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EUNITE Executive Summary
IBA C Telecommunications and Multimedia

1. Introduction

The IBA C Telecommunications and Multimedia committee focused its activity on the Intelligent Technologies and the Smart Adaptive Systems of three major related axis: multimedia, semantic web and networks.

In the one hand, linking and extending intelligent technologies with the multimedia field has been of great importance for a variety of current technological results. In the other hand the expansion of the web, and especially of its knowledge aspects has made of the semantic web a prominent field. Moreover all this large content is distributed over the net and intelligent ways of accessing it, searching it and transforming for different devices have been developed.

In the following we are going to present what have been the main achievements obtained in these areas. This will lead us to a short overview of today's status and today's challenges for the use of Intelligent Technologies and Smart Adaptive Systems. Then we will visit some particular successful examples and we will finish with the major events, which will have certainly a lot of influence in the future of these fields.

2. Achievements in Telecommunication and Multimedia with Intelligent Technologies and Smart Adaptive Systems

In the one hand, the continuous production of **multimedia** content and the need for efficient personalized browsing, access and retrieval of it in heterogeneous environments is of major importance, asking for intelligent technologies related to automatic or 'semi'-automatic annotation of multimedia content, user modeling and personalization, knowledge discovery context analysis, inference and reasoning. Smart adaptive techniques are major components of the systems currently investigated, developed or tackled in these frameworks. Moreover, multimodal man machine interaction, considered in the framework of ambient intelligence is another related field where the need for adaptation, usage of knowledge and user modeling are similarly crucial components.

A very complete panel of these achievements is presented in the book edited by Stamou G. and Kollias S. titled "Multimedia and the Semantic" to appear.

In the other hand, in semi-structured textual data such as most of the world-wide web, the data is largely free of formal semantics and requires human interpretation to make sense of it. The **semantic web** is designed to be the next evolution step of the world wide web, allowing relational knowledge to be embedded as meta-data in web pages enabling machines to use ontologies and inference rules in retrieving and manipulating data.

The construction of domain-dependent information such as sets of synonyms, hypernyms, subclass superclass relations etc. is a labor-intensive but necessary step in creating ontologies, which can subsequently be used in tasks such as information fusion, information retrieval, and information discovery. Fortunately today using Intelligent Technologies or Smart Adaptive Systems we are able to tackle this difficult problem. In fact, the special session Semantic and Context Aware Intelligent Systems of ICANN'03

and in the IBA-C session of Eunite-02 included soft computing tools, which can be used to automate preliminary stages of ontology creation.

Finally, with the increasing complexity and capabilities of networked information appliances and services, user modeling and more generally adaptive information access over **networks** is becoming an increasingly important research area. Simple user profiles already personalize many software products and consumer goods such as digital TV recorders and mobile phones. A user model should be easy to initialize, and it must adapt in the light of interaction with the user. In many cases, a large amount of training data is needed to generate a user model, and adaptation is equivalent to retraining the system. Specific tools and theoretical approaches using Intelligent Technologies that attempt to solve these problems were presented in the 1st International Workshop on Adaptive Multimedia Retrieval (AMR 2003).

3. Status of Smart Adaptive Systems in Telecommunication and Multimedia.

As we saw above major achievements have been obtained and presented in young workshops that made part of traditional and important conferences. This reflects a certain degree of maturity and organization of these new approaches. Therefore a natural perspective is the further development of the individual fields. But it is to notice that much effort is still required at the interaction of the above fields, which are still going ahead quite separately, thus resulting in not many intelligent knowledge-based multimedia systems. At the same time, it is becoming increasingly clear that this interweaving of technologies is necessary to cope with the exponentially increasing need for access to huge amounts of information worldwide.

Today there are two major fields which are related and should further be linked with intelligent adaptive technologies: the first is multimedia modeling, mainly in the framework of MPEG-7 and MPEG-21 standardization activities and the second is the Semantic Web W3C field of activities. In the former much focus is being currently given to the semantic issue, which needs extensive research to be effectively linked with the reasoning, consistency checking capabilities of current knowledge technologies. Intelligent systems have a crucial role in this interweaving, since they can combine higher-level representations and concepts with low level multimedia representations and descriptions.

A second challenge is to make possible the collaboration over the network of specialized multimedia tools, and this in an intelligent way. Today's tools are all specialized in one particular media (and usually in one particular approach or aspect). In fact, it is impossible for one team to make a real complex, intelligent and fully *multi*-media system. Therefore intelligent network technologies are necessary, which will be able not only to transfer this new type of data, but also to maintain its coherence (from data and complex system point of view).

The developments we have seen in the multimedia area and in the telecommunications fusion today into a new challenge: the pervasive network. The idea is that for instance various sensors in the home environment can monitor the health or the activity of an individual. A fundamental limitation of all systems trialed to date is that they monitor instantaneous activity. New research programs should aim to create a system that detects subtle changes over time, and adapts its definition of a particular behavior by monitoring trends and using input from human experts such as health care professionals.

4. Smart Adaptive Systems in Telecommunication and Multimedia do exist ??

Based on all the tools presented in the specialized conferences and overview papers, we can say that Smart Adaptive Systems in Telecommunication and Multimedia do exist. But these intelligent systems are unfortunately not extremely common. The reason of this scarcity is the fact that the intelligent or adaptive part comes always at end of the development of any system. And multimedia and telecommunication systems are already very complex in nature and therefore seldom the development arrives to the integration of the intelligent technology. This observation was clearly presented by Nürnberger A. and Detyniecki M. in their chapter: "Adaptive Multimedia Retrieval: From Data to User Interaction" of the book "Do smart adaptive systems exist - Best practice for selection and combination of intelligent methods" edited by Bogdan G. for Springer and Eunite.

Even though the process of building a Smart Adaptive System is long and heavy, we have some successful examples. For instance there is an interesting Image and Text retrieval interface based on Self Organizing Maps developed under Nürnberger A. supervision, which is able to adapt its navigation interface not only to the data but also to the user preferences (based on its interaction). Another good example is the intelligent system for facial expression recognition developed under the supervision of Kollias S., which is based on the human brain structure and focus on emotions. We have also the Intelligent Personal Assistant (IPA) developed by BTextact, which incorporates a user profile and FILUM, a more flexible method of user modeling. These have been applied to the Telephone Assistant and Email Assistant components of the Intelligent Personal Assistant. Field tests have been performed using a mobile version giving students personalized access to information.

5. Major events in Adaptive Systems in Telecommunication and Multimedia

The community of Intelligent Technologies and Smart Adaptive Systems for Multimedia and Telecommunications has been very active. We notice the emergence of several specialized workshops, as part of established conferences.

Specialized Conferences and Workshops:

- 11.10.2001 - 12.10.2001: International Workshop on Very Low Bitrate Video Coding (VLBV01) - Responsible Person: Stefanos Kollias
- 13.12.2001: Workshop during Eunite 2001 on Computational Intelligence in Telecommunications and Multimedia - Responsible Person: Martin Spott
- 08.04.2002 - 10.04.2002: 2nd European Workshop on Computational Intelligence in Telecommunications and Multimedia - Responsible Person: Weiru Liu
- 19.09.2002 - 21.09.2002: Session on "Multimedia Technologies and Ontologies" during Eunite 2002 - Responsible Person: Trevor Martin
- 10.07.2003 - 12.07.2003: C Session on Computational Intelligence in Telecommunications and Multimedia at eunite2003 - Responsible Person: Stefanos Kollias
- 26.06.2003 - 29.06.2003: Session at ICANN 2003 - Semantic and Context Aware Intelligent Systems. - Responsible Person: Stefanos Kollias
- 01.09.2003 - 03.09.2003: Session at UKCI 2003 - Inductive and Bayesian Net Approaches to SAS - Responsible Person: Trevor Martin
- 15.09.2003 - 18.09.2003: 1st International Workshop on Adaptive Multimedia Retrieval during KI'2003 - Responsible Person: Marcin Detyniecki

There have been also a lot of publications, not only in the conferences quoted above, but also in other ones. We will quote here only publications that are important from an overview perspective. And this are the following books and books chapter:

Books and Books Chapters:

- "*Multimedia and the Semantic Web*", edited by Stamou G. and Kollias S. for Wiley, to appear in 2004.
- Martin, T.P., "*Searching and Smushing on the Semantic Web*" - Challenges for Soft Computing, in "*Soft Computing - Enhancing the Power of the Internet*", M. Nikraves, et al., Eds., Springer (2003).
- Nürnberger A. and Detyniecki M., "*Adaptive Multimedia Retrieval: From Data to User Interaction*" in "*Do smart adaptive systems exist - Best practice for selection and combination of intelligent methods*" Bogdan G. et al. Eds., Springer (to appear).