection to the Internet.

SRI PAS is involved in a very broad network of international co-operation with numerous foreign scientific institutions and scholars. In particular, the Institute and its staff participated in a number of international projects financed or co-financed from the European sources. These include:

- a COAST project (Tempus JEP-585), with other participants coming from Spain, Hungary and Italy (1991-1993),
- a TEMPUS project "Shape Optimization: Application to Structure and Environment (JEP 07228-94),
- a Copernicus project "European Science and Technology Transfer Network" (ESATT, IC 1001), with other participants coming from Germany, Bulgaria and Hungary (1994-1995),
- a Copernicus project "Information Dissemination in European RTD" (INDIS, IC 1030), with other participants coming from Germany, Bulgaria, Hungary, Romania and Russia (1996-1997),
- a Copernicus project "Decision Support System for Statistical Quality Control of production Processes" (CP93:12074) with partners from Germany.

Further, in 1997 the Institute was granted the project on dissemination of the information about European Union through services in the Internet, within the framework of PHARE/FIESTA programme (no. 0/406/1/97). Between 1995 and 1999 the Institute collaborated closely with the Polish Operational and System Research Society in implementation of some other international projects:

- the project called EU CompEcs, "A Network of the Human Capital and Mobility Programme", in which partners from 6 EU and 3 pre-accession countries participated,
- the Phare distance education project related to environment and energy (DE 97/439).

Prof. Janusz Kacprzyk, Ph.D, D.Sc., born: July 12, 1947. Current position: Deputy Director for Research, SRI PAS. His selected research interests include fuzzy logic, fuzziness in database management systems, intelligent decision support systems, fuzzy and possibilistic approaches to knowledge representation and processing. International co-operation experience: participation in many international projects, notably COAST project (Tempus Project JEP-585), ERUDIT, COST Action 15. International Fuzzy Sets Association (IFSA) Vice President (1990-95) and Council Member (1995-1999). EUSFLAT Board Member. Editor-in-chief of two series "Studies in Fuzziness" and "Advances in Soft Computing" at the Springer Verlag Group. Relevant practical experience: development of a database querying system for handling imprecise queries. Author and co-author of ca. 30 books/edited volumes and 200 articles.

Prof. Olgierd Hryniewicz, Ph.D, D.Sc., born February 16, 1948. Professor at the Systems Research Institute (SRI) of the Polish Academy of Sciences in Warsaw. Head of the Laboratory of Quality Control (1976-1984), Head of the Statistical Quality Control group at SRI (1984-1992), Deputy Director for Research of SRI (1992-1998), Director of SRI (1998-). Prof.Hryniewicz received his PhD title in 1976 (in reliability), and D.Sc.(habilitation) title in 1985 (in statistics, and statistical quality control). In 1988 - 1989, he worked at the University of Wuerzburg, Germany. Prof.Hryniewicz is the author of more than 80 books and scientific papers on statistics, decision making and fuzzy modelling. He was a leader of the SRI's team participating in a Copernicus project (CP93:12074)

Prof. Eulalia Szmidt, Ph.D., D.Sc., born June 26, 1956. Current position: Assistant Professor. Her selected research interests include: intelligent decision support systems, soft computing theory and applications, knowledge representation. She participated in joint research project within an international community dealing with intuitionistic fuzzy sets theory and its applications.

Dr. Jan W. Owsinski, Ph.D., born on 12 June 1946 in Gdansk, has for a long time been associated with the Systems Research Institute of the Polish Academy of Sciences. Currently, he is heading, in parallel, a small independent body called The Interfaces Institute, involved in a number of projects in a broadly conceived scientific service domain. Dr Owsinski has a significant international experience, starting with his assignment in 1975-79 at the International Institute for Applied Systems Analysis in Laxenburg, Austria, and ending with his management of a series of Nordic-Baltic workshops on regional development, integration and competitiveness, and publications thereof, an on-going activity. He has run several international meetings, and published a number of English-language volumes. In his research Dr Owsinski specialises in advanced

data analysis techniques and algorithms, and their applications, including economy, regional science, spatial analysis etc., as well as in economic modelling. He is particularly interested in the possibly general, but also flexible, methods bordering upon knowledge acquisition and synthesis. The list of publications of Dr Owsinski contains well over 100 positions. Participation in EU financed projects: CompEcs and DE 97/439.

Dr. Przemyslaw Grzegorzewski, Ph.D., mathematician, born May 2, 1963. M.Sc. from the Warsaw University (applied mathematics), Ph.D. from the Systems Research Institute, Polish Academy of Sciences, in 1997 for his thesis entitled "Statistical Decisions with Vague Data: Application in Statistical Quality Control". From 1989 at the Institute of Mathematics, Warsaw University of Technology, and from 1994 at the Systems Research Institute, Polish Academy of Sciences. Dr. Grzegorzewski is a consultant of the Polish Committee for Standardization and a reviewer for Mathematical Reviews. He is a recipient of the Polish Mathematical Society Prize and the Rector of the Warsaw University of Technology Prize. He is the author of about 20 scientific papers on statistics, statistical quality control and fuzzy sets. He participated in a Copernicus project (CP93:12074).

Dr. Grazyna Szkatula, Ph.D., born April 21, 1955. Current position: Assistant Professor, SRI PAS. Her selected research interests include machine learning: theory and application, knowledge acquisition and representation. Relevant practical experience: implementation of numerous database systems for various applications (finances, social affairs, administration and medicine).

Dr. Slawomir Zadrozny, Ph.D., born December 9, 1957. Current position: Assistant Professor, Head of the Centre for Information Technology, SRI PAS. His selected research interests include: database management systems, intelligent decision support systems: theory and implementation, artificial intelligence, fuzzy and possibilistic approaches to knowledge representation and processing, data analysis. International co-operation experience and participation in EU financed projects: Tempus (COAST), Copernicus (ESATT and INDIS) and PHARE/FIESTA. Relevant practical experience: development of a database querying system for handling imprecise queries; design and development of systems relying on remote database access over the Internet; development of an intelligent decision support system for consensus reaching aid.

Politecnico di Bari, Italy

Department of Electrical and Electronical Engineering (D.E.E)

Department of Architecture and Town Planning,

The *Department of Electrical and Electronical Engineering* (D.E.E.: Dipartimento di Elettronica ed Elettrotecnica) is part of the Politecnico di Bari. The department works in a number of research areas of Electrical and Electronic Sciences. These can be classified under the following nine major headings: Computing systems; Converters, Electrical Machines and Drives; Electrical and Electronic Measurements; Electrical Energy Systems; Electric Circuits; Electromagnetic Fields; Electronics; System and Control Engineering; Telecommunications.

The D.E.E. has an annual budget of over one billion ITL and has a staff of about 80 people, including teaching, administrative and technical members.

Professors of D.E.E. teach about 90 regular courses, most of which are included in the graduate and undergraduate curricula of Electrical and Electronical Engineering. Some courses are also included in the curricula of Civil Engineering, Mechanical Engineering and Environmental Engineering. Approximately 3500 students are enrolled in the courses and, since 1960, more than 1600 students have obtained the degree in Electrical Engineering and Electronical Engineering. The D.E.E. also offers three post-graduate research programs (the Italian equivalent of a Ph.D.): the first one is in Electrical Engineering; the second one covers the many topics of Electronics; the third one is concerned with Industrial Automation.

The *Department of Architecture and Town Planning* belongs to the Polytechnic of Bari, an academic institution -currently with an enrollment of about 10.000 students (roughly, 8.500 for the School of Engineering and 1.500 for the School of Architecture)- created in 1990 with the departure of the School of Engineering and the School of Architecture from the University of Bari.

DAU now occupies an area of about 1.500 sq mt in the University Campus of Bari. It has an annual budget of approximately one billion Italian liras and a staff of about 40 people including teaching, administrative and technical personnel. Professors from DAU teach about 40 courses, most of which are included in the graduate and undergraduate curricula of the Programs of Civil Engineering or Building Engineering. Some courses are also included in the curricula of the Programs of Environmental Engineering or Architecture. Approximately 4.000 students are enrolled in those courses and, since 1946, more than 2.000 students have obtained their

master degrees in Civil Engineering or Building Engineering going through the training activities performed by DAU.

DAU offers three post-graduate doctoral research programs (Italian Ph. D.) in Building Engineering, Environmental Economics, Evaluation Methods for Planning and Design. DAU also houses the post-graduate School of Spatial Planning of the University of Bari (SPPUT: Scuola di Perfezionamento in Pianificazione Urbana e Territoriale), a two years program established in 1978 and currently run by the School of Economics and the School of Arts of the University of Bari and by the School of Engineering of the Polytechnic of Bari, offering 20 courses on issues ranging from engineering to economics and culture. DAU, finally, has operational laboratories in the fields of Computer Aided Design, Building Technology, Photogrammetry, and Spatial Planning. Research from DAU covers the following major topics:

building refurbishment, building utilities, building types, financial project evaluation, urban renewal, site planning, multivariate and multicriteria analysis for planning, applications of Artificial Intelligence to planning, environmental monitoring, fuzzy control.

Artificial Intelligence for spatial planning

Research issues by the DAU Group

In the last few years the AISP Laboratory at DAU has been running research on:

- i. planning theory;
- ii. KBDSS and GIS

As regard (i), DAU research has investigated issues on shifting from linear-monotonic vs complex-non monotonic planning, planning under uncertainty, multi-agent planning, contingent planning, planning hierarchies and abstraction.

As regard (ii), DAU research has also investigated issues on expert systems tasks (consisting of diagnosis, control, strategy, and decision making, with substantial applications on development control, indoor pollution detection, utility networks performance, targeted for the typical needs of public local planning and building agencies) and on spatial recognition (in particular on detection and classification of spatial "concepts" -space elements from aerial topographic maps-).

DAU research has also investigated issues on incorporating automatic intelligent systems within GIS, with a special attention for expert systems and machine learners functioning both individually and cooperatively to support and/or substitute conventional decision support systems for GIS; another interest has been developed for a more friendly configuration of GIS by using hypermedia routines.

Bruno Maione was born in Napoli (Italy). He received the degree in Electrical Engineering with honors from University of Napoli in 1964. Prof. Maione is currently Full Professor of Automatic Control at the Department of Electrical and Electronic Engineering of Bari (Italy) and held the position of faculty dean at Polytechnic of Bari. (1986-1992). In 1983 and 1985 he was visiting professor at University of Florida (Gainesville). His primary areas of research and teaching are intelligent control, discrete event dynamical system modeling, systems and control theory. From 1996 to 2000 he has served as contact person of the Politecnico di Bari, key-node in ERUDIT, the European Network of Excellence for Fuzzy Logic and Uncertainty Modeling in Information Technology, supported by the European Commission DG III Industry-Esprit Programme. In the framework of ERUDIT, he was in the International Program Committee of several conferences. He is currently head of several research projects in collaboration with the Italian Ministry for University and Scientific and Technological Research (MURST) and the Italian National Research Centre (CNR). He is author of several international publications.

Mariagrazia Dotoli was born in Bari (Italy) in 1971. She joined the Polytechnic of Bari as Assistant Professor in Systems and Control Engineering in 1999. She received the degree in Electronic Engineering with honors in 1995 and the Ph.D. in Electrical Engineering in 1999, both from the Polytechnic of Bari. In 1995 - 96 she was a visiting scholar at the Pierre and Marie Curie University, Paris, France. In 1997 -98 she was a visiting scholar at the Technical University of Denmark, Lyngby, Denmark. Her primary research and teaching interests are in the field of Nonlinear Control, Computational Intelligence Techniques and Distance Learning. From 1997 to 2000 she has served as co-chairman of the Training and Education Committee (TED) of ERUDIT, the European Network of Excellence for Fuzzy Logic and Uncertainty Modeling in Information Technology, supported by the European Commission DG III Industry-Esprit Programme. In the framework of ERUDIT, she was member of the International Program Committee of several conferences. She is currently involved in several research projects in collaboration with the Italian Ministry for University and Scientific and Technological Research (MURST) and the Italian National Research Centre (CNR). She is co-author of several international publications.

Prague University of Economics, Czech Republic

Laboratory of Intelligent Systems

The Laboratory for Intelligent Systems was founded in 1996 within a program organised by the Ministry of Education, Youth and Sports to support research at Czech universities. The goal of the Laboratory is research and development of technologies applicable in intelligent systems, and the experimental verification of these tools on practical problems (namely with economic orientation). Specifically, research activities in the Laboratory are mainly oriented to the following three areas:

- uncertain knowledge modelling in the framework of both additive and non-additive measures: the research goal in this area is focused on uncertain knowledge integration, composition of measures and chain graphs and conditional independence. We have also studied various approaches to learning Bayesian networks from data.
- knowledge discovery in databases: the research goal in this area is to study the application possibilities of mathematical-logic principles in KDD. We also developed a KDD tool for creating association and decision rules.
- intelligent search for relevant information: the research goal in this area is to apply AI methods to simplify the search and navigation on the Internet (Web).

The Laboratory was involved in organising several international conferences: Fuzzy congress IFSA'97, machine learning and KDD conferences ECML'97 and PKDD'99, and workshops on uncertainty processing WUPES'97, WUPES'2000.

Petr Berka, Deputy head of the Laboratory, graduated from the Czech Technical University in 1983. In 1991, he received his PhD in Bionics. From 1984 to 87 he was a member of the Dept. of Biomathematics, Physiological Institute, Academy of Sciences. In 1988, he joined the University of Economics. Since 1995 he has been an Associate Professor in Computer Science. He is a member of the Czech Society of Cybernetics and Informatics, European Coordinating Committee for AI, and Special Interest Group for KDD. Research areas: Expert systems, machine learning, knowledge discovery in databases, intelligent systems on the Internet. Other EC projects: MLNet (ESPRIT IV project 29288), Sol-Eu-Net (IST-1999-114)

Jiri Ivanek

Graduated with a major in Theoretical Cybernetics at the Faculty of Mathematics and Physics, Charles University, Prague, in 1976, and received his CSc. degree (PhD.) in Mathematical Logic from the Mathematical Institute of the Czechoslovak Academy of Sciences in 1985. Since 1976, he has been a member of the University of Economics, Prague: from 1990 to 92 he was the head of the Dept. of Information and Knowledge Engineering, in 1992-98 he served as the vice-rector of the University of Economics in the areas of information infrastructure, science and research. Since 1995, he has been the director of the Centre of Information and Library Services of the University of Economics. He joined the Laboratory in 1998. He is a member of the scientific boards of the University of Economics and its Faculty of Informatics and Statistics. He is also a member of the Czech Society of Cybernetics and Informatics. Research areas: Uncertainty processing, fuzzy logic, data mining and knowledge discovery in databases. Other EC projects: MLNet (ESPRIT IV project 29288), Sol-Eu-Net (IST-1999-114)

Radim Jirousek

Head of the Laboratory, graduated from the Charles University's Faculty of Mathematics and Physics in 1969. In 1977, he received his CSc. degree and in 1993 his DrSc. Degree, both in Theoretical Cybernetics from the Academy of Sciences. From 1970 - 1979 he was a member of the Department of Medical Cybernetics of Research Institutes under the control of the Ministry of Health. From 1979 - 1993 he was a senior research fellow of the Institute of Information Theory and Automation of the Academy of Sciences (UTIA AV CR). Since 1993 he has been with the Faculty of Informatics and Statistics of University of Economics (FIS VSE), Prague. In the period 1991 - 1998, he was awarded 12 research grants, the most important among which was that received from the Ministry of Education of the Czech Republic, which enabled the foundation of the Laboratory. Radim Jirousek is a member of the scientific boards of the FIS VSE and UTIA AV CR. In the Czech Society for Cybernetics and Informatics he was a scientific secretary (1989-1993) and since 1993 he has been a vice-president. He is also a member of editorial board of *Kybernetika*. In 1988, R. Jirousek organized Workshop on Uncertainty Processing in Expert Systems that has since become a regular (each three years) informal meeting of researchers dealing with different models of uncertainty. Research areas: Probabilistic methods of artificial intelligence, Markov graphical models, decision under uncertainty. Other EC projects: MLNet (ESPRIT IV project 29288), Sol-Eu-Net (IST-1999-114), Managing Uncertainty in Medicine (Copernicus project CIPA 3511CT930053)

Risoe National Laboratory, Denmark

Optics and Fluid Dynamics Department

is a state institution under the Danish Ministry of Research. Established in 1958, Risoe today has a staff just over 900, of which one third are scientists. It carries out research in science and technology, providing Danish society new opportunities for technological development.

At the Optics and Fluid Dynamics Department one research area is information processing, including research in the area of artificial intelligence and image processing. We have been involved in a number of industrial and European research projects dealing with data mining, example-based learning as well as image processing. We have especially been involved with developing training and optimisation algorithms for the so-called n-tuple classifier.

Thomas Martini Joergensen, received his M.Sc. in electrical engineering from the Technical University of Denmark in 1989, and his Ph.D. in information processing in 1992 also from the Technical University of Denmark. Since 1992 he has worked at Risoe National Laboratory, where he has done research in neural networks and worked in a number of EC and industrial projects involving the use of neural network technology and image processing. He represents Denmark in the NeuroNet network of excellence on neural network technology.

Christian Linneberg, received his M. Sc. degree in electrical engineering from the Technical University of Denmark in 1994. Since 1996 he has been employed at Risoe National Laboratory. At the present he is finishing an industrial Ph.D project on information processing and data mining. Part of this work takes place at the industrial partner, Intellix, which is a Danish company using neural network technology for knowledge extraction and data mining.

Sentient Machine Research, The Netherlands

Sentient Machine Research was founded in 1990 with the aim of building a business out of making computers smarter. Our mission is to create business out of intelligent software solutions, based upon on a proprietary technology for building associative (content search), adaptive (self-learning) and judgmental (assessment of qualities) solutions. To cross the chasm to widespread application by end users we focus at three emerging product-market combinations: Business Intelligence, use datamining to discover strategic knowledge hidden in large amounts of data; Electronic marketplaces: match supply and demand on the web; Multimedia: automatic interpretation and assessment of content for surveillance and video search solutions. Both the business intelligence and electronic marketplace product market combinations are serviced by our datamining & matching environment DataDetective. Other core technologies include image and text mining.

Sentient has been a partner in the IST project Vicar (Video Indexing, Classification, Annotation and Retrieval) in which a video search engine was built for several European television archives. Using the video search engine, the archives were able to offer better access and service to their customers, resulting in increased sales. Sentient was primarily responsible for developing the high level intelligent image recognition modules which extracted content from the video stream. Sentient is currently actively marketing the results of Vicar, by offering integrated media asset management solutions to visionary television archives. Sentient is also running a smaller European project within the Essi framework. This project, Nuggets, aims at improving datamining software development processes by modularizing datamining software into reusable components.

Furthermore, we are finalizing the negotiation for three European research projects, all in the area of adaptive systems, The goals in these projects are respectively: to build an adaptive autonomous robot for sewer inspection; to develop a personalized content based search agent for distributed multimedia collections; and to propose a privacy enhanced (PET) intelligent agents architecture for electronic markets.

Peter van der Putten has received a MSc degree in Cognitive Artificial Intelligence at Utrecht University in 1996, with a specialization in neural networks. In 1995 he worked for half a year as a trainee for Shell Brasil in Rio de Janeiro, in the area of electronic commerce. Since 1996 he is employed as a consultant and project manager at Sentient Machine Research. He has been actively involved in both commercial and research & development projects concerning face recognition, data mining, web mining, data fusion and text mining. Within the Vicar video search engine project Mr. Van der Putten has been involved in research and comparison of core image recognition algorithms. Furthermore, he was a member of the marketing committee

that was responsible for exploitation of Vicar technology. Within Sentient he is responsible for all activities in the area of business intelligence and multimedia. Mr. Van der Putten has a part time research position at the Leiden Institute of Advanced Computer Science of Leiden University, where he performs research in the area of multimedia datamining and teaches in multimedia and datamining subjects. Mr. Van der Putten is member of the Executive Board of the NeuroNet Network of Excellence in Neural Networks.

Marten den Uyl got a degree in cognitive psychology from the University of Amsterdam in 1978. From 1978 till 1987 he worked as a researcher at the University of Amsterdam and at Stanford University, California (80 - 81) on various research projects. Research topics include : the use of schematic knowledge structures ('scripts') in the understanding of narratives (78 - 80) ; the function of meta-cognitive control mechanisms in text comprehension (81 - 84) ; psychophysics and theories of judgment ; modeling the cognitive structure of ethnic attitude; connectionist modeling of memory and judgment (84 - 87; development of the resonant field neural network) ; hedonic valuation and control in modular distributed systems. In 1987 he joined Bolesian, a Dutch knowledge engineering company, to work as a consultant in the design and development of knowledge-based systems for business applications. In 1990 Marten den Uyl founded Sentient Machine Research B.V. in Amsterdam, which is currently a leading SME in intelligent software solutions.

SiemensBuilding Technologies AG, Switzerland Cerberus Division

Established 1941, Cerberus is a leader in electronic safety and security engineering, operating successfully on an international scale. Cerberus security systems protect life and property against fire, intrusion and gas. The company distinguishes itself from its competitors through high quality products with innovative design, proven application engineering and above-average services. Cerberus is a division of Siemens Building Technologies AG, Zürich. Together with the other divisions Landis&Staeafa, Facility Management and Project Business, Siemens Building Technologies AG has some 31,500 employees worldwide and recorded sales of DEM 8'334 Mio. (EUR 4'261 Mio.) in 1998/99.

R&D is given high priority at Cerberus. We develop all key products for our security systems in-house. Experience gained in systems engineering and the requirements of our customers are directly incorporated in our research and development concepts. The main emphasis of R&D is at the parent company. The regions have their own development capacity, which is focused on the needs of the regional markets.

Dr. Marc Thuillard, Ph.D. Physics, M.S Math., manager fire development special detectors, has published over 50 publications and patents in the domain of sensorics, soft computing and microelectronics. He has been acting as a member of the steering committee in ERUDIT I and ERUDIT II. He has co-chaired, first with Prof. C.J. Harris then with Prof. T. Martin the technical committee B: „Components and Consumer Industry“. Within ERUDIT II, he has initiated a newsletter, “Fuzzy and Soft Computing Digest“.

Softeco Sismat SpA, Italy

Softeco Sismat SpA is a privately-held corporation that has been in business since 1979. We are a major supplier of Information Technology and automation systems and related services and support for industrial/service companies and organisations. Based in Genoa, Softeco Sismat has branch offices also in Milan and Parma. Technological innovation and a continuous attention to the evolving world of Information Technology is the cornerstone of our business strategy, with over 10% of technical resources constantly devoted to research and development. Softeco Sismat develops high-quality software application systems that meet the specific requirements of large industrial and service customers. We are staffed by over 130 professionals, many with experience in the planning, design, production and marketing of software systems and products. 70% are graduates in technical-scientific subjects and are organized according to their field of specialization: production, R&D, software products and training.

Present on the national and international markets, Softeco Sismat operates in the following fields:

- infrastructures and services: telecommunications, transportation, environment, energy, banks, public administrations;
- industries: manufacturing, petrochemical, electronic, mechanical and metallurgical;
- scientific organizations: laboratories, research centres.

Our key specialisation areas include: Client-Server and distributed architectures (multi-tier architectures,

network computing, internet-based solutions); Object-Oriented systems; Databases (Relational and Object Oriented); mission critical software for real-time industrial applications (process control and supervision, telecommunication networks, transportation systems, factory automation, medical systems); Network Computing and eBusiness/eWork applications (Internet, Intranet, Java); middleware and software for the integration of applications in heterogeneous environments (Application Servers, Object Brokers, etc.); content-based techniques and applications (Intelligent Information retrieval, XML, ...); Artificial Intelligence and Decision-Support Systems; advanced interfaces (Multimedia, Auto-adaptive, GIS, etc.).

Corporate services are organized into four lines:

- planning and development of turn-key software systems and applications, oversight and control of industrial processes, management of corporate information systems, integration of multi-vendor systems
- Research & Development aimed at realizing high value-added corporate software products
- special consulting: corporate organization and strategies, definition and assessment of innovative technological solutions, feasibility studies, finalization of planning structures and customer development
- distribution, technical assistance and training in software products.

We distribute and support international software products, leaders in their market segment, as well as proprietary products designed and realised by the Production and R&D departments. We also organizes a wide range of training courses in software technologies designed specifically for end-users and system planners and developers.

Softeco Sismat has a stable and longstanding involvement in international RTD projects. We have participated and are participating to 4thFP and 5thFP projects under several programmes, including: DGIII's ESPRIT, DGXII's Industrial and Material Technologies (BRITE/EuRam), DGXIII's Telematics Applications (Transport Sector), DGXVII's THERMIE , DGVII's Transport Research, DG Information Society IST Programme.

The expertise available covers several IT areas, including artificial intelligence, knowledge systems modelling, neural networks, advanced human-computer interaction, distributed objects and agents based systems, multimedia systems, simulation, geographical information systems, computer-based training, computer vision systems.

The following is a list of current or recently completed projects in the area of Traffic and Intelligent Transport Systems: ENTERPRICE, (DGXIII, Telematics Applications / Transport), SAMPO (DGXIII, Telematics Applications / Transport), SAMPLUS (DGXIII, Telematics Applications / Transport), JUPITER (DGXVII, THERMIE), SMARTEST (DGVII, Transport Research), ECC-AIRS (JRC Ispra; DGVII, Transport Research), ASIA (DGIII, ESPRIT), PASSION (DGIII, ESPRIT), INVETE (DG-INFISO, IST, Systems and Services for the Citizens Key Action). Softeco Sismat have participated as a node to the ERUDIT Network of Excellence, actively contributing to the work of Technical Committee C on Traffic. For more information, please consult our web site at: http://www.softeco.it/english/index_n.html

Marco Boero - Senior Engineer and Project Manager with a degree in Informatics and Electronic Engineering from the University of Genoa, Dep. of Computer, Telecommunication and Systems Science. His background includes computer, simulation and automation systems for the industry in various areas, including applications for manufacturing systems, transportation, training, resources and risk management. He is experienced in advanced information technology and modelling methods, including Artificial Intelligence and Knowledge Based Systems, simulation, Cooperative Working and Decision Support Systems. He is author of several international papers and co-author of a book on Artificial Intelligence applications to transportation and traffic engineering.

He has more than ten year experience in the field of RTD projects both at the national and European level. He has been involved in several 4thFP projects, in some as a project coordinator, including BRITE/EuRam, Environment, DRIVE I, II and Transport Telematics, THERMIE, Transport Research, as well as in the current 5thFP, in the IST programme. As for transport and mobility related RTD projects, he has been involved in the DRIVE I projects V1039 ATTAIN (Survey of Artificial Intelligence Applications to Traffic Engineering) and V1055 (Artificial Intelligence techniques for traffic control); the DRIVE II projects V2039 KITS (Knowledge-based, intelligent traffic control architectures); the Telematics Applications Program project TR1020 ENTERPRICE (Enhanced network for traffic services and information provided by regional

information centres in Europe) and TR1046 SAMPO (Systems for advanced management of public transport operations); the DGVII's project SMARTTEST (Simulation modeling applied to road transport European scheme tests). He actively participated to the work of ERUDIT Technical Committee C "Traffic".

Spanish Council for Scientific Research (C.S.I.C), Spain Industrial Automation Institute, IAI

The Spanish Council for Scientific Research was established in 1939. The CSIC is organized as an autonomous body within the Ministry of Education and Culture with its own legal status and assets. It is the largest multidisciplinary research organization in Spain and one of its basic functions is to carry out research in its Institutes. At present, priority research objectives of the CSIC are outlined in the National Plan for Scientific Research and Technological Development.

The CSIC has 96 Institutes throughout Spain: Madrid (42), Andalucía (16), Cataluña (13), Valencia (5), Aragón (5), Galicia (4), Castilla-León (3), Canarias (2), Asturias (2), Murcia (1), Baleares (1), Cantabria (1), and it has another one in Rome (Italy). Most of these institutes belong entirely to the CSIC, but about 20 of them are joint centres with Universities. The CSIC has Delegations in seven Autonomous Communities and official representations both in Brussels and Rome.

The scientific activity of the CSIC is essentially carried out in the following research areas: Humanities and Social Sciences/ Biology and Biomedicine/ Natural Resources and Environment/ Agricultural Sciences/ Physics/ Material Science and Technology/ Food Science and Technology/ Chemistry

Personnel: Scientists: 1900/ Technical: 2600/ Administrative: 1000/ Postgraduate students and post-doctoral fellows: 1700

The Industrial Automation Institute, belonging to the Spanish Council for Scientific Research, was founded in 1971 to develop research activities in the field of the industrial automation. The IAI has centered its activities on Computer Aided Manufacturing, Robotics, Sensors Systems Integration, and Intelligent Control of Processes and Systems.

The IAI is composed of Staff Scientists: 23; Technical: 23; Administrative: 8; Services:

24; postgraduate students and post-doctoral fellows: 56. The Institute is structured in three Departments: Automatic Control, Industrial Informatics and Systems.

IAI Basic Research Projects:

"Techniques and architectures to improve real time ultrasonic imaging for NDT". CICYT, 1993-96.

"integration of inductive learning techniques on a distributed architecture for sensor fusion in industrial environments", CICYT, 1992-95.

"Multi-Agent hierarchical architecture for complex behaviour generation in an autonomous robot", CICYT, 1994-97.

"Hierarchical control System for tool-machine based on artificial intelligence techniques", CICYT, 1996-1999.

"Integrated System for Active Vision", CICYT, 1996-99.

"Multi Agent Architecture: Complex Behaviour generation for an outdoor spraying robot" CICYT, 1999-2001.

"KDD support System for decision making to weeds control based upon risk maps", CICYT, 2000-2002.

Multisensor information system for environmental surveillance", CICYT-EU, 2000-2001.

IAI R & D Projects:

"Traction enhancing mining equipment accessory", BRITE-EURAM CRAFT-i 1561 91, 1994-95. "Intelligent robotic welding systems for unique fabrications", ESPRIT6O42, 1992-95.

"Advanced robot control with multisensor integration", ESPRIT-ECLA 02/76100, 1993-95.

"Multitrack: Intelligent inter-modal supervision and communication of good transport", E.U.Telematics TR-1040, 1996-99.

"Cooperative network for CIME technologies in Europe", ESPRIT-III-9901, 1994-96

"Computer integrated system for shoe lasts manufacturing" BRITE-CRAFT-BE-52-341, 1999-2000.

"Auxiliary climbing robot for underwater ship hull cleaning of sea adherence and surveying", E.U:A1-FP5RTD, 2000-2002.

IAI Industrial Projects:

"Multi-transducer touch-probe techniques in ultrasound", E.U.-CDTI, 1994-96.

- “A pipelined architecture system for U.S. non destructive evaluation“, Tecal S.A., 1995.
 “On board diagnostic and mobile alerts system“, RONDA-CAM, 1995-96.
 “System for classifying and detecting patterns of defects in the chip manufacturing process“, ATT-CAM, 1995-1996.
 “High speed automatic inspection of collar connections of oil drills pipes“, TECALCDTI, 1996-97.
 “US based system for inspecting train wheels cracks at low speed“, TALGO, 1996-2000.

Maria C. Garcia-Alegre is a staff scientist in the Systems Department at the Instituto de Automática Industrial (IAI), Consejo Superior de Investigaciones Científicas (CSIC) in Madrid since 1990. She received a Ph.D. degree in Physics at the University of La Laguna, Tenerife in 1983, where she held a permanent position as an Assistant Professor. She was a visiting Professor at the Applied Machine Intelligence & Robotics Laboratory at Drexel University, Philadelphia in 1992 doing research on hierarchical architectures for intelligent robot behaviour generation. Participant and leader of several European and National Research Projects related to Mobile Autonomous Robots, Fuzzy Logic, Agents Architectures and Artificial Vision Systems. She is a member of several professional societies, IEEE, EUSFLAT, CAEPIA. Her work has been published in professional journals, books and conferences proceedings in Computer Science, Fuzzy Logic and Robotics.

Spanish Council for Scientific Research (C.S.I.C), Spain The Artificial Intelligence Research Institute (IIIA)

The Artificial Intelligence Research Institute (IIIA), is a leader laboratory on Artificial Intelligence in Spain, belonging to the Spanish Council for Scientific Research (CSIC). The IIIA is, since 1994, located in the campus of the Autonomous University of Barcelona. It was created from the AI research group existing at the CEAB in Blanes since 1985. The scientific quality of IIIA research is acknowledged in national and international forums, by its participation in projects, publications, PhD thesis, teaching, prizes, etc.

Research Lines

The IIIA team is presently working in the following lines:

- **Knowledge-based systems**: advanced inference models, uncertainty/imprecision modelling, expert systems, reflective and modular KB architectures.
- **Intelligent Agents**: multi-agent systems, negotiation and trading in electronic markets, autonomous robots.
- **Logic, Reasoning and Search**: fuzzy logic and fuzzy reasoning, multi-valued logics, similarity-based logics, dynamic logics, visual specification and visual languages, rewriting techniques, second order logics, efficient algorithms for constraint satisfaction.
- **Machine learning**: inductive learning, architectures integrating machine learning and problem solving, case-based reasoning.

The IIIA has been particularly active in publications. Close to 600 scientific papers from the IIIA have been published in journals and conferences of the field, this is a very significant portion of the overall Spanish production in AI. In the main general AI conferences (IJCAI, AAAI and ECAI) most (in some editions ALL) of the papers accepted are by IIIA researchers.

Several papers on medical expert systems, approximate reasoning, inductive learning, case-based reasoning, multi-agent systems and electronic commerce are widely cited internationally.

IIIA researchers were awarded the European Artificial Intelligence Research Paper award in 1987, the ECAI Programme Committee best paper award in 1992, and the ICMC (International Computer Music Conference) best paper award in 1997. In addition, IIIA members are or have been present in the Editorial Board of more than 15 international journals, and they are systematically requested to review papers submitted to the best international journals and conferences and chair or be part of programme committees of the main AI conferences.

Research Projects

Research at the IIIA is organised around projects, from national and international programs. Regarding European projects, the IIIA has participated in the following projects: VALID (Esprit II 2148), IPCES (Esprit II 2448), DRUMS (Esprit II BRA 3085), DRUMS II (Esprit III BRA 6156), MUM (Copernicus, 10053). The IIIA has also participated in the project VIM (HCM net, ERBCHRXCT9304001) and it was in charge of the coordination of the Network of Excellence in Machine Learning MLNET (Esprit IV 7115). Currently, the IIIA participates in the following european projects: COMRIS (Esprit LTR 25500), IBROW3 (Esprit LTR 27169), ECSPLAIN (V Framework, IST 11969), SLIE (V Framework IST-1999-10948), IBROW (V Framework IST-1999-19005), the Network of Excellence in Machine Learning MLNET II (Esprit 29288), and in the the Network of Excellence for Agent-based Computing (Esprit 27225). Regarding national projects, the IIIA has been in the past involved in more than 15 projects. Currently, the IIIA participates in the following projects: REST (CICYT, TIC96-0721-C02-2), SMASH (CICYT, TIC96-1038-C04-01), MODEL (CICYT, TIC97-0579-C02-01), MOTLLO (CERTAP of the Generalitat de Catalunya), and Robot Movil (CERTAP of the Generalitat de Catalunya) and receives funding as a "consolidated group" from the Generalitat de catalunya. With all these projects (among them 10 european + 3 european networks) the IIIA has competitively obtained since 1987 close to 700 million ptas to finance its research activities.

Teaching and Supervision

Teaching activities complement research. Regularly, IIIA researchers teach graduate courses at the Tecnical University of Catalonia, Autonomous University of Barcelona and the University of Barcelona. A continuous activity at the IIIA has been the advise and supervision of PhD thesis. Since its foundation in 1985, IIIA researchers have supervised 18 PhD thesis on different AI fields. Currently, 14 PhD students are under supervision by IIIA members.

International Collaboration and Hosting

Intensive collaborations, mostly within the framework of European community programmes, have taken place with industries and academic institutions of many countries and, particularly, with France, Belgium, the Netherlands, Italy, Germany, United Kingdom, Denmark, Slovenia, United States, Mexico, and Argentina.

The IIIA receives regularly visiting researchers from other universities and research institutions. Well-known senior researchers have chosen the IIIA to spend (totally or partially) a sabbatical year. We can mention Walter van de Velde (Vrije University, Brussels) during 1990-91, Piero Bonissone (General Electric Research Labs, USA) during 1996-97, Celine Rouveiroi (University of Paris XI) during 1998, Tom Dietterich (Oregon State University) during 1998-1999. The IIIA also hosted post-doctorate fellows funded for the European Union, as Christian Bliet (HCM grant) during 1996-97 and Richard Benjamins (TMR grant) during 1997.

Francesc Esteva received his B.Sc. in Mathematics in 1969 and his Ph.D. also in Mathematics in 1974, both from the University of Barcelona. He was Full Professor at the Thechnical University of Catalunya and he is currently the Director of the Artificial Intelligence Research Institute (IIIA) of the Spanish Research Council (CSIC). He has published about 100 papers in Journals and Conferences mainly in the area of approximate reasoning and its applications to different areas like knowledge-based systems and case-based reasoning. Modal and Multi-modal Systems and mainly Fuzzy and Multi-valued Logics are the topics he has been working in. He is currently the Director of the Institute and the President of EUSFLAT (European Society for Fuzzy logic And Technology).

Lluís Godo got the Ms.C. degree in Mathematics by the Universitat of Barcelona and the Ph.D. in Mathematics (AI program) by the Universitat Politecnica de Catalunya (UPC). His field of expertise is logic and artificial intelligence, in particular fuzzy logic, qualitative reasoning and multi-agent systems. He has authored over 60 papers, most of them in international conferences and journals. He has served in many program committees of national and international conferences (like ECAI, UAI) and has also participated in several competitive funded projects, both spanish (CICYT) and european (ESPRIT). He was Program co-chair of the 6th IEEE Int. Conference on Fuzzy Systems (FUZZ-IEEE'97) and he is Area editor of the int. journal Fuzzy Sets and Systems.

Pere Garcia received his B.Sc. in Mathematics in 1983 from the University of Barcelona and his Ph.D. in Computer Science in 1988 from the Thechnical University of Catalunya (UPC). He was Professor at the Thechnical University of Catalunya and he is currently a researcher of the Artificial Intelligence Research Institute (IIIA) of the Spanish Research Council (CSIC). He has published about 100 papers in Journals and

Conferences mainly in the area of approximate reasoning and its applications to different areas like knowledge-based systems, case-based reasoning and Multi-Agent Systems. Multi-valued Logics, Modal and Multi-modal Systems and mainly Fuzzy Logic are the topics he has been working in. Similarity-based reasoning and its application to interpolative, case-based reasoning and change theory are his main areas of interest at this moment.

University of the Aegean, Greece

Business Administration Department

The University of the Aegean (www.aegean.gr), Greece was established in 1984, as a decentralized, networked University, in one of the Less Favored Regions (LFR) with the lowest income per capita of EU and includes approximately 200 islands, inhabited by a population of 600,000 people. Nowadays the University of the Aegean consists of 17 undergraduate and 4 postgraduate departments (4500 students), with facilities in 5 different islands across the Aegean Sea, namely Lesbos, Chios, Samos, Rhodos and Syros. The Dept. of Business Administration (BA) of the University of the Aegean, (established 1985, Chios) focuses in areas such as accounting & finance, business economics, strategic management and new technologies, marketing, maritime transportation and tourism management. The dept of BA participates as coordinator or subcontractor in international and national funding research and technology projects and organizes or hosts various international events such as conferences, summer schools and scientific meetings (e.g. co-organizer of the International Symposium on Computational Intelligence and Learning, COIL2000, Chios, Greece, 21-23 June, 2000).

George Dounias born in Greece, 1967, holds a Production and Management Engineering Diploma (1989), from the Technical University of Crete, Dept. of Production Engineering & Management, and a Doctoral Diploma (PhD, 1995) from the same Dept, Section of Organization and Administration, in the area of Artificial Intelligence, Decision Making and Complex Dynamic Systems. Since September 1999 he works as Permanent Academic Staff (Lecturer) in the University of the Aegean, Dept. of Business Administration, Chios, Greece. Between 1996-1999, he was working as Adjunct Professor in the University of the Aegean, Dept. of Business Administration and the Technical University of Crete, Dept. of Production Engineering & Management. His research interests are closely related to Inductive Machine Learning, AI and Medical Decision Making, Fault Diagnosis in Power Plants, Fuzzy Logic and Soft Computing, Engineering Management & Decision Analysis, Knowledge Based Systems, Knowledge Discovery and Data Mining. He is the author or co-author of 28 totally, journal or conference papers published and/or presented in these areas. He has been Chairman and member of the organizing and/or program committees for international events related to artificial intelligence. He is a member of the Medical Decision Making Society (USA), The New York Academy of Sciences (USA), the Institute of Electrical and Electronics Engineering (IEEE), and worked as Project Evaluator in the European Union for DG XIII, Telematics Programs, Administrations Sector.

Technical University of Denmark

Department of Automation

The Department of Automation covers two main research areas:

- Control and Supervision
- Measurements and Instrumentation

Within these areas, the work is focused on specific topics, including fuzzy and neural network control.

The staff consists of 14 full time researchers, 9 temporary researchers, 10 technical support, and 14 PhD students. The department is hosting approximately 10 midterm projects and 20 master thesis projects per year. More details at <http://www.iau.dtu.dk>.

Jan Jantzen (*1953), associate professor at the Technical University of Denmark (DTU). Military service in the submarines 1972-74; MSc in electric power engineering from DTU 1979; PhD in systems science from DTU 1982; systems designer at LK-NES, Inc, 1979-1982; Queen's Quest Visiting Scholar at Queen's University, Kingston, Canada, 1982-1983; computer consultant at SimCorp, Inc, 1984-1985; visiting scientist at IBM T.J. Watson Research Center 1986; assistant professor at DTU 1986; associate professor 1990; part time consultant 1993-95.

Technical Universtij of Kosice, Slovakia

Center for Intelligent Technologies at FEI TU Kosice

Faculty of Electrical Engineering and Informatics is a part of Technical University of Košice. It has 2000 students and over 200 permanent faculty staff. Dr. Sincák is with Department of Cybernetics and Artificial Intelligence. From 1995 an AI Lab was established and Dr. Sincák has established a Computational Intelligence Group CIG consisting of 3 permanent staff, 4 internal PhD students, 4 external PhD students and 5 MSc. Students. The research of CIG is focused to various aspects of Computational Intelligence including neural networks, fuzzy systems and hybrid systems. The WEB page of CIG is <http://neuron-ai.tuke.sk/cig>.

CIG is involved in number of projects and is a leading lab in Computational Intelligence in Slovakia. One of the important scientific events is the organisation of Euroconference in August 2000 – International Symposium on Computational Intelligence with aprx. 100 people world-wide. The Web page of this symposium is <http://neuron-ai.tuke.sk/cig/isci>.

CIT is oriented into 3 main directions of application of CI in classification problems, prediction problems and intelligent control. The list of publication is included. CIT has cooperation with companies and their cooperation is based on consultancy services and pilot projects. Also one of the companies provide PhD fellowship for CIT in domain of financial cybernetics.

Assoc. Prof. Dr. Peter Sincák

M. Sc. in Cybernetics and Artificial Intelligence from Technical University of Kosice, Slovakia (1984). Institute of Experimental Physics, Department of Space Physics, Slovak Academy of Science, Kosice, Slovakia (1984 until 1992). Involved in an institutional project concerning image processing of remotely sensed images. Ph.D. project at the Institute of Information Theory and Automation, Czech Academy of Science in Prague, Czech Republic (1988 until 1992). Ph.D. dissertation dealing with image processing of multispectral images from remote sensing defended in 1992. Department of Cybernetics and Artificial Intelligence, Faculty of Electrical Engineering and Informatics at Technical University of Košice (July 1992 - present). Associate Professorship from Department of Cybernetics and Artificial Intelligence, Technical University of Kosice (1997). Head of the AI section of the Department of Cybernetics and Artificial Intelligence (1994 until October 1997). Vice-Dean with responsibility for international relations and informatics at Faculty of Electrical Engineering and Informatics, Technical University of Kosice (since February 1997).

Number of projects concerning image classification problems. Various projects promoting CI tools at the Faculty of El. Engineering and Informatics (Since 1994). Different projects concerning neural networks and fuzzy logic with emphasis on industry (Since 1995). PI of project #94077 between Technical University of Košice and University of Minnesota (Assoc. Prof. Dr. Howard Veregin is a Co-PI) which is devoted to accuracy assessment of intelligent classifications of multispectral images. (1994 until 1998). Special EU TEMPUS project oriented towards development of courses on application of CI tools in hydrology. In frame of this project, research in application of neural networks in hydrology. (Since 1996)

Approximately 20 papers in journals and domestic & international conferences. He was a coeditor of 2 books published in Springer-Verlag “The State of Art in Computatioual Intelligence” and “Quo Vadis Computational Intelligence” in August 2000.

Technical University of Madrid (UPM), Spain

Department of Artificial Intelligence

The Department of Artificial Intelligence (part of the Faculty of Computer Science of the Technical University of Madrid - UPM) includes 36 faculty members holding Ph.D. Degrees in Computer Science, Mathematics, Electrical Engineering, Decision Analysis and other fields, as well as several research assistants at the doctoral, graduate, and undergraduate levels.

There are several research groups and laboratories whose main areas of research are the following:

- Knowledge engineering (Know. acquisition, Reasoning, Industrial Diagnosis)
- Computer vision and robotics
- Neural networks and genetic algorithms
- Logical models
- Logic and constraint logic programming
- Natural language, intelligent man-machine interaction

- Information retrieval
- High performance implementation and parallel processing
- Decision analysis
- Medical informatics

The Department has participated in a large number of international and national research programmes and collaborations. In particular, in the last years the Department has contributed to several EU funded research projects, notably ARTIS, KITS, PEPMA, PRINCE, VALID, ACKNOWLEDGE, PIGMALION, ARTEMIS, FLUIDS, SPRINT, RADIOWEB, DISCIPL and ADVICE. In addition, it is a key node in several Networks of Excellence, such as AgentLink, COMPULOG-NET and ERUDIT. It has also participated in other collaborative research under CICYT, RACE, HCM and binational programs.

Research projects active during last years are supported in part by EU funds (ESPRIT, DRIVE, ATT, Telematics Applications, INCO-COPERNICUS, IST), by Spanish public funding agencies (INEM, CAM, CYCIT, DGICYT), or by other Spanish private organisations and companies.

Within this department, the people involved in the activities of the ERUDIT network and its potential continuation are responsables of the Intelligent Systems Group (ISYS) created by Professor José Cuenca in 1983. Since the beginning, the main research area faced by ISYS has been the design and development of knowledge-based systems. During the first years, some knowledge-based systems of first generation were developed applied to management of credits assignment and credit cards delivery, and management of air tickets reservation. After, ISYS was working on the application of second generation knowledge representation environments to physical systems where two systems were developed, one of them was a software environment applying deep reasoning to industrial diagnosis (FIABEX project) and the other one was a decision support system in flow situations (SAIH project, CYRAH and SIRAH systems).

As a consequence of the results obtained from the research on second generation knowledge models, in 1991 another line of research in the area of intelligent systems architectures was opened for the development of applications at a knowledge level. The design of this type of architectures was supported by national (TRYSS and AURA projects) and EU funded projects (KITS and ARTIS DRIVE II projects) where different traffic control decision support systems have been developed. The complexity of the problems faced with these systems made necessary the use of several intelligent techniques in an integrated architecture and led to the design and implementation of a novel tool for easy building and management of complex knowledge structures named KSM (Knowledge Structure Manager environment).

Furthermore, ISYS is also working in the line of using ideas of cognitive architectures to build intelligent cooperative systems. This line was opened by an ESPRIT exploratory action named PECOS and was continued by European and national funded projects, ESCAD (Computer Support for Co-operative Activities in the area of Distance Education) and EXPERNET (A Distributed Expert System for Management of a National Network).

The experience gained in the research of cognitive architectures had also been applied to develop intelligent interfaces supported by conversation models that provide an improvement in the level of human-computer interaction offered by the conventional approaches. This research line was supported by two EU funded projects of the Forth Framework Programme: ARTEMIS and FLUIDS. Also, ISYS has national funded research projects applied to Natural Language Understanding in co-operation with linguistic experts from the Old Languages Research Group of the Linguistic Institute of the National Council for Research (CSIC).

At present, an integrated approach of the past experiences is being applied in the EU funded project ADVICE, where an agent-based and knowledge-based architecture is being developed to support intelligent assistance in E-commerce environments on a conversational basis (NL interaction).

Dr. Josefa Hernández is associate professor in the Artificial Intelligent Department of the Technical University of Madrid. She has a Degree in Mathematics (1989), M.Sc. in Knowledge Engineering (1993) and Ph.D. in Computer Science (1998). Her main research areas include: knowledge representation and organisation, human-computer interaction supported by intelligent interfaces, real time decision support systems, knowledge architectures applied to real world problem domains (traffic management, emergency management). Participant in several DRIVE, ATT, Telematics Applications, ESPRIT and IST European projects since 1991 as well as other research projects financed by public and private Spanish organisations

and companies. Co-chair of the Technical Committee C on Traffic and Telecommunications of the ESPRIT Network of Excellence ERUDIT: European Network for Fuzzy Logic and Uncertainty Modelling.

Dr. Ana García-Serrano is associate professor in the Artificial Intelligent Department of the Technical University of Madrid. She has a Degree in Mathematics (1983) and Ph.D. in Computer Science (1987). Her main research areas include natural language processing supported by intelligent techniques, computer-supported collaborative work, distributed artificial intelligence and logic programming. She has been involved in several EU and national funded research projects, being relevant her work with the Linguistic Institute of the National Council for Research (CSIC) and the application of intelligent techniques for e-commerce support (ADVICE, IST-1999-11305). President of the Programme Committee of the Biannual Spanish Conference on Artificial Intelligence (1999).

Prof. Dr. Julio Gutiérrez Ríos got the degree of Telecommunication Engineer in 1977 and the Ph.D. on Telecommunication Engineering in 1981, both in the Technical University of Madrid. Currently is a full professor on Computer Architecture and Technology at the Faculty of Computer Science of the same University from 1987, and along three years was Deputy Director of the National Spanish Institute for Aerospace Technology. His areas of interest are Fuzzy Systems, Digital Signal Processing and Logic Design. He has published more than seventy scientific works in these areas.

Technische Universität Clausthal, Germany **Institut für Technische Mechanik**

The Technical University of Clausthal is the smallest Technical University in Germany. Nowadays the main focus of teaching and research at TU Clausthal is on Materials Science, Mechanical Engineering, Process Engineering, Information Technology and on courses which link business content with the fundamentals of science and engineering. With its staff of about 100 professors, 450 scientific associates and about 3500 students, TU Clausthal is structured to facilitate interdisciplinary research. Clausthal is located 100 km south of Hanover and 80 km north of Göttingen in the Harz Mountains in the State of Lower Saxony.

The department Mechanics of vibrations and machinery diagnosis is engaged in the field of fuzzy Techniques since 1990. Starting with the development of fuzzy pattern recognition tools for the condition monitoring of rotating machinery the institute has developed many applications based on softcomputing methods. Actually four researchers work in the area of fuzzy technologies. Members of the department published more than 50 papers, articles and contribution for books during the last 6 years.

The department is a node in the NoE ERUDIT and Dr. Jens Strackeljan is co-chairman of the Technology Transfer Committee.

Dr. Ing. Jens Strackeljan, Master degree in mechanical engineering science Technical Uni. of Clausthal in 1989, 1993 Ph.D. TU Clausthal., 1988-93 Researcher at the Institute of Applied Mechanics at the TU Clausthal and since 1993 Senior Researcher and Lecturer, Research topics: Fuzzy Technology in condition monitoring and quality control, methods for classification and automatic feature selection, use of softcomputing methods in the mechanical vibrations. Co-Chairman of the Technology Transfer Committee of ERUDIT since 1997, Chairman of the AFN in Germany since 1994. Publication of 50 papers, articles and contribution for books during the last 6 years.

TSS-Transport Simulation Systems S.L., Spain

TSS is a company specialising in traffic and transport simulation set up in 1998 by members of the former LIOS (Laboratori d'Investigació Operativa i Simulació), a transport research group within the Department of Statistics and Operations Research of the Universitat Politècnica de Catalunya. LIOS has participated actively in R&D Programmes of the European Union, particularly in the areas of the applications of high-performance computing and new telematic technologies to transportation, as well as in projects for the administration and private companies on various aspects of transportation planning, public transport and traffic management systems. The partners of the company have been involved in the EU projects: V1054 ASTERIX, V1015 CLAIRE and V1007 SOCRATES, of DRIVE I. V2013 SOCRATES KERNEL, V2027 GAUDI, and V2043 ARTIS, of DRIVE II, ATT Programme, and in the TR 1020 ENTERPRICE, TR 1030 IN-RESPONSE, TR 1007 CAPITALS and SMARTEST RO-97-SC1059 projects of the 4th Framework Programme. Models built with GETRAM/AIMSUN2, both by TSS staff and by end-users, have been used in various projects in the cities of Barcelona, Madrid, Valencia, San Sebastian, Genova, Florence, Makkah, Auckland, Dublin,

Montréal, Bonn, München, Prague, Stockholm, The Hague, Rotterdam and Maastricht.

Prof. Dr. Jaime Barcelo, Born in Valencia, Spain, on April 18, 1944, received a Degree in Physics by the Universidad de Valencia in 1967, and a Ph. D. in 1974 by the Universitat Autònoma de Barcelona, on a Major in Mathematical Programming and a Dissertation Thesis on Benders Decomposition and Implicit Enumeration. His research works has dealt namely with the field of Optimisation, with special emphasis on Combinatorial and Integer Optimisation, and Optimisation methods in Transportation, and Simulation, with special emphasis on applications of simulation to transportation systems, CIM, and topics on Simulation and Artificial Intelligence. He is Professor of Operations Research at the Department of Statistics and Operations Research of the Universitat Politècnica de Catalunya since 1984. Principal investigator of Research Projects funded by the Interministerial Commission for Science and Technology of Spain. Participant in three projects of the DRIVE I Programme of the CEE: V1007 (SOCRATES) System of Cellular Radio for Traffic Efficiency and Safety (partner), V1015 Artificial Intelligence Based Traffic Control Systems (partner), and V1054 (ASTERIX) System and Scenario Simulation for Testing RTI Systems (Prime Contractor) and in Programme DRIVE II projects: V2013 (SOCRATES KERNEL), V2027 (GAUDI: Generalised and Advanced Urban Debiting Innovation), and V2043 ARTIS (Advanced Road Transport Informatics in Spain); in project PETRI of PACOS Initiative (ESPRIT, HPC Domain), and on project GUIDAS, a project on Artificial Intelligence and Simulation in Traffic Control Systems sponsored by the "Dirección General de Tráfico" of the Spanish Government. Currently involved in the 4th Framework Programme projects: IN-RESPONSE, ENTERPRICE, SOCRATES3 and CAPITALS. He is the author of over fifty papers in international and national scientific journals, proceedings of international and national conferences, and chapters in books.

Jaime L. Ferrer, MS Degree in Computer Science, Simulation Analyst of TSS, Graduated in Computer Science at the Politechnical University of Catalonia (UPC) in 1985. He received a Postgraduation diploma in Artificial Intelligence: Procedures, Technics and Applications by UPC in 1987. Since 1992 he is Assistant Professor in the Department of Statistics and Operations Research at the UPC, developing lecturing activities on Simulation, Stochastic Operations Research and Statistics. He has been the responsible for the development of AIMSUN2 microscopic simulator during the last years and is currently working on the new improvements to the model. He was also responsible for the technical support and training of WITNESS Simulation Environment in Spain (1991-92). He has participated in a number of spanish and european projects. Among them, TRYS and INTRYS Projects (sponsored by Dirección General de Tráfico) for the integration of simulation models into an Artificial Intelligence based traffic management system for the Barcelona and Madrid Ring Roads (1991-96), DRIVE Projects CLAIRE: An Artificial Intelligence based Traffic Control System (1989-91), Development of a Simulation Study for CAPRABO Automatic Warehouse using WITNESS (1991-92), SOCRATES Kernel: Incorporation of vehicle guidance models to AIMSUN2 (1993-95), and other EU projects as SAVE: Environmental Modeling (1995-96), PETRI: Parallel Environment for a real-time Traffic Management and Information System (1995-96), and currently, SMARTEST: Simulation Modelling Applied to Road Transport European Scheme Tests.

Jordi Casas Vilaró, MS Degree in Computer Science, Senior Analyst of TSS graduated in Computer Science at the Politechnical University of Catalonia (UPC) in 1991. Since 1992 he is Assistant Professor in the Department of Statistics and Operations Research at the UVIC, developing lecturing activities on Deterministic Operations Research and Statistics. He has been the participated in the development of AIMSUN2 microscopic simulator during the last years and is currently working on the new improvements to the model. He has participated in a number of spanish and european projects. Among them, TRYS and INTRYS Projects (sponsored by Dirección General de Tráfico) for the integration of simulation models into an Artificial Intelligence based traffic management system for the Barcelona and Madrid Ring Roads (1991-96), DRIVE Projects SOCRATES Kernel: Incorporation of vehicle guidance models to AIMSUN2 (1993-95), and other EU projects as SAVE: Environmental Modeling (1995-96), PETRI: Parallel Environment for a real-time Traffic Management and Information System (1995-96), and currently involved in the 4th Framework Programm project CAPITALS.

Universita degli Studi di Genova, Italy

DIBE-Department of Biophysical and Electronic Engineering

The Department of Biophysical and Electronic Engineering (DIBE) established at the University of Genoa in 1984, spurred on the initiative of a group of researchers active in: Electronics, Telecommunications, Bioengineering, Circuits and Systems, Electromagnetic Fields, Mathematical Physics. DIBE is a continuously evolving scientific technical and educational endeavor. Its members exploit the potential offered by research

and teaching activities for developing applications within a well established framework of co-operation and contracts with the European Commission and, national and international Research Agencies, Industries and Institutions. DIBE's teaching and professional structure consists of "research groups" aimed at the study and solution of the different issues which arises in the analysis and application fields of Information Technology and Biophysical Engineering. Each group is composed by a teaching and research staff and external collaborators. The research groups are autonomous, but also frequent interactions occur for specific projects and achievements. For all the experimental and theoretical research activities, DIBE has an efficient network of laboratories, all of them used also for teaching purposes. DIBE is a crossroad, where demands from society meet scientific research, and positive stimuli in all directions occur. Research and teaching resources are applied to projects achieving great efficiency, making possible technology transfer and innovation at controlled costs. DIBE has been one of the first university departments to be authorized by the European Commission to charge cost statements on a full basis. The management philosophy, assumed by DIBE since its inception, has resulted in steady growth asserting DIBE in the European advanced technology scenario as an innovative and productive scientific-teaching institution.

Research activities

Applied Electromagnetics: Interaction between electromagnetic fields and biological system; Optical signal processing; Electromagnetic modelling and numerical simulations at radio and microwave frequencies; Nonlinear media; Scalar and vector fields in the presence of noise; Electromagnetic compatibility; Electromagnetic techniques for detection, non-destructive tests and environment monitoring;

Computer Architecture and VLSI systems: The group promotes research activities aimed at integrating the modern electronics technology with the demands of the contemporary society. Outstanding skills are developed in VLSI digital systems design and integration and in software algorithm implementation. The application scope ranges from consumer electronic devices to network communications protocols, from computer architecture and embedded systems to special purpose graphics applications

Space Science and Engineering: The SSE group has been carrying out space research since the beginning of the 80's, contributing to the ASI and NASA programs in the following fields: space telecommunications, materials under microgravity conditions, prospection of geosphere.

Mathematical Physics: Wave propagation. Application of the wave splitting technique to waves in inhomogeneous media; methods of solution through integral equations or through the reflection and transmission matrix. Mathematical models of continuous media. Models of mechanical and electromagnetic continua with dissipativity induced by memory effects.

Electronic Systems and Networking: Electronic systems for advanced information processing; Hardware and firmware design and realization (DSPs, FPGAs, Analog circuits); Distributed systems for high performance computing; Multimedia systems and networking.

Neural and Bioelectronics Technologies: Solid-state microtransducer-based systems for biotechnological, pharmacological and environmental applications; Automated instrumentation, data acquisition and signal processing for biomedical applications; Neuroinformatics and computational neuroscience; Design of array of microtransducers and multisensor-based integrated systems; Characterization of potenziometric and amperometric biosensors: automated measurements and computer simulations; Recording and simulation of the electrical activity of networks of neurons and brain tissue coupled to microtransducer arrays; Scanning Force Microscope and microcantilever based sensors.

Signal Processing and Telecommunications: Biomedical imaging: medical imaging systems; Multimedia Systems: joint source and channel coding; transmission on wireless and wired channels; visual databases; multiple access systems (TDMA, FDMA, CDMA); Remote sensing: agriculture, forestry, water resource management; risk and disaster management; Surveillance Systems: outdoor risky environments monitoring; underground stations surveillance; Underwater Scene Analysis: robotic vision; sea-floor imaging; object recognition and classification

Microelectronics:

Design and development of mixed mode (i.e.: analogue/digital integrated circuits) microelectronic systems, based on CMOS and SOI sub-micron technologies, for: image and signal processing and recognition (e.g.: optical character recognition systems, industrial quality control systems, etc.), telecommunications (wireless and wireline e.g. high speed transceivers and AtoD converters, PLLs, RF circuits, etc.); CAD tools for automatic circuits and systems design; Automatic speech recognition for multimedia applications.

Natural and Artificial Nonlinear Complex Systems: Nonlinear circuit theory and applications: analysis and synthesis of cellular circuits, circuit modeling of hysteretic phenomena and of biological neurons, chaotic circuits; Molecular electronics: modelling of molecular assemblies for intelligent processing of information, nanoscale characterization of molecular devices, quantum information processing, self-assembling superlattices for parallel processing, molecular dynamics; Bioelectromagnetics and bioacoustics on molecular assemblies: therapeutic and diagnostic applications, biotechnologies, safety studies; Dynamics of financial

systems.

The Physical Structure of Perception and Computation: Models of natural perceptual systems (neuroinformatics and visual neuroscience): recurrent models of spatio-temporal receptive fields; Design of artificial perceptual systems (machine vision): distributed architectures for texture analysis; stereo depth estimation; complex motion analysis; Neuromorphic microelectronic design (perceptual microsystems): CMOS visual sensors for early visual tasks.

Davide Anguita was born in Genova in 1963. He obtained the "Laurea" degree in Electronic Engineering in 1989 and the Ph.D. in Electronic Engineering and Computer Science in 1994 from University of Genova. From 1989 to 1991 he worked at Esacontrol in the field of distributed systems for traffic control. From 1993 to 1994 he was postdoc research assistant at ICSI (Berkeley, USA), working on modeling and simulation of artificial neural networks. Since 1996 he is Assistant Professor at DIBE. He is a lecturer in the following courses: Digital Systems Electronics, Industrial Electronics, Circuits and algorithms for signal processing. His interests include: Intelligent electronic systems, Artificial neural systems, Neurocomputing, Parallel and distributed computer architectures.

Daniele D. Caviglia was born in Vado Ligure, in Italy, in 1956. He graduated in Electronic Engineering and specialized in Computer Science at the University of Genoa in 1980 and 1982, respectively. From 1983 to 1992 he was Assistant Professor at the Department of Biophysical and Electronic Engineering of the University of Genoa, where his research activities concerned device modeling, VLSI design and development of VLSI CAD tools. Since 1992 he is Associate Professor of Microelectronics at the same University. He is currently teaching two courses: *Microelectronics* and *Telecommunication Electronics 3*. His main research interests are now in the field of algorithms and architectures for artificial neural networks and in their VLSI implementation.

Maurizio Valle was born in Loano (SV), Italy, in 1959. He received the Master degree in Electronic Engineering and Computer Science at the University of Genoa in 1985. Since 1985 he joined the VLSI Design Center of DIBE (University of Genoa) working on VLSI systems design. In 1990 he received the Ph. D. degree in Electronic Engineering and Computer Science from the University of Genoa. From 1990 to 1992 he worked at DIBE as post doc research assistant of: a) Consorzio Genova Ricerche (1990 – 1991); b) ST Microelectronics Spa, with a grant of the Italian Ministry of University and Scientific and Technological Research (1990 – 1991); c) Italian National research Council (1992). In 1992 he became Assistant Professor; he is currently teaching the courses of Laboratory of Microelectronics and Industrial Electronics 1 and 2 (Laurea degree). His main research interests are in the area of mixed – mode microelectronic systems (in CMOS and SOI technologies) for signal processing. Target applications are in the field of industrial quality control analysis, consumer appliances, sensors readout circuitry and telecommunication systems. Among others, he has been engaged in research topics as the development of self-learning analog VLSI neural systems and on the microelectronic implementation (both analog and digital) of neural networks architectures. In this area, he is currently investigating neural networks based circuits and systems for the non-linear equalization of communication channels.

Recent EC projects in the field Artificial Neural Networks:

NeuroNet I and NeuroNet II (1998-2000):The Network of Excellence in Neural Networks.

RAIN (1997-1998):Redundant Array of Inexpensive workstations for Neurocomputing, EC Esprit Project (No. 85387). The project aimed at demonstrating and assessing High Performance Computing and Networking in neural network applications for industry and medicine. The project targeted low-cost implementations, for easier technology transfer to SME, based on clusters of workstations.

ONNI-ADC (1994-1998): Open Neural Network Initiative for Advanced Defect Classification. EC ESPRIT/OMI project. The topic of the project was the design and development of a real time quality control system for the steel industry based on a neural network approach. The research unit of DIBE designed and developed the neural architecture and an ASIC (called MLP-chip) whose architecture is optimized for the real time implementation of hierarchical Multi Layer Perceptron based architectures. The MLP chip has been manufactured and tested on the final hardware-software set-up

Universität Dortmund, Germany

The chair for Artificial Intelligence (LS VIII) at the faculty for computer science of the University of Dortmund contributes expertise in knowledge-based systems for knowledge management, intelligent agents, statistical learning theory, and knowledge discovery in databases. Having investigated the application of machine learning to robotics within the European project Blearn II (BRA 7274), it is currently involved in the

European projects COMRIS (LTR 25500) in the framework of ‚Intelligent Interfaces to Information‘, Mining Mart (IST 11993), and in the Collaborative Research Center 475 of Statistics for ‚Complexity Reduction in Multivariate Data Structures‘ and the Collaborative Research Center 531 of Computer Science for ‚Computational Intelligence‘ funded by the German National Research Agency DFG. It is a partner of the Network of Excellence ERUDIT for Machine Learning and related fields, of MLNetII (P29288) as well as of the PECO Network for Inductive Logic Programming. Katharina Morik represents the Training Committee of MLnetII. A first Intensive Course on Artificial Intelligence in 1999 focusing on Knowledge Discovery and Data Mining attracted more than 100 participants, about half of them from industry. For statistical learning theory, the LS VIII is acknowledged as a research center, since the first efficient implementation of the Support Vector Machine has been implemented there.

Prof. Katharina Morik, 1981 Ph D on Natural Language Systems at the University of Hamburg; 1982-1984 Scientist of the project ‚HAMBURG Application-Oriented Natural Language System‘ at the University of Hamburg; 1985-1988 Internal leader of the German Research Project ‚KIT-Lerner: Machine Learning and Knowledge Acquisition‘ at the Technical University Berlin; 1989-1991 Senior Scientist at the German Research Center for Computer Science (GMD, St. Augustin, Germany) and partner in the European project ‚MLT: Machine Learning Toolbox‘; since 1991 Full Professor at the computer science department of the University of Dortmund. After 7 years in the editorial board of the ‚Machine Learning Journal‘ (Kluwer Academic Publisher) she is currently a member of the editorial boards of ‚Int. Journal for Human-Computer Interaction‘ (Academic Press), ‚Int. Journal Knowledge and Information Systems‘ (Springer), and ‚Informatik Spektrum‘ (Springer). She has been a member of several programme committees of international conferences on Machine Learning, Multi-strategy Learning, Inductive Logic Programming, and Knowledge Discovery/Discovery Science. She organised the ‚First European Summer School on Machine Learning‘ as program chair in 1989, a workshop on ‚Machine Learning Applications‘ at the IFIP world congress in 1994, and an ‚Intensive Course on Artificial Intelligence – Data Mining and Knowledge Discovery‘ in 1999. Within the Network of Excellence for ‚Machine Learning and Related Fields‘ she represents the Training Committee.

Patric Brockhausen, 1994 Diploma in computer science at the University of Dortmund; 1995-1997 Ph D student of Daimler Benz Research Center Ulm for relational knowledge discovery in databases; 1997-1998 Scientist within the collaborative research center of Statistics (SFB 475) on ‚Complexity Reduction in Multivariate Datastructures‘; since 1998 assistant at LS VIII of the University of Dortmund. His particular expertise is in accessing and managing very large databases for knowledge discovery.

Thorsten Joachims, 1994-1996 study of machine learning at the Carnegie Mellon University in Pittsburg, USA; 1997 Diploma in computer science at the University of Dortmund; since 1997 assistant at LS VIII of the University of Dortmund. His particular expertise is in Statistical Learning Theory and its applications to large text document collections as are in the World Wide Web. He developed the first efficient implementation of Vladimir Vapnik’s Support Vector Machine.

University of Magdeburg — Knowledge Discovery and Machine Learning, Germany

At University of Magdeburg, the Knowledge Discovery and Machine Learning group is situated in the Institute for Knowledge and Language Processing, School of Computer Science. The group is lead by Prof. Stefan Wrobel and consists of two positions permanently devoted to research in Machine Learning, plus additional third party funded researchers. The group is a main node in the ESPRIT network of excellence in Machine Learning (MLnet2) and is running the MLnet2 Online Information Service. Members of the group have participated in a number of prior ESPRIT projects, among them the projects “Machine Learning Toolbox” (MLT, P2154), “Inductive Logic Programming” (ILP, P6020), and “Inductive Logic Programming 2” (ILP2, P20739). There is close collaboration with neural network, fuzzy logic and document processing groups in Magdeburg. The group is a partner of the coordinated German research effort on “Information Fusion” with a project on active learning. The main research focus of the group is on processes of learning and discovery, and in how such processes can be effectively modelled, supported and carried out automatically by computer algorithms and user-friendly software systems. The members of the group have contributed to a number of areas relevant to the project. Firstly, the data mining system Kepler and its plug-in architecture can serve as a useful basis for the data mining/text mining software modules of the project. Second, members of the group are involved in the development of a number of techniques with particular usefulness for on structured data and document (collections), namely efficient matching of complex objects, first-order instance-based learning approaches with RIBL and RIBL2 and subgroup discovery for first-order representations with the MIDOS algorithm. Third, we are conducting research on model selection procedures and active learning, which provide general approaches to deal with selection of good models and large

datasets.

Prof. Dr. Stefan Wrobel, M.S., studied computer science in Bonn and Atlanta, GA, USA (M.S. degree, Georgia Institute of Technology), receiving his doctorate from Univ. of Dortmund. He has been in active in Machine Learning since 1986, first at Technical Univ. of Berlin, then from 1989 at GMD as a research scientist and later leader of the Machine Learning/Data Mining Group. In 1997, he co-founded Dialogis GmbH, also serving as one of the companys technical directors. At the end of 1998, he became professor of computer science at Univ. of Magdeburg, where he leads the chair "Knowledge Discovery and Machine Learning". Prof. Wrobel has participated in a number of national and European-funded projects (MLT, ILP, ILP2) and is a member of the MLnet2 management board. He is a member of the editorial board of several journals and has (co-)chaired two conferences. He has published extensively on subjects relevant to the project.

Dr. Tobias Scheffer studied computer science at the Technische Universitaet Berlin where he received his master's degree in 1995 and his doctoral degree in 1999. Between 1994 and 1999, Dr. Scheffer has been working as an associate lecturer and a research associate at the TU Berlin and was awarded an Ernst von Siemens fellowship in 1996. He has been a visiting researcher at Siemens Corporate Research, Princeton, the University of New South Wales, Sydney, and the University of Dortmund. Since 1999, Dr. Scheffer is a lecturer at the Otto-von-Guericke-Universitaet Magdeburg. Tobias Scheffer's research focus is on the theory and application of machine learning algorithms.

Universitätsklinikum der RWTH Aachen, Germany

The Klinikum of the RWTH Aachen is a hospital of medical maximal care in the western part of the State of North Rhine-Westfalia (NRW). The hospital consists of a main building with 130,000 m² effective area, a building for research, and one for supply, and two apartment houses for the employers. The hospital was set up 1982 by the government of the State North Rhine-Westfalia. It is run by the medical faculty of the Rheinisch-Westfälische Technische Hochschule (RWTH) Aachen. The University Hospital contains 30 clinical departments, 11 clinical theoretical institutes, and 5 institutes for basic research. At the Medical Faculty 2.500 students are registered for human medicine, 500 for dentistry, and 50 for logopedia. In 1999 620 research projects were supported by the state government and 520 research projects were funded by external sources. The hospital staff amounts to 820 medical educated persons, 1000 persons in the field of nursery, and 900 persons in the field of medical technique, and 330 in administration. About 45,000 in-patient treatments, and 110,000 out-patient treatments are completed per year.

Medial information is engaged in service and research. The main tasks in service are establishing and running the central information system for all departments and institutes including the central data base for the patients. Furthermore all PC and UNIX workstations of the hospital for students have to be watched, and the methodological consultation for the whole medical faculty is the task of the institute of medical information. Research concerns the development of computer assisted information for medical documentation, validation for computer assisted information systems in the large hospital as well as developing theory and design of knowledge-based assisted systems for medical diagnosis and theoretical planning.

Design and application of new image processing devices in medical diagnoses, content based research in image data bases, colour texture, and movement analysis of video sequences are application fields. Automatic segmentation and measurement of biological objects as well as design of model-based system for establishing net-based computer assisted learning documents are further tasks.

Prof. Dr. med. Diedrich Graf v. Keyserlingk, 1967 Certification for medical practitioner, 1970 Assistant professor for anatomy at the second Anatomical Institute in Berlin, 1972 Appointment of the university lecturer, 1972 Super numereri professor in Berlin, since 1982 Head of the Department of Anatomy of the RWTH Hospital in Aachen.

His special attentions in teaching and examination are anatomy for students of human medicine and dentistry, as well as neuroanatomy for students of logopaedia, morphometry, and image processing for students of mathematics and informatics. The research of the department concerns intellectual and interactive support for three dimensional obligations space imagination of medical persons. The general idea is that the theory and applications should follow health care needs as directly as possible. Single tasks should be solved problem oriented. The main application fields are gross- and microscopical variations of brain structures, bones, and muscles, and the claim is to correlate structure and function or dysfunction at all levels of morphological

resolutions. A course 'Soft computing in medicine' is offered to students of medicine, mathematics, and informatics.

Relevant publication: Fuzzy Sets in Medical Image Processing. In Fuzzy Systems in Medicine edited by SZCZEPANIAK, P.S. et al., Springer Verlag 2000.

Involvements in other EG projects already finished: 3rd Research Framework programme of the EC 'Telematic Systems of General Interest', Subprogramme AIM, project A/2003, acronym COVIRA, project title 'Computer Vision in Radiology' and in the same framework project A/2056, acronym CAMI 'Computer Assisted Medical Interventions'.

Université Catholique de Louvain, Belgium

Microelectronics Laboratory

The Microelectronics Laboratory of the "Université catholique de Louvain" deals with several research areas. The main one is the design, fabrication and test of semiconductor devices and integrated circuits: analog basic blocks (amplifiers, filters, sensors, etc.), analog signal processor (artificial neural networks and fuzzy logic), digital processors (image processing), etc. Another important research activity covers algorithmic aspects related to data analysis, signal processing, and security of information. These two activities are strongly linked in various domains of applications. In particular, the laboratory studies VLSI implementations of artificial neural networks for signal processors, smart cards, and other types of devices making use of advanced signal processing and data analysis techniques.

The main topics of present research are:

- Design and fabrication of SOI (Silicon On Insulator) devices and circuits
- Design and fabrication of sensors
- Theoretical and experimental investigation of quantum devices
- Artificial neural networks
- Medical electronics
- Specialised Processor Architectures (analogue and digital)
- Low-power systems
- Hardware-software co-design
- Cryptography and smart cards

The microelectronics laboratory has a permanent staff of 8 academic professors and scientific researchers.

There are about 20-25 Ph.D. students and 15 technical staff. More than 40 publications in international journals or conferences are written each year by members of the laboratory. The equipment of the laboratory represents an investment of around 10 millions euros and mainly includes:

- A 350 m² processing line (class 100 or 1000 clean rooms), with photolithography, plasma etchers, diffusion, oxidation, hydrox and solid source doping furnaces, thin-film deposition (LPCVD polysilicon and nitride, APCVD oxide, PECVD, etc.), EATON ion implanter, scribe and automatic wafer dicer;
- A network of SUN and PC (NT) workstations, together with X-terminals;
- Specialised software packages for process and device modelling (Suprem 4, Medici, Da Vinci) and for VLSI design (Synopsys, Cadence, Snake, MaxPlus II, OrCad, VHDL simulator, HSpice, Anacad, etc.)
- Advanced electrical characterisation equipment, both for analogue and digital tests.

The laboratory has been and is involved in several European Community research projects. In the field of this proposal, the laboratory was involved in the "Nerves" and "Elena" Esprit projects about artificial neural networks. The laboratory is also involved in several national projects about artificial neural networks, sensors, dedicated VLSI architectures for intensive digital signal processing, etc.

Michel Verleysen was born in Brussels, Belgium on October 27, 1965. He received the engineering degree from the Université Catholique de Louvain, Louvain-la-Neuve, Belgium in 1987, and the Ph.D degree in microelectronics from the same university in 1992. He was invited professor at the Ecole Polytechnique Federale de Lausanne (Switzerland) in 1992. Since 1992, he has been research fellow and research associate of the Belgian National Fund for Scientific Research, and he is now invited lecturer at the Université Catholique de Louvain. His main research areas are artificial neural networks (VLSI implementations and algorithms for data analysis) and mixed analogue-digital VLSI circuits. He is currently involved in two EC-funded projects in the field of VLSI biomedical devices. He is also editor-in-chief of the Neural Processing Letters Journal (Kluwer), organiser of the annual European Symposium on Artificial Neural Networks, and chairman of the IFIP working group 10.6 on neural networks. He is author or co-author of more than 50 publications or conference communications in the fields of VLSI devices and neural networks. He was responsible of UCL's participation in the Esprit Nerves and Elena projects.

University of Bristol, United Kingdom
AI Research Group

The Artificial Intelligence Group at the University of Bristol carries out research in the development and use of innovative methods for handling uncertainty in real-world AI applications. The research profile encompasses fundamental theoretical work and a number of more applied projects in collaboration with industries and research organisations. Theoretical areas include fundamental aspects of knowledge representation and uncertainty, inference under uncertainty (particularly mass assignment theories), machine learning, use of FRIL to model uncertainty in knowledge-based systems, and application of soft computing to image understanding, human-computer interfaces, and user modelling.

The A.I. Group has an international reputation and a solid publication record, having published over 200 research papers in leading journals and conference proceedings during the past 5 years. There are strong international links, and joint research projects are currently underway with universities and industrial or research organisations in countries such as Japan, United States, Germany, Spain, Italy, and the United Kingdom. The group has secured funding from international and national research contracts with bodies including CEC (Esprit and other programmes), EPSRC, British Aerospace, Defence Research Agency, British Telecom, BP, SEMA Group, Intera-ECL, and Marconi.

In recent years, members of the group have organised workshops on

- logic programming and soft computing
- intelligent sensors
- computational intelligence and user modelling

The A.I. Group forms part of the University of Bristol's Advanced Computing Research Centre. (see <http://www.cs.bris.ac.uk/ACRC/>). There are strong links with the Machine Learning group, which is a node of ML-NET.

Dr Trevor Martin, Reader in Artificial Intelligence, University of Bristol, Organiser, Coil workshop on Computational Intelligence for User Modelling, Bristol, 1999, Member of ERUDIT Steering Group and co-Chair of Technical Committee B since 1998.

University of Chemical Technology and Metallurgy, Department of Automation in Industry, Sofia, Bulgaria

The University of Chemical Technology and Metallurgy - Sofia is also a large research and development centre. Its academic, research and teaching staff is capable to solve complex chemical, metallurgical, technological and control tasks as well as problems concerning environment protection. The department of Automation in Industry exists as an independent unit since 1971. It is involved in education of students for receiving B.S., M.S. and Ph.D. degrees in the following areas:

- Control and automation in chemical and metallurgical industries;
- Quality control and industrial management;
- Industrial information technologies.

Up to now more than 1400 students have graduated from this Department. For each academic year about 50 newcomers are being enrolled for the Full-time as well for the Correspondence forms of education. The academic staff of the Department of Automation in Industry consists of 25 persons, including 5 full professors and 12 associate professors. The educational process is based on the background of chemical and metallurgical engineering. The Department of Automation of Industry conducts wide scientific and research collaboration with many European Universities in England, Germany, France, Italy, Holland, Finland, Greece, Russia, Poland, etc. Totally 8 TEMPUS Projects have been successfully completed. Also some Projects under PHARE Program, including COPERNICUS Projects are being developed. Due to the wide international collaboration between the Department and many countries from EC several modern Laboratories have been created and equipped with modern computer facilities and pilot plants, process simulators and experimental rigs.

There are four main laboratories for research and development in the Department:

- Process modelling and control;
- Industrial systems - analysis and design;
- Experimental design and quality control;
- Optimization and decision making;

In the Project the Process Modeling and Control Laboratory will participate as representative of UCTM. The main area of expertise of the laboratory include

- First principle modeling of processes with heat and mass transfer and chemical reactions.
- Input-output data based modeling using NN, FL and statistical approaches for chemical, metallurgical and power plants.
- Diagnosis of measurement errors and data reconciliation.
- Model based inference, predictive, partial and reconfigurable control of complex technological plants with large uncertainty, unfrequently measurements and nonlinearities.
- Modeling and control of hybrid systems.
- Hierarchical and distributed control of industrial processes.

The main current and recently finished EU projects of Laboratory are:

1. TEMPUS JEP project 3645-92 "Center for Advanced Control Engineering" (1992-1995).
2. COPERNICUS Network Project "Dynamic Control and Management Systems in Manufacturing Processes" (DYCOMANS)(Phase I 1995/98)
3. COPERNICUS Network Project "Dynamic Control and Management Systems in Manufacturing Processes" (DYCOMANS)(Phase II 1998 - 2001)
4. INCO COPERNICUS Network Project "Advanced Methodologies and Tools of Manufacturing Systems"(AMETMAS-NOE)(1997-2000)

The laboratory of Process modeling and Control has a efficient co-operation with number of SME'S in the field of control engineering. In this way the RTD results of Laboratory could reach end user. The Laboratory of Process Control enjoys long time efficient and successful cooperation with SME START Engineering JSCo

Prof. **Mincho Hadjiski** was born in 1938. He received MS degree on Power Engineering in Technical University – Sofia, Ph.D. on Control Engineering in Higher Power Institute – Moscow and Dr.Sc. on Process Control in University of Chemical Technology and Metallurgy(UCTM) Sofia in 1962, 1966 and 1979 respectively. He is a Professor on Process Control in UCTM from 1982 and now is a Leader of the Process Modeling and Control Laboratory of Department on Automation in Industry. His research interests includes first principle modeling, inference measurement and control of chemical, metallurgical and power plants,

hybrid system (modeling and control), multivariable control, model predictive control intelligent modeling and control, scheduling and coordination in Large Scale Systems (LSS). He is author of 240 publications and 10 books. He serves as a member of TC on MMM automation of IFAC, member of IPCs, Chairman of NOCs. He was national coordinator of number EC-projects – TEMPUS, COPERNICUS, INCO-COPERNICUS.

Dr. **Nikolinka Christova** received MS degree in Industrial Automation and Ph.D. on Methods and Algorithms for Data Reconciliation and Diagnosis of Measurement Errors in Technological Systems from the University of Chemical Technology and Metallurgy, Sofia, in 1982 and 1999 respectively. She participated in the Course on Intelligent Technologies and Soft Computing in Mangalia, Romania in 1995. She received Professional Certificate in Management from the Open University, Business School, Sofia, in 1996. Dr. N. Christova has carried out research scholarship at the University of Patras, Greece (1998 - present). Now Dr. N. Christova has a position of Assistant Professor at the Department of Automation in Industry, UCTM, Sofia on Integrated Control Systems. Her main research interests are in the field of intelligent supervisory control systems, fuzzy logic and

University of Coimbra - Center for Informatics and Systems - CISUC, Portugal

Soft Computing and Applications Group

CISUC- Center for Informatics and Systems is a Research facility of the University of Coimbra. It is composed by the following groups/lines of research: Computer Science, Artificial Intelligence: Foundations and Applications, Simulation and Information Technologies in Education and Training Automation, Soft Computing and Applications, Dependable Systems, Communications and Telematic Systems, Data Bases, Software Engineering and Information Systems

The Automation, Soft Computing and Applications Group has been or is developing the following lines of research:

Intelligent Control

Adaptive and Robust Multivariable Control: Forgetting factors for recursive identification with increasing convergence and robustness. Study of some classes of nonlinear systems where these methods can be applied considering particularly the problem of robustness. H infinity synthesis methods for decoupling of MIMO systems. Implementation in pilot processes.

Self-Organising Fuzzy Control (SOC) : SOC with a fixed maximum number of rules and adaptive similarity factor with general applicability to stable monotone systems.

Adaptive Fuzzy Control : On-line adaptation of the scale-factors in fuzzification and defuzzification. On-line adaptation of the membership functions in PID type fuzzy controllers.

Neural Real-Time Control of Nonlinear Systems : Real-Time, on-line, learning of Radial Basis Function (RBF) Neural Networks with P means clustering for activation functions and recursive least squares for weights. Development of simple structures for closed loop control using RBF Neural networks.

Intelligent Neuro-Fuzzy Structures : Fuzzy systems for prediction of the behaviour of industrial processes allowing to include the initial operators knowledge and then with on-line learning procedures based on neural networks training algorithms. Industrial data mining for empirical modelling and prediction.

Computer Vision

Image Processing Techniques using Parallel Algorithms

On-Line Automatic Visual Inspection Lime granule inspection in pulp and paper industry. Analysis of structural wood properties at the vessels and at the fibers levels. Measurement of wood chips for pulp. Pulp Inspection: the sizes and distribution of dirt spots to measure the distribution of these spots.

Application of Neural Networks

Neural Networks were successfully applied to identify patterns in Elementary Arc Segments for the localisation of highly irregular elliptical shapes in multi-connected scenes. The architecture used is a feedforward ANN with 6 input, 8 hidden and 1 output neurones all with sigmoid activation functions of type logsig, whose inputs are a set of geometrical measures which describe the intended pattern.

Industrial Applications : Pulp and paper industry: dirt analysis in unbleached eucalyptus globulus pulp and dimensional analysis of lime balls produced by the lime kiln; measurement of average volume of wood chips; analysis of growing characteristics in pines transversal cuts.

Optimisation

Hierarchical Optimisation Methods : Temporal and spatial aggregation in a discrete optimal control formalism applied to the production scheduling task in (continuous) process industries.

Global Optimisation using Genetic Algorithms : Genetic algorithms for multicriteria problems issued from the simultaneous consideration of the production scheduling and the energy optimisation problems in an industrial complex. Genetic operators for the constrained framework.

Decision Support Systems for Industrial Applications

Development of interactive software systems for (re)configuration of the DSS to any particular mill, using an object-oriented philosophy and advanced tools.

Supervision & Diagnosis

Soft Computing for Development of Fault-Tolerant Robust Control Systems

A fault-tolerant control system is a controlled system with the capability to continue operating acceptably to fulfil specified functions following faults in the system being controlled or in the controller. A fault-tolerant control system is designed to retain some portion of its control integrity in the event of a specified set of possible component faults or large changes in the system operating conditions that resemble these faults

Other applications

Application of the Hopfield Networks to Routing on Data Networks

Neural networks have been proposed as a new computational tool for solving constrained optimisation problems. In this area of research the topic being investigated is the feasibility of application of Hopfield neural networks to routing in QoS Networks.

Robot Learning and Path Planning using Neural Networks.

The mobile navigation of robots is a complex task which needs the workspace for correct trajectory planning. Learning is essential for accomplishing the intelligent navigation of the robot. The research is based on using neural networks for intelligent navigation of the mobile robot NOMAD.

The team is actually composed by 3 PhD, 6 PhD students, 3 M.Sc. students

António Dourado Correia. Associate Professor with Aggregation of Informatics Engineering Department, aged 46. Electrical Engineering (UC, 1977), Ph.D. (LAAS du CNRS, France, 1984) in Automatic Control. Since 1985 has been conducting research in cooperation with Portuguese industry (principally pulp and paper) for modelling, control and optimisation of processes. Has participated in several European Projects- in Comett II, Esprit, Erasmus, Copernicus - and COSY project of European Science Foundation. Has participated in the Program Committee of several international conferences in the fields of systems and control, production management, etc. He is a founding member of EUCA- European Union Control Association and member of its Council. Founder also of APCA- Associacao Portuguesa de Controlo Automático (the IFAC NMO), having been its Secretary (1995), Vice- President (1997) and President (1998-2000). Has published more than one hundred papers in refereed international journals, books, conference proceedings.

Bernardete Martins Ribeiro. Auxiliar Professor of Informatics Engineering Department. Chemical Engineering (UC), PhD (UC, 1995) in Informatics (Neural Networks and Automatic Control). Since 1996 has been leading research in Neural Networks and Application in cooperation with Portuguese industry (namely plastics industry). She has been member of Program Committees in International Conferences on Neural Networks and published about thirty papers in international journals and conference proceedings.

University of Crete, Greece

Division of Bioinformatics

The University of Crete was established in 1973 and started functioning in the academic year 1977-78. As a higher education institution, it is a legal person of public law, i.e. it operates under the supervision of the State. The seat of the University is in Rethymnon. The organisation and administration of research are based on the principle of autonomy.

The University of Crete has 6618 students (5875 at the undergraduate level and 687 at the postgraduate level), more than 400 Faculty members and researchers as well as approximately 240 administrative staff, in Schools and their Departments in the cities of Rethymnon and Heraklion.

At Heraklion, the **School of Sciences** includes the Departments of Biology, Chemistry, Computer Science, Mathematics and Physics, while **the School of Health Sciences** includes the faculty of Medicine. Although still very young, the University of Crete has already shown its commitment in the evolving European process. It is currently coordinating and participating in EU programs and activities such as ERASMUS, LINGUA, TEMPUS etc. and has important links and cooperations with other Mediterranean and Eastern Europe countries as well as with many US Universities and Colleges, through international Programs.

Athanasios V. Vasilakos (born 1959 in Greece) received the BS (1983) in Electrical Engineering from the University of Thrace (Greece), the MS (1986) in Electrical and Computer Engineering from the University of Massachusetts at Amherst, (USA) and the Ph D (1988) in Computer Engineering from the University of

Patras (Greece). From 1988 to 1991 he was with the Computer Engineering Department of the University of Patras and the Computer Technology Institute in Patras. From 1991 to 1995 he was professor of Informatics at the Hellenic Air Force Academy. Since 1995 he is Research Professor with the Institute of Computer Science, Foundation for Research and Technology Hellas (FORTH, Greece) and a consultant to Greek Government. From Jan. 1999-Dec 1999 he was Visiting Professor at the University of Alberta, Canada. Recently he is a Professor with the Division of Bioinformatics, Dept. of Biology, University of Crete. His main interests are Communication networks, B-ISDN ATM networks, Mobile Nets., Computational Intelligence (fuzzy logic, neural networks, GAs, machine learning), and Bioinformatics (molecular and quantum computing). He is co-chairman of the Technical Committee: Telecommunications of the ERUDIT Network of Excellence for Fuzzy Logic in Europe. He is member of the Program Committee of several Conferences, Associate Editor of IEEE Communication Magazine, and Editor of the journals: "Applied Computing Review" (ACM), "Computer Communications" (Elsevier), "Soft Computing" (Springer). He is co-author (with W. Pedrycz) of the book (the first book in the field) "Computational Intelligence in Telecommunications Networks" (CRC Press, to appear, Spring 2000). He has authored over 70 papers mostly regarding the applications of Computational Intelligence in the Computer networks problems and is a member of ACM, ACM SIGCOMM, IEEE Societies. He chaired several R&D Projects in Informatics and Telecommunication.

DaimlerChrysler AG, Germany **Data Mining Solutions" (FT3/AD)**

The "Data Mining Solutions" (FT3/AD) group is part of the "Autonomous Systems and Pattern Recognition" lab which, in turn, belongs to the Information Technology division within DaimlerChrysler Research and Technology. FT3/AD consists of 12 permanent members plus another 18 PhD students and temporary members. The group is headed by Prof Nakhaeizadeh, who has been active in the area of Data Mining and Machine Learning for many years. FT3/AD mainly focuses on Data Mining and Text Mining methods to provide advanced, complex decision and product support systems for Business to Customer, Business to Business, Internal Business, and Financial Business applications at DaimlerChrysler.

Neural networks, symbolic Machine Learning, Case-Based Reasoning, statistics and optimization as well as information filtering methods are on the list of core technologies applied, adapted, or developed by the group. Besides various DaimlerChrysler internal research projects, the group has been involved in various successful European projects, like, e.g., StatLog, CRISP-DM, METAL, or INFOMAN during the last years.

Udo Grimmer

After working as a technician in the fields of mechanical engineering and air conditioning for few years, Udo Grimmer completed his studies at the Technical College (Fachhochschule) Ulm. He received his Dipl.-Ing. (FH) in July, 1990.

He joined the DaimlerChrysler Research and Technology Center in September 1990. During the first years he has been working in projects related to software quality improvement methodology. Since 1994, he is a member of the Data Mining group. He has mainly been involved in the corporate financed project "Data Mining Using Machine Learning". Currently, he is project leader of an ESPRIT project (INFOMAN, ref. no. 29114) and one DaimlerChrysler research project in the area of data quality improvement.

Prof. Dr. **Gholamreza Nakhaeizadeh** received his Ph.D. in Applied Bayesian Statistics in 1984 and his Habilitation (Postdoctoral Thesis) in Applied Econometrics at the Karlsruhe University in 1988. During 1978-1989 he was research fellow and lecturer at the Karlsruhe University. In 1989 he changed to DaimlerChrysler Research Center in Ulm and started his research in the field of Machine Learning (ML) and Data Mining. From 1990-1993 he was Project Director of the Esprit-Project StatLog (Evaluation of ML-algorithms). He has directed the corporate financed project "Data Mining Using Machine Learning" from 1995 to 1999. Since 1998 he is Leader of the Research Department "Data Mining Solutions" in Ulm. Since 1989 he is also Professor of Economics and Econometrics at the Karlsruhe University. He has been initiator and co-chair of 9 international workshops on Machine Learning, Data Mining and Applied Econometrics. He is author of 3 monographs and about 35 refereed papers, editor of the book "Data Mining, theoretische Aspekte und Anwendungen" and co-editor of 8 books and Proceedings.

Rautaruukki Oy, Finland

Rautaruukki Group is a Finnish steel company, with production of steel upgrading in 14 countries in Europe. Rautaruukki manufactures flat and long steel products, upgraded products based on them and related service. Flat products include tailored hot and cold rolled plates and sheets, coated sheets, tubular products, cold formed sections and system products for building. More than half of the long products are rolled special products and further processed products. Basic products include merchant bars, wire rods, profiles and reinforcing. In 1999 the total production of the Rautaruukki Group was 4.2 million metric tons of steel. The operations of Rautaruukki are divided in five industrial divisions, one of them being Rautaruukki Steel, which is the first link in the chain that consists of the group's production of plates, sheets, pipes and tubes as well as the upgrading of these products. The main products are flat products consisting of hot-rolled plates and strip products, and cold-rolled, hot-dip galvanized and coil-coated sheet products. In the year 1999 steel production of the division was about 2.5 million tons, produced by the staff of 5000.

Rautaruukki Steel invests about one per cent of turnover on research and development operations. Research and development has been divided into short and long term operations. Short-term research and development is the responsibility of the individual industrial division. R&D with longer-term implications come under the Corporate R&D network. In order to acquire sufficient resources, knowledge and skills, co-operation work at the European, national and direct collaboration with universities and competence centers is nowadays imperative.

Steel product manufacturers are under a growing pressure to improve the yield and quality of their products. To meet this challenge, highly advanced and automated systems are being applied to new and updated mills. In order to make use of the huge amount of available data and to make the control of the mills more flexible, new soft computing methods have been introduced to enhance the control systems. Some examples from Rautaruukki are fuzzy monitoring and control functions of sinter plant and steel plant operations, as well as neural network approaches at several production locations. It seems that these technologies are viable alternatives (or most often enhancements through hybridisation) for steel manufacturing control where the processes and phenomena are typically non-linear, physical background may be partly unknown or the models are too heavy to be used on-line and measurements often indirect and the measurement conditions severe.

Paavo Ruha, M.Sc. (Tech.), Research Manager at Rautaruukki Corporate Research and Development. Special field is modelling and data analysis methods from which e.g. such soft computing methods as artificial neural networks, fuzzy logic and evolutionary computing (genetic algorithms) could be mentioned. Mr. Ruha has been involved as a co-ordinator and methods expert in EU IV FP project "Application of Neural Network based Models for Optimisation of the Rolling Process", acronym NEUROLL, contract number BRPR-CT96-0342. At present Mr. Ruha works at ECSC project 7210-PR-164 "The prediction of the mechanical properties of hot rolled strip products by the means of hybrid methods", where methods comprise neural and statistical treatments, among other things.

Agne Bogdanoff, M.Sc. Lic.Tech., Development Engineer at Quality and Process Development at Rautaruukki Steel's Plate Products unit. Special field is modelling and artificial intelligence methods such as fuzzy logic and neural networks. Mrs Bogdanoff has worked on ECSC project P3773 Profile, flatness and ski-end control in plate rolling, where neural networks has been used in rolling force modelling. She is also worked in national Hi-Tech Steel project. One part of that project is plate mill's temperature modelling by physical and neural network methods. At present she is working with flatness control by using quality control tools.

DAEDALUS Informatics Ltd , Greece

DAEDALUS Informatics Ltd was established in 1991 by a group of EDP specialists and engineers. The founding perspective endeavoured, was to establish an innovative and flexible commercial scheme able to host and promote the results and experience of multi-annual research in information, engineering and renewable energy technology.

The Company's central offices are located at privately owned premises in Glyfada, Athens, Greece. The company's commercial activities are focused in two major fields of science: Informatics and Maritime Technology.

In Informatics, the purpose of the company is to develop and promote applicable R&D products, know how transfer and services, including turn key solutions in Office Automation or Multimedia Systems, design and

development of multimedia training or business systems for use by the Public Sector, Academic Institutions or enterprises, as well as production of CD ROM based publications. The company is also particularly keen to participation as in EEC sponsored research programs, as either a technology partner, as a subcontractor or, as a "black box" manufacturer. Among the company's current minor activities are the integration and trade of purpose-specific multimedia systems, small scale design and manufacturing in the fields of data acquisition and data logging hardware.

In Maritime Technology, the company is actively engaged in world-wide key research on the exploitation of renewable resources derived from marine wave energy. The company holds international patent rights to wave energy exploitation devices carried over floating structures, whilst a number of additional patents are pending.

Currently occupied are 8 people, yet the number of associated specialists and part-time partners amounts to a multiple of that, enriching the company's enabling force and allowing the existence of broad but fully diversified and flexible scheme. In addition, the company has direct connection and joined activities with a number of domestic Academic Institutions, Universities and research centers, on a national as well as on a European domain, so as to be able to provide a broad spectrum of services in specialized education, research and design. The company joins a multitude of experience from a broad spectrum of science and technology levels, thus being able to provide an optimum blend of research, design & manufacturing.

The company's activities have expanded to the Cypriot market, whereat a commercial joint venture with the affiliated branch DAEDALUS Multimedia Ltd, was established in 1991. The company's premises are based in Nicosia and it currently occupies 3 people. It's major activities are VAR, know how and consultancy services in the Office Automation and Multimedia markets, in a variety of applications in the public or private sectors. Besides import, trade and representation of Hardware and Software, the company actively promotes the products of the Hellenic branch.

Most recent enterprise companion, DAEDALUS U.K., is the newly established branch of the company in Nottingham, England. Currently operated by 3 people, serves as a commercial and distribution front-end for services and turn key solutions in Office Automation and Multimedia Document Management. In addition, the company actively promotes the products of the Hellenic branch.

Evangelos M. Mylonas

Studies - Education

- M.Sc. studies at "Cranfield Institute of Technology", England, on Energy Conservation and the Environment (1981)

Professional Experience

- Technical Director and shareholder of Electel Ltd specializing in software development, image processing, document management, computers, support and wave energy applications (1986 - 1991)
- Technical Director and founder of DAEDALUS Informatics Ltd specializing in research and development for Multimedia Information Management Systems and renewable energy resources (since 1991)
- Technical Director of DAEDALUS Multimedia Ltd in Nicosia/Cyprus, specializing in multimedia applications (since 1994)
- Technical Consultant of ALPHA OMEGA Ltd in Nicosia/Cyprus specializing in Electronic Publishing (since 1995)
- R&D Director of AA Aktomihaniki Ltd in Nicosia/Cyprus for coastal protection, coastal engineering and reformation (since 1996)

S.I.Vavilov State Optical Institute, Russia

Federal Unitary Enterprise "All-Russian Scientific Center "S.I.Vavilov State Optical Institute" (SOI), St.Petersburg, Russia, was founded in 1918. (<http://soi.srv.pu.ru>)

The Group for Optical Neuro-Fuzzy Systems

The research team incorporates scientists and engineers from both Laboratories for Optical Neural Networks and Photophysics of Surfaces and students from State Institute of Fine Mechanics and Optics - Technical University. The team has 25 years experience in investigation of holography for the tasks of air navigation and robotics, and Neural Networks for image associative processing. Theory, optical devices and experimental setups were developed. Now the team's activities are aimed at basic and applied research in the field of optical methods of implementation of a neuro-fuzzy approach to an artificial intelligence problem

including development and research of liquid crystal structure based spatial light modulators. For carrying out complex research technological equipment and holographic beds are available.

Alexander Vladimirovich Pavlov, Senior Scientist, Ph.D.

Current Position: Senior Scientists, Head of the Group for Optical Neuro-Fuzzy Systems, S.I.Vavilov State Optical Institute (SOI), St.Petersburg, Russia.

Education: 1980 Diploma of Engineer-researcher in Opto-Electronic Devices, Institute for Fine Mechanics and Optics, Leningrad, USSR, 1996 Ph.D. degree in Opto-Electronic Devices, S.I.Vavilov State Optical Institute, St.Petersburg, Russia, 1998 Senior Scientists diploma in Opto-Electronic Devices, S.I.Vavilov State Optical Institute, St.Petersburg, Russia: 1995-now - Head of the Research Group for Optical Fuzzy Systems, Lab. for Optical Neural Networks, SOI.

Research Activity:

1977-90 - An application of holographic technique to pattern recognition for air-navigation and robotics.
1985-now - Based on the Fourier-Holography Setups Optical Neural Networks for Image Associative Processing, 1995-at present - Implementation of Fuzzy and Neuro-Fuzzy Approaches to Artificial Intelligence by Holographic Techniques. Has more than 50 published scientific articles in the area of Holographic Correlators, Optical Neural Networks, Optical Implementation of Fuzzy Set Theory operators. His biography is included into a number of international biographical books. Official organiser of Special Invited Session "Optical Holography in Artificial Intelligence" - Int. Conf. on Neural Information Processing ICONIP'97, Dunedeen, New Zealand, 1997. Member of Int. Program Committee of International Conference on Neural Computation NC'2000, Berlin, May, 2000. Member of European Optical Society. Member of ERUDIT network.

The Group participates in preparation of the ARCO (computation in optics and viability of architectures for parallel image processing) proposal for European network for human resources improving.

University of Manchester Institute of Science and Technology, United Kingdom

UMIST, the university of science and technology in Manchester, a specialised university concentrating on science, engineering, technology, management and languages, attracting high quality students from throughout the United Kingdom and the rest of the world. Founded in 1824 by industrialists, UMIST continues to have close and special industrial links, and, because of these, our taught courses and research are highly relevant to business and commerce, as well as being intellectually stimulating in their own right. As a community of over 6,000 students and 500 academic staff, UMIST is proud of its teaching and research strengths: strengths acknowledged by national ratings in which we figured as the top university outside Oxbridge and London. As a consequence, UMIST graduates are highly employable. The UMIST 'team' has been described as having a 'formidable intellectual vitality'. It has been thus for 175 years, and was again recognised recently by the prestigious awards of the Queen's Award for Export Achievement, the Prince of Wales' Award for Innovation (twice), and, uniquely, the Queen's Anniversary Prize for Higher Education on each of the three occasions it has been awarded.

The Department of Electrical Engineering and Electronics offers you some of the best teaching and research facilities to be found in any university. MITEL, Siemens, Phillips, FUJITSU, Pilkington, Brother and many other well known electronics companies have manufacturing facilities in the area and the Department maintains strong links with industry. It is for very good reasons therefore, that we are one of the largest department of Electrical and Electronic Engineering in the country. Our well equipped laboratories include clean rooms, the most modern facility for molecular beam epitaxy and one of the largest high voltage laboratories in Britain. The Department at Electrical Engineering and Electronics presents all the characteristics of the Institute. Seven of its full-time academic staff have higher doctorates, 88% have PhDs and 60% have professional qualifications, including 13 Fellowships of professional institutions.

The Control Systems Centre (CSC) was founded in 1966 as a research centre for multidisciplinary research in control systems. Over the years, the Control Systems Centre has grown as the application of control has grown, and researchers in UMIST's Control Systems Centre have been among the pioneers in control systems research and have made a range of important contributions to the subject. The Centre also has its own book series (published by Wiley) which covers research results developed in the Control Systems Centre. The Control systems Centre (CSC) is based in the Department of Electrical Engineering and Electronics (EE&E)

but works with other UMIST departments and universities to apply novel systems theory to problems of fundamental and industrial interest. This work is carried out in partnership with external funding agencies and companies, including large global enterprises and a range of Small and Medium-sized Enterprises (SME's). The CSC is strongly supported by industry at a fundamental level. For example, one professorship and one research lectureship are supported by LucasVarity (now TRW), along with a range of industrial scholarships. The Control Systems Centre at UMIST is acknowledged as a leading international centre of innovation in Control Systems and enjoys a good collaborative research with a number of UK and overseas universities with a regular stream of visiting international researchers. The Control Systems Centre in EE&E currently has six full-time academic staff and one part-time member, and a large community of research assistants, PhD and MSc students. In addition there are four technical support staff, three visiting professors, two visiting senior lecturers and a number of contributing industrial collaborators. The centre is located in newly refurbished laboratory and office accommodation. Associated with the new accommodation is a purpose built electro-mechanical development laboratory, and a technology transfer facility.

Olaf Wolkenhauer studied Control Engineering in Hamburg, Germany and at the School of Systems Engineering in Portsmouth, UK. He obtained his PhD from the Department of Electrical Engineering and Electronics in Manchester in 1997. Since 1997 he is a lecturer at the Control Systems Centre, UMIST. He published a research monograph on 'Possibility Theory with Applications to Data Analysis' and in January 2001 a textbook on 'Data Engineering: Fuzzy Mathematics in System Theory and Data Analysis' is published by John Wiley & Sons, New York. He has visited a number of European Universities and recently returned from a research fellowship at the Control Laboratory, Technical University Delft. His present research interests are in bioinformatics, the application of systems and control theory in genomics and microarray data analysis in particular. He is the director and coordinator of the UK interdisciplinary research network for Genetic Systems. He has recently been appointed a joint position with the Department of Biomolecular Sciences at UMIST.

LABEIN, Spain

Fundacion LABEIN is a private, non profit technological research & innovation center, settled in Bilbao, Spain with more than 45 years of experience in supporting enterprises and administration bodies in their technological and innovation needs. The members of the foundation are regional administration bodies of the Basque country as well as around 30 enterprises (both SMEs and large ones) representing a wide number of industrial and service sectors from Spain. LABEIN's support to their customers is carried out by means of RTD and Demonstration projects, Technology Transfer & Innovation projects, Technical Assistance, Advanced Management Systems (Quality, Environmental, Safety...) as well as Training and Dissemination activities.

LABEIN field of activities is Information Technologies, Construction, Environment, Mechanics, Electronics, Electrotechnics and Total Quality Management. It has a permanent staff of 185 employees (70 % with University degree and 22 doctors), and a wide range of testing laboratories. LABEIN's turnover was around 13 MEuro in 1998. LABEIN has a good experience in carrying out collaborative projects at European level from different European RTD and TT&innovation programmes (more than 100 up to now) such as Brite, SMT, CRATF, Esprit, Environment, Innovation, ECSC-Steel, SPRITE, RECITE, etc .

It is certified under ISO 9000 and EN 45001 for their project and laboratory activities and is member of various international and national organisations such as: EACRO (European Association of Contract Research Organisations), EUROLAB (European Testing Laboratories Organisation), ESI (European Software Institute), FEDIT (Federation of Spanish Research Centres), EITE (Basque Association of Research Centres) and other international and national organisms.

The research group who is going to participate in the EUNITE NoE is the TI Dept. LABEIN has been interested during the last years in evaluating the potential applications of fuzzy logic and neural networks in industrial processes and traffic management. The TI department of LABEIN employs 35 professionals.

Jose Luis Los Arcos was born in Spain in 1959. He obtained a B. SC degree in Electrical Engineering in 1982 from the Basque Country University (Bilbao) and a PhD. from the School of Engineering of Basque Country University.

He joined LABEIN IN 1984. From 1984 to 1985 he was research award holder at the Electronics Department developing a simulator/training system for operators of electric arc furnaces. From 1986 to 1988 he worked as

Senior Researcher at the Electronics Dept. involved in projects dealing with robot control systems and applications of knowledge-based systems to control of industrial processes. Since 1989 he is Project Manager at the LABEIN Information Technologies Dept. working in EU funded projects.

START Engineering JSCo.

START Engineering JSCo is a successor of the former state organization MONTAGI with more than 40 years experience introducing of control systems in mainly all power plants in Bulgaria. START Engineering's specialists have been working in the Middle East, Africa, Central Europe and in the countries of the former USSR. Now START Engineering JSCo (SE) is a fully private company with no state capital. About 160 specialists work in the firm. START Engineering consists of 12 branches placed in the main industrial centers of the country. The main office of the company is in Sofia and SE has an efficient communication network for flexible management of all branches. SE possesses experience and know how of introducing of DCS and PLC, design and delivering of equipment. Till now SE has automated more than 25 plants with 100-150 to 1500-2000 input/output signals for each.

The specialists of SE apply modern methods of control to solve the complicated technological problems, such as fuzzy control, model based predictive control, gain scheduling control. Some of SE projects have been realized in cooperation with companies like Westinghouse, ABB, Siemens, Allan Bradley and Telemecanique.

In the field of Power industry the specialists from SE have been participating in introduction and commissioning of almost all small and big power sites - factory power plants, smaller and bigger heating plants in the cities, in the big power units - power plant "Bobov Dol", the power complex "Maritsa East" and etc. During the last decade START Engineering introduced mainly Information and Control Microprocessor Systems in the heat power plants - in complete engineering - design, supply of equipment, assembly, starting up works and introducing of all functions of the system. Nine of all seventeen 210 MW block-turbine units in Bulgaria are automated by START Engineering. On all of these objects SE together with other organizations develops and can apply and test new methods and algorithms concerned with control and solving technological problems: combustion; fuel - air rates; temperature control and diagnostic of the equipment; reliability and safety of the operations; decreasing of the environment pollution.

START Engineering renders assistance of some organizations including the Ministry of the Energetic. Now SE works not only on above mentioned problems but participates in bids in Bulgaria and Russia jointly with leading western firms. START Engineering is now involved in COPERNICUS network DYCOMANS (Project 941246).

Metodi Nikolov was born in 1950 in Sofia. He has graduated from the Technical University - Sofia, Bulgaria, Department: Automation of Industry with a degree MSc. in Electrical Engineering. He has additional training in Technical University, Sofia - "Application of Microprocessor techniques for identification and automation of technological processes". He has been working on design and implementation of DCS (with equipment from different companies like SIEMENS, ABB, HONEYWELL, etc.) and site management in different projects mainly in Power Plants. Since 1995 he is a head of group for participation in EC Project COPERNICUS -DYCOMANS. Since 1997 he is a IEEE member. At the present time he is a Managing Director of automation branch PNU in START ENGINEERING JSCo.

Milko Stanimirov was born in 1969. In 1990-1995 He has graduated from the Higher Institute of Chemical Technology - Sofia Bulgaria, Department of Information Technology and Automation. Core subjects: Theory of Automatic Control; Automation and Control of technological processes; Software Engineering; Optimization methods; Identification: Computer languages; Mathematical modelling of technological objects; Decision making in management and technology control; Control Systems Design. He has good experience in introduction of Distributed Control systems, automation and control of technological processes in Thermal & Hydro Power Plants. He has been working since 1995 in START ENGINEERING JSCo.

University of Applied Sciences Zittau/Goerlitz, Germany

IPM - Institute of Process Technique, Process Automation and Measuring Technique

We are a research team at the institute of Process technique, process automation and Measuring technique (IPM) at the University for Applied Sciences Zittau/Görlitz. Our institute is composed of the departments

nuclear engineering, industrial combustion, electrical drives/control engineering, and process automation/measuring technique. Our main research focuses in the department of process automation/measuring technique are

- Signal-analysis and processing,
- Intelligent control systems,
- Programmable logic controller,
- Modelling and simulation,
- Fuzzy-control and identification,
- Neuronal Networks,
- Modell-based measuring systems and
- Risk assessment.

For the control of time critical systems and especially for diagnosis and surveillance we are using DSP systems for signal and image processing as well as infrared cameras for process state detection. The test and realization of our developments are realized on application oriented examples. For this we are using test facilities like

- magnetic bearing test facilities,
- Pressurizer test facilities,
- Combustion test facilities,
- Steam generator test facilities, etc...

We are also equipped with software tools for simulation, design and development of corresponding applications.

University of Paris Dauphine XI, LAMSADE, France

The common aim of all research performed at LAMSADE is to contribute to the foundation of a Decision Aid Science. Such a science must necessarily take its inspiration, concepts and tools from fields as diverse as computer science, mathematics, management science, economics, sociology and epistemology.

Areas or research ongoing within LAMSADE include:

- developing new concepts and axiomatic bases; theorem proving.
- constructing and testing methods, heuristics, algorithms and general purpose procedures, all automated to various degrees. The methodologies examined are not merely those of conventional Operational Research. They also include many others such as multiple criteria analysis and modelling, decision support systems, expert systems, artificial intelligence, negotiation support and group decision making.
- computerizing such methods and methodologies under conditions of rapid access to very large data bases and optimal allocation of hardware and software resources, usually in a distributed manner.
- analyzing, on the one hand, the interactions between decision-aid system and, on the other hand, the structure, culture, history and organizational semantics within which such systems lie.

Alexis Tsoukiàs (1959) is a CNRS senior researcher at LAMSADE, Université Paris Dauphine. He holds a PhD in Computer Science and Systems Engineering from Politecnico di Torino (Italy) where he also graduated engineering studies. His research interests include subjects as: decision aiding process analysis, non conventional preference modelling, applied non classical logics, ordinal mathematical programming, ordinal measurement, multi-agent systems, software evaluation and selection, where he published more than 40 journal articles and book contributions. The last two years he was vice-president of ROADEF (the french OR society) and presently serves as secretary of EURO (the european association of OR societies). Personal web page: <http://www.lamsade.dauphine.fr/~tsoukias>.

Netherlands Energy Research Foundation ECN

The Netherlands Energy Research Foundation ECN is the leading institute for energy research in the Netherlands. ECN carries out basic and applied research in the fields of efficient utilisation of energy, nuclear energy, fossil fuels, renewable energy sources, and policy studies.

ECN employs more than 800 staff. Contracts are obtained from the government and from national and foreign organisations and industries. ECN's research results are published in an number of report series, each series serving a different public, from contractors to the international scientific world.

The ECN scientific and technical staff are dedicated to the ECN mission: contributing to a clean and reliable energy supply for a viable world.

Within this knowledge-based company, the ECN Business Unit Energy Efficiency focusses on improving the efficient use of materials and energy in industrial processes and products. This unit provides expert advice and practical support to companies that encounter technological problems.

One of the technical services provided is Process Information Technology. This includes, but is not limited to:

- process modelling, simulation and advanced visualisation;
- process monitoring and control systems using fuzzy logic and neuro-fuzzy techniques;
- condition monitoring systems using neural networks, for preventive maintenance and sensor and signal validation;
- demand side management programmes.

ECN Energy Efficiency works for large and small companies from differing market segments, such as:

- suppliers of energy and environmental equipment;
- energy production and distribution companies;
- waste processing and recycling companies;
- engineering and consultancy firms;
- energy-intensive industries;
- government and government-related organisations.

Not only small and medium-sized companies but also large enterprises and organisations have already co-operated with ECN, including AKZO-Nobel, Mallinckrodt Medical, Dutch Ministeries, Océ, Philips, Siemens, Hoogovens, NAM and General Electric.

ECN does not only carry out medium-term and long-term development projects; an immediate and practical consultancy is also possible. Moreover, we can assist in obtaining subsidies for development projects. ECN is independent and is not affiliated with any hardware or software vendor.

The University of Twente, The Netherlands

The University of Twente is a university that offers both technological and social study programmes. We characterise ourselves as an entrepreneurial university, adapting our research efforts to the benefit of society in general. The entrepreneurial attitude permeates the university: from our students to our professors. It is a state of mind, a mental approach to science and society, which allows us to respond rapidly to new ideas and challenges. We believe that this approach is forged through the nature of our study programmes, in the qualities we seek in appointing new members of staff, and in our research and funding policies.

Experience, expertise and involvement in other EC projects of the Department of Computer Science:

NFC I + II (finished project): European Euregio Projects which aimed at the transfer of Neuro Fuzzy technology from the academic world to small and medium sized companies.

ECIC: European Euregio Project which aimed at the transfer of Computational Intelligent Techniques from the academic world to small and medium sized companies.

ECHO: ECHO is a project within the 5th Framework Programme IST (Information Society Technologies) of the European Union.

MUMIS: MUMIS is a project within the 5th Framework Programme IST (Information Society Technologies) of the European Union. MUMIS will develop basic technology for automatic indexing of multimedia programme material.

Olive: Olive is funded by the European Commission, DG XIII. OLIVE is developing a system which automatically produces indexes from the sound track of a programme (television or radio).

Anton Nijholt started his professional life as a programmer at TNO-Delft (Dutch organization for applied research). Then he decided to study at Delft University of Technology (mathematics and computer science) and to spend the rest of his life close to computers. He held positions in computer science departments at University of Twente, University of Nijmegen, Free University of Amsterdam (VUA) (all in the Netherlands), McMaster University (Canada) and Free University of Brussels (Belgium).

Presently he is working as full professor of computer science at the University of Twente. He coordinates the Parlevink research group (with Franciska de Jong), consisting of about 35 assistant/associate professors, Ph.D. students, secretaries and researchers employed by national and European projects. He is also main organizer of the Twente Workshops on Language Technology (TWLT). In 1994 he founded the publishing company Neslia Paniculata. In the period 1995-1996 he was a NIAS-fellow in Wassenaar. In 2000 he will be involved in several workshops.

Mannes Poel studied Mathematics at the University of Groningen. He obtained his Master's degree (cum laude) in August 1982. He became a PhD student at the University of Utrecht from which he received his PhD in Mathematics in 1986. After his PhD he was visitor at the Department of Mathematics at MIT and postdoc at the University of Groningen. In 1989 he got a permanent position at the Department of Computer Science at the University of Twente. His main research interests at that time were formal methods and distributed processes. In these years he became interested in neural networks and artificial intelligence in general. Nowadays his prime interest are neural networks, reinforcement learning, intelligent hybrid systems and AI applied in Intelligent Agents.

Martijn van Otterlo is currently a Ph.D. at the Department of Computer Science of the University of Twente. His main research topic is Learning in Multi Agent Systems.

Marko Snoek is currently a Ph.D. at the Department of Computer Science of the University of Twente. His main research topic is Computational Intelligent Techniques in Learning Organizations.

Adic - Asociacion par el desarrollo de la ingenieria de conocimiento The Instituto de Ingenieria del Conocimiento (IIC)

The Instituto de Ingenieria del Conocimiento (IIC) is a private R&D center sponsored by IBM Spain, Union Fenosa (Spain's third ranking electric power supplier), Banco Santander Central Hispano Americano (Spain's main bank) and the University Autonomous of Madrid. The IIC is located in the campus of the University Autonomous of Madrid and was founded in 1989. In these years the Institute has focused on the development of tailor made applications for either large and small national companies, while carrying a strong research activity.

At present IIC's activities can loosely be divided among four areas of expertise:

- Neural Networks and Quantitative Methods.
- Human Resources management.
- Multimedia and Education software.

IIC also has a marketing department, created four years ago in order to better respond to the needs of the different markets and to commercialize the technology developed at IIC. Among other undertakings, IIC has and is participating in ESPRIT projects both as prime contractor in the ESPRIT III HINT 6447 (HPCN) project, the ESPRIT IV DIXIT 22130 (ST) project and the CRAFT ACT project, and as a full partner in the two NeuroNet Network of Excellence projects, and the SIENA Leveraging Action.

Regarding IIC's Neural Network activities, it has an active NN group that both carries fundamental research, contributing regularly to main journals and conferences. It also has a strong activity in developing neural networks applications for industrial and commercial customers. Examples of IIC's NN projects are

- The AltaDen system, a neural modelling and prediction system installed in a petrochemical plant in Repsol's refinery complex of Tarragona.
- High performance printed forms recognition systems, such as those installed in the Banco Bilbao Vizcaya, second largest bank in Spain for bank effect recognition, and in the Spanish Social Security office.
- The Minerva system of credit card fraud prevention, installed at SEMP (Spain's larger provider of credit card services).

José Ramón Dorronsoro (1955, Andoain, Guipúzcoa, Spain) holds Ph. D. degrees in Mathematics from Washington University of St. Louis (USA) and the Universidad Complutense of Madrid. He has published a number of papers in major journals on pure and applied aspects of Fourier analysis, and on neural networks theory and applications, and also several communications in large neural network conferences. He is a member of IIC since 1989, and currently acts as Technical Director. He has a long experience in NN project

development and has served in the boards of the Esprit projects Neuronet and Siena. He also teaches in the Universidad Autónoma de Madrid, where has been Head of the university's Computer Engineering Department.

University of Jyvaskyla, Department of Mathematical Information Technology

The research is done in cooperation with local telecommunication partners in the following areas:

- uncertainty modeling of telecommunication switching systems;
- design of robust switching structures for multiple end users.

The applications are related to common projects with the industrial partners in the following areas:

- software implementation of integrated traffic control applications;
- implementation of new traffic standards in mobile telephony and computing.

Coventry University, United Kingdom

Coventry University is a medium sized University, with about 14,000 full time students and 500 academic staff. The corporate strategy includes a commitment to research, especially that linked to industrial/commercial exploitation. There is also a commitment to the incorporation of research interests in the teaching programme. A major identified research strength is in the area of control theory and its applications, and work in this area is coordinated by the Control Theory & Applications Centre (CTAC). This is a cross-disciplinary research group, situated physically in the School of Mathematics and Information Sciences, but including members from the School of Engineering. The Centre has about 12 associated academic staff and approximately 20 full-time and 5 part-time PhD students. As well as projects involving the application of fuzzy/neural network and genetic algorithm techniques to engineering problems, the Centre coordinates projects based on these 'soft-computing' techniques in other discipline areas, for example in the fields of biology and medicine. An emerging area of interest is the use of fuzzy and neuro/fuzzy techniques in decision taking.

School of Mathematical and Information Sciences

Research Groups and Centres

Research and consultancy feature strongly in the work of the School, supporting the undergraduate programmes by providing a stimulating environment in which to study. We are able to offer research expertise in a range of disciplines including

- Applied and computational mathematics
- Biomedical computing
- CASE tools and software engineering
- Control theory and applications
- Data modelling
- Neural networks
- Engineering statistics
- Genetic algorithms
- Information systems development methodologies
- Mathematical education
- Mathematical modelling (including computational modelling)
- Operational Research
- Process control and process capability
- Statistical computing

Research work within the School is internationally recognised and excellent collaborative links have been established with industry, commerce and other universities both within the UK and overseas. Staff are regularly invited to speak at prestigious meetings around the world. Collaborative ventures with industrial and commercial partners also help to ensure that staff are at the forefront in the use of up-to-date technology and are continually aware of employers' expectations of graduates.

Research in the School of Mathematical and Information Sciences is mainly centred on identified teams:

- Applied Mathematics and Computation Group (CAMAC)
- Biomedical Computing Research Group (BIOCORE)
- Control Theory and Applications Centre (CTAC)
- Data and Knowledge Engineering Research Group (DKERG)
- Statistics and Operational Research Group

As well as its scientific research activities the School also attaches importance to educational research and a significant amount of effort is directed towards identifying and promoting quality teaching and learning methodologies. Also, at postgraduate level, the School offers an attractive range of taught courses leading to MSc degrees.

Nigel Steele, born 9/9/1945 in Oxford, UK, educated at King Henry VIII School Coventry, and Southampton University, has been employed as a lecturer at Coventry University and its predecessor Institutions since 1968, becoming Head of Mathematics in 1995, and Professor of Mathematics in March 2000. He is Fellow of the Institute of Mathematics and its Applications, a Chartered Mathematician and a member of Council and the Executive Board. He is also a Member of the Royal Aeronautical Society. He has a long standing association with ICSC as a member of the academic advisory board.

University of Valladolid, Industrial Engineering Group

The Industrial Engineering Group has been set up to cover the activities of the Department related with Production Engineering and Managerial Economics. The Group has teaching activities in the following degrees and centers:

College of Industrial Engineering: INDUSTRIAL ENGINEERING, MANAGEMENT ENGINEERING

Technical School: INDUSTRIAL ENGINEERING, TELECOMMUNICATION

Faculty of Sciences: CHEMICAL ENGINEERING

School of Telecommunication and Information Technologies: COMPUTING ENGINEERING, ELECTRICAL ENGINEERING

ARS (Association pour la Recherche Scientifique), France

We are currently working on a system to reduce noise in financial time series using neural networks and genetic algorithms. We have done a market research on the needs of capital market players in the domain of optimization/simulation programming applied to financial engineering (forecasting, derivatives pricing, risk management, etc.).

We have also done two other technical study on:

* Online training over the internet with AI techniques

* Differential equations solving using Genetic algorithm techniques

Amaury de la Vaissiere:

Work experience

6/98 - 4/00 BANK ONE, Software maintenance

12/96 - 6/98 ATECHSYS, as an analyst programmer in different french banks

6/96 - 10/96 JP MORGAN, Software maintenance

Academic record

9/89 - 6/94 EFREI (Engineering degree in Electronics and IT)

9/88 - 6/89 Baccalaureate in Mathematics, Physics and Biology

ALLOGG, Sweden

Allogg' business concept is to execute consulting commissions and develop products for the civilian market in the area of data acquisition and mathematical-physical analysis with profitability on short or medium long terms.

ALLOGG AB, is a small company, established in 1982, with a high competence profile. We are working in close connection with administrations like the Swedish National Road Administration and the Swedish

Radiation Protection Institute. We have established contacts and cooperate with universities and institutes of technology in Sweden and abroad such as the Universities of Stockholm, Linköping and Lund, Karolinska Hospital in Stockholm and the Steinbeis Stiftung in Germany. We are also in close cooperation with, but are not bound to, production companies in Sweden.

Corinne Braban-Ledoux, Ph.D. in Computer Science from the University Pierre et Marie Curie in Paris. Her interest focuses on the application of advanced computer science techniques to transportation problems. She is working part-time for Allogg on the Säkereken project.

Universiteit Nyenrode has a strong reputation in the field of management programs. Added to that it is the only private university in The Netherlands. Nyenrode maintains close ties with the national and international business communities. Apart from its regular educational programs and research activities, Universiteit Nyenrode offers a wide range of training programs for business managers.

NOTION, The Netherlands

The Nyenrode Institute for Knowledge Management and Virtual Education

Notion's distinctive features

Notion focuses on the use of, amongst others, artificial intelligence in order to make implicit knowledge transferable, without turning it into explicit knowledge. However, that implicit knowledge needs to be available for sharing.

Learning is considered to be the other side of the same knowledge token: learning relates to knowledge sharing. Virtual on-line learning laboratories are the way ahead for companies, in so far that they are learner-centered (just-in-time, just-enough) and joined to the corporate knowledge base.

The key for success in knowledge management is the integration of the correct paradigm, the necessary infrastructure (human resources policy, ICT and learning content), but all that while giving the responsibility for the process to the learners.

Notion aims to deliver, according to national and international standards, research output of high academic standards, shown by publications. Equally, Notion esteems highly the corporate relevance of its research, proven by its corporate acceptance.

Some (research) projects in a nutshell

- Building a virtual corporate university.
- Designing intelligent search engines in order to make knowledge bases accessible.
- Design a knowledge-share platform and policy for a company.
- The use of neural networks for identifying client profiles.
- Intelligent agents in the front-office.
- On-line contract acceptance, based on back-office knowledge, using AI techniques.
- Constructing an advice system using experience-based knowledge.
- From best-practices to dynamic and adaptive best-principles learning.

Walter Baets holds the Philips Chair in Information and Communication Technology at Nyenrode University, the Netherlands Business School and he is director of the Nyenrode PhD Program. He is director of Notion, the Nyenrode Institute for Knowledge Management and Virtual Education, a competence center sponsored by Achmea, Microsoft, Philips and Sara Lee/DE. He graduated in econometrics and operations research at the University of Antwerp (Belgium) and did postgraduate studies in Business Administration at Warwick Business School (UK). He was awarded a PhD from the University of Warwick in Industrial and Business Studies. After pursuing a career of more than ten years in business, he held positions in the academic world in Belgium, Russia, the Netherlands and Spain. He was particularly active in management development both in Russia and in the Arab world.

Institut National Polytechnique de Toulouse, France

INP Toulouse is a French federation of 4 Higher Engineering Schools (Grandes Ecoles - ENSAT, ENSCT, ENSEEIHT, ENSIGC) providing education/continuous education and conducting research in the fields of Agronomy, Chemical Sciences, Electronics, Electrical Engineering, Fluid Mechanics, Computer Sciences, Telecommunications, Chemical Engineering... The Institute awards 650 engineers diploma and 120 Doctorate diploma per year. A thousand researchers and research students work within 14 research units, most of which are associated to the CNRS or to the INRA organisations.

INP is involved in several international schemes (27 cooperation agreements, 400 student exchanges), including European Education ones (Erasmus, Tempus, Leonardo, Human Capital and Mobility/TMR ...). Industrial partnership is widely developed and encouraged within INP (45 Million FF worth collaborative research contracts per year), and technology transfer is a priority (creation of SME's, licensing policy, about 120 French patents filed by INP or industrial partners, 40+ INP international patents,...). Many RD projects (45 since 1991) have been conducted with the support of the European Commission (LIFE, Innovation,... ; PCRD : BRITE-EuRam, JOULE, ENVIRONMENT, ESPRIT, ACTS, AIR/FAIR, BIOMED, CRAFT,...).

Agro-industrial Chemistry Laboratory (LCA) is located in ENSCT and focus its research activities mainly on non-food valorization of agricultural products and by-products. In the framework of 4 thematic research axis: i) Chemistry, energy, environment; ii) Agroresources extraction and transformation; iii) Agromolecules chemistry; iv) Agro-industrial process, 9 teams develop a technological research closed to industrial problems and with a strong partnership with companies, mainly SME's.

Aroma & Sensory Metrology Group (GAMS) managed by Dr. Thierry TALOU develops a technological research mainly on aromas and fragrances (both animals and plants) and on design of novel rapid analytical techniques such as "electronic noses" (combining gas sensors arrays to computerized pattern recognition techniques). This new technology is applied both to Quality Control application and process monitoring.

Thierry TALOU: 40 years old, Dr. INP Toulouse, Senior Research Engineer and Senior Flavorist, Scientific Manager «Aromas & Sensory Metrology» Research Team, Headmanager «Electronic nose» Department President of CIRANO (International committee for electronic nose study)

Two research themes are concerned by my scientific activities:

THEMA 1 :Aromas and Fragrances: Both analytical (Headspace, GC, GC-MS, GC-Sniffing, Sensory Analysis), biochemical (biogenesis of the aroma during biological cycle), ecological (influence of the cultural treatments on the aroma composition), industrial (formulation of natural and nature identical flavourings) aspects are studied by myself and my coworkers (4 students)

THEMA 2 : Odor gas sensors (Electronic nose technology). Pioneer in France in the development of this technology in agro-industry, based on the coupling of non selective gas sensors and artificial intelligence. Our works are focused on the conception of new apparatus for application in R&D, Quality Control and Process monitoring. The electronic nose department (3 students, 3 technicians, 1 engineer) develop numerous agreements with SME's in Europe on feasibility studies of the technology and with large industrial groups for applied research studies in the framework of Ph.D thesis.

Recent involvements in European programs mainly concern the co-ordinations of a Cooperative Research Project on truffles (EUROTUFFE/FAIR (1999-2000) and of an European PhD thesis (Marie Curie Host Industry (2000-2003) on the same subject and the participation to 2 European Thematic Networks: NOSE/ESPRIT (1998-2000) and EUNITE.

DAUIN - Department of Automatic Control and Computer Engineering Politecnico di Torino, Italy

The Department of Automatic Control and Computer Engineering (DAUIN – Dipartimento di Automatica e Informatica) was established in 1982 by a group of researchers from the Institute of Electrical Engineering of the Engineering Faculty of Politecnico di Torino. The Department promotes and organizes research activities in the areas of science and technology of automatic controls and computers, and their mutual integration. DAUIN has a staff of 18 Full Professors, 16 Associate Professors, 15 Researchers and 37 Ph.D. Students, plus a technical and administrative staff of 10 people.

DAUIN is involved in National and International Research Projects, granted by Italian Research Agencies, and by the European Commission, as well as in specific Research Networks; in many cases it had the role of Coordinator or Prime Contractor. DAUIN has also a number of research contracts with Italian Industries and Companies, which ensured a research budget of about 1,7 million EURO in 1999.

Research at DAUIN is organized into three main areas: Computer Science, Automatic Control and Operation Research. Within each area several research groups develop their activities, using a number of experimental laboratories.

The robotics group was established in 1992 and expanded in 1999, with the creation of an experimental laboratory (LABROB – Laboratory of Robotics) performing both research and teaching tasks.

Research activities include: impact control; force-control and force-feedback; mechatronics; flexible arm control with piezoelectric transducers; stereo vision; sensors (vision, force); space robotics; neuro-fuzzy networks; trajectory planning; real-time DSP-based architectures for fast prototyping of digital control systems.

Available equipments are: 1 COMAU Smart 3 industrial robot with open C3G 900 control software; 1 Direct Drive Manipulator by IMI including a 2-axis planar arm actuated by NSK Megatorque drives; real-time computer architectures and O/S (OpenDSP, Tornado, Generis, RTLinux); flexible arm with direct drive and piezoelectric self-sensing transducers; vision systems.

Computing facilities at DAUIN are organized in a sub-network connecting the single lab networks; in the Mechatronics/Control/Robotics area no less than 35 workstations are available, running NT/Windows operating systems, with some dedicated real-time systems. The university network is based on several servers and firewalls, connected also to the administration subnets.

In addition, a Center for Prototyping Services (CSPP), organized around a mechanical/CAD/electronic workshop, support most of experimental activities carried on in the various laboratories.

Basilio Bona received the “Laurea” degree in Electrical Engineering at Politecnico di Torino in 1971. He held different research and teaching positions at the Dipartimento di Automatica e Informatica – DAUIN (Department of Automatic Control and Computer Engineering) of Politecnico di Torino from 1973 to 1986, when he became Full Professor of Industrial Robotics. Presently he is member of the Academic Senate of the Politecnico di Torino, President of the Prototyping Service Center of Politecnico di Torino and member of the Governing Board of the Information Engineering Faculty of Politecnico di Torino. From 1994 to 1998 as President of the local chapter of the Italian Automation Association he was responsible of two European Community Leonardo projects. He has been the principal investigator of several Research Projects granted by the Italian National Council of Research (CNR), the National Ministry of Education (MURST), and the Italian Space Agency (ASI), as well as with several private enterprises. Prof. Bona is responsible of the Robotics Laboratory at DAUIN, and his research interests include robotics and mechatronics, digital control and advanced control architectures, fuzzy systems, identification and parameter estimation in linear and nonlinear systems. (see also <http://ladiserver1.polito.it/robotica/Curriculum/bben.htm>)