COST-TIST

COST Action 276

Information and Knowledge Management for Integrated Media Communication

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FINAL REPORT

Period: from 06-2001 to 06-2005

Action Identification Data

COST Action *276*
Information and Knowledge Management for Integrated Media Communication

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Slovenia 05/04/01	Norway 06/04/01	Switzerland 10/04/01
Cyprus 25/04/01	Slovakia 02/05/01	Hungary 17/05/01
Croatia 17/05/01	Italy 30/05/01	Romania 07/06/01
Czech Republic 28/06/01	Bulgaria 31/07/01	Ireland 3/10/01
Turkey 11/07/02	F.Y.R. of Macedonia 10/10/02	F.R. of Yugoslavia 11/11/02
Austria 29/06/04		

Institutes of non-COST countries: *(list)*
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Action Web site: http://cost276.fe.uni-lj.si, http://cyberspace.mht.bme.hu/cost/cost276,
Chairperson:

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2. **OBJECTIVES**

The main objective of the Action is to develop advanced multimedia data and knowledge management technologies for personal multimedia communication systems and services, including specific signal processing and implementation techniques for users' personal terminals. In addition, key system aspects are considered, such as: system integration, personification of services, usage trials and demonstrations of advanced personal services. The activities do not only influence the base of innovations and competitiveness, but are also making a contribution towards answering personal and European society's needs. The results include:

- Improved multimedia information and data management methods, content and knowledge metadata descriptors,
- Agent architectures and technologies for agent communication and agent mobility, data delivery and retrieval, and for system management,
- Individualised service platforms based on user interface personalization,
- New algorithms, architectures and system design that provide special features required by personalised multimedia services,
- Advanced methods for Signal, Video, speech and sound processing and coding.

The Action is oriented towards long-term basic research while recognising the iterative nature of developments in this field, due to the rapid development cycles of new technology. The major goals of the project were (1) to produce and to demonstrate working elements of advanced personalised multimedia communication systems and services and (2) to develop a vision of future application possibilities. Integration of all mentioned technologies into a single demonstration package was not targeted by the Action.

3. **TECHNICAL DESCRIPTION AND IMPLEMENTATION**

The work on the COST 276 involves the following main types of resources and addresses listed opened problems:

- Centralised sites with correspondingly important computational resources to manage large multimedia databases and application files, including powerful terminal nodes for multimedia data access, offering a support for a variety of services (for a detailed explanation see results in Section 5.1).

- Architecture for building distributed information systems from existing information resources based on software agent and distributed object technologies. An agent-based architecture, with messages exchanged via the FIPA Agent Communication Language (more detailed description is given in Section 5.2 and partially in Section 5.1).

- Terminals requiring specific signal processing methods and implementation technologies to address application-dependent requirements, while coping with stringent constraints such as multi-standard support, miniaturisation and the connected problem of designing ergonomic users interfaces despite of the small size, and low-power consumption to extend the autonomy of the portable devices (the targeted problems are described in Section 5.3 and more general tools in Section 5.4).

- Communication with fixed / wireless networks; distributed resource management between centralised sites and remote (wireless) terminals, network management (the description of

issues as data provisioning resources in Section 5.1 and as implementation in Section 5.3 and Section 5.4).

According to the addressed challenges their technical nature, the research has been organised in the following working groups:

WG1: Multimedia information, knowledge and data management.

    TOPICS:
- Multimedia information, knowledge management and data management
- Content and knowledge metadata descriptors

    COORDINATOR: A. R. Figueiras-Vidal, Univ. Carlos III de Madrid , Spain
    PARTNERS:
- Universidad Carlos III de Madrid, Spain
- TU Cluj-Napoca, Romania
- University of Ljubljana, Slovenia
- Sintef Telecom and Informatics, Trondheim, Norway
- University of Bordeaux I, France
- University of Florence, Italy
- University of Neuchâtel, Switzerland
- Middle East Technical University, Turkey
- Software Competence Center Hagenberg GmbH, Austria
- Cyprus Neuroscience & Technology Institute, Cyprus

WG2: Agent architectures, technologies and metadata descriptors.

    TOPICS:
- Agent architectures for agent communication and agent mobility
- Agent technologies for data delivery, retrieval and system management

    COORDINATOR: A. Vlaicu, TU Cluj-Napoca, Romania
    PARTNERS:
- TU Cluj-Napoca, Romania
- Universidad Carlos III de Madrid, Spain
- University of Ljubljana, Slovenia
- Budapest University of Technology and Economics (Hungary)
- Université de Bordeaux I (France)
- Middle East Technical University, Turkey

WG3: Technologies for personalised multimedia communications and interfacing.

    TOPICS:
- Technologies for user interface personalisation
- Technologies for personalised multimedia communications

    COORDINATOR: M. Ansorge, University of Neuchâtel, Switzerland
    PARTNERS:
- Institute Rudger Boskovic, Zagreb, Croatia

- Czech Technical University in Prague, Czech
- RepublicUniversity of Bordeaux I, France
- Budapest University of Technology and Economics, Hungary
- University of Trieste, Italy
- University of Florence, Italy.
- TU "Gh. Asachi", Iasi, RomaniaTU Košice, Slovakia
- University of Ljubljana, Slovenia
- Universidad Carlos III de Madrid, Spain
- University of Neuchâtel, Switzerland
- Federal Institute of Technology in Lausanne, Switzerland
- Emitall S.A., Montreux, Switzerland

WG4: Personalised Advanced methods for Signal, Video, speech and sound processing and coding.

TOPICS:
- Dedicated advanced methods for signal, video, speech and sound processing and coding (underlying technologies for WG3)

COORDINATOR: M. Najim, Université de Bordeaux I, France
PARTNERS:
- TU Cluj-Napoca, Romania
- TU Iasi, Romania
- University of Neuchâtel, Switzerland
- Universidad Carlos III de Madrid, Spain
- University of Ljubljana, Slovenia
- Budapest University of Technology and Economics, Hungary
- TU Košice, Slovakia
- Université de Bordeaux I, France
- Czech Technical University in Prague, Czech Republic
- Sintef Telecom and Informatics, Trondheim, Norway
- Norwegian University of Science and Technology, Trondheim, Norway
- University of Trieste, Italy
- Informatics and Telematics Institute, Thermi-Thessaloniki, Greece
- University of Florence, Italy
- Middle East Technical University, Turkey
- Emitall S.A., Montreux, Switzerland
- Software Competence Center Hagenberg GmbH, Austria

The actual work carried out and the detailed description of activities for the quoted working groups is given in Section 5.

The cooperation between project participants is based on strong personal and electronically established contacts among researchers from collaborating institutions. The research activities and orientations were coordinated on meetings of working groups and especially of the Managing Committee. The scientific results have been exchanged among participants and made open to a wider audience during regular workshops which took place twice a year. Partners organising a particular Workshop were taking care of publishing the presented results, accumulating the knowledge gained during the project. The Workshops were opened to a wider scientific society by inviting top researchers in specialised fields, important for the COST 276 Action as plenary

lecturers. All of the workshops have been opened to non-COST participants; this way, the workshop attendants were constantly provided by an additional source of knowledge. Additionally, the open policy of project management allows participant extension throughout the duration of the project.

Joint research was also supported by means of Short Term Scientific Missions, which mostly allowed students and researchers to share their knowledge at a visiting institution. Besides the high technical value of the meetings and visits, the social impact of meeting in-person is not to be underestimated.

4. PARTICIPATION AND COORDINATION

4.1 Management Committee

Chairperson:

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Spain	Prof. Dr.	Domingo Docampo	ETSI Telecomunicación, Universidad de Vigo
	Prof. Dr.	Aníbal R. Figueiras Vidal	Escuela Politécnica Superior, Universidad Carlos III de Madrid
France	Prof. Dr.	Marie-Laure Boucheret	ENST – Site of Toulouse
	Prof. Dr.	Mohamed Najim	ENSEIRB, University of Bordeaux I.
Slovenia	Prof. Dr.	Borka Jerman Blazic	Josef Stefan Institute, Ljubljana
	Prof. Dr.	Jurij F. Tasic	Faculty of Electrical Engineering, University of Ljubljana
Norway	Dr. Ing.	Kjell Ove Kjolaas	SINTEF Tele og data, Trondheim
	Prof. Dr.	Andrew Perkis	Institutt for teleteknikk v/NTNU, Trondheim
Switzerland	PD. Dr.	Michael Ansorge	Institute of Microtechnology, Electronics and Signal Processing Lab., University of Neuchâtel, Neuchâtel
	Prof. Dr.	Andrzej Drygajlo	EPFL, Lab. de Traitement des Signaux, Lausanne
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Slovakia	Prof. Dr.	Ján Turán	Dept. of Electronics and Multimedia Communication, Faculty of Electrical Engineering and Informatics, University of Technology Košice
Hungary	Prof. Dr.	Kalman Fazekas	Budapest University of Technology and Economics, Dept. of Microwave Telecommunications, Budapest
Croatia			
Italy	Prof. Dr.	Giovanni L Sicuranza	Dipartimento de Elettrotecnica Elettronica Informatica, Universita degli Studi di Trieste
	Prof. Dr.	Vito Cappellini	Dipartimento di Elettronica e Telecomunicación, Univerista degli Studi di Firenze
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	Prof. Dr.	Aurel Vlaicu	Dept. of Electronics and Telecommunications, Technical University of Cluj-Napoca.
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	Prof. Dr.	Jan Uhlir	Faculty of Electrical Engineering, Czech Technical University in Prague, Prague
Bulgaria			
Ireland	Prof. Dr.	Michael Peter Kennedy	Dept. of Microelectronic Engineering, University College Cork
Turkey	Prof. Dr.	Gözde Bozdagi Akar	Dept. of Electrical & Electronics Engineering, Middle East Technical University (METU), Ankara
F.Y.R of Macedonia			
Serbia and Montenegro Union	Prof. Dr.	Miroslav Lutovac	University of Belgrade, Faculty of Electrical Engineering, Belgrade

Austria	Prof. Dr.	Oscar Mangisengi	Software Competence Center Hagenberg GmbH

4.2 Participating Institutions

No.	Country	Acronym.	Institution
1.	Austria	SCCH	Software Competence Center Hagenberg
2.	Croatia	IRB	Institute Ruder Boskovic, Zagreb
3.	Cyprus	CNTI	Cyprus Neuroscience and Technology Institute
4.	Czech Republic	CVUT	Czech Technical University in Prague
5.	F.R. Yugoslavia	UBelgr	University of Belgrade
6.	France	UBordeaux	University of Bordeaux I
7.	Greece	ITI	Information Proc. Lab., Informatics & Telematics Institute
8.	Hungary	BUTE	Budapest University of Technology and Economics
10.	Ireland	UCC	University College Cork
11.	Italy	UF	University of Florence
12.	Italy	UTrieste	University of Trieste
13.	Norway	NTNU	Norwegian University of Science and Technology, Trondheim
14.	Norway	SINTEF	Sintef Telecom and Informatics, Trondheim
15.	Romania	TUIasi	Technical University "Gh. Asachi", Iasi
16.	Romania	TUCluj	Technical University Cluj-Napoca
17.	Slovakia	TUKE	Technical University of Košice
18.	Slovenia	IJS	Josef Stefan Institute
19.	Slovenia	UniLj	University of Ljubljana
20.	Spain	UC3M	Universidad Carlos III de Madrid
21.	Spain	UVI	Universidad de Vigo
22.	Switzerland	Emitall	Emitall S.A., Montreux
23.	Switzerland	EPFL	Swiss Federal Institute of Technology in Lausanne
24.	Switzerland	Uni-NE	University of Neuchâtel
25.	Turkey	METU	Middle East Technical University

The representatives of all institutions are listed in Sec. 4.1, unless for No. 22, who is

Prof. Touradj Ebrahimi
Emitall S.A. (Electronic Media Innovations)

4.3 Meetings of the Management Committee

- Inaugural Management Committee Meeting, Brussels, Belgium, June 22nd, 2001.
- 1st COST 276 MC meeting, Madrid, Spain, November 21st, 2001.
- 2nd COST 276 MC meeting, Florence, Italy, March 25th, 2002
- 3rd COST 276 MC meeting, Budapest, Hungary, October 12th, 2002
- 4th COST 276 MC meeting, Bordeaux, France, April 1st, 2003
- 5th COST 276 MC meeting, Prague, Czech Republic, October 3rd, 2003
- 6th COST 276 MC meeting, Thessaloniki, Greece, May, 7th, 2004
- 7th COST 276 MC meeting, Ankara, Turkey, November, 5th, 2004
- 8th COST 276 MC meeting, Trondheim, Norway, May 27th, 2005

4.4 Meetings of the Working Groups

- Meeting WG.1-4, Madrid-Leganés, Spain, November 21st, 2001
- Meeting WG.1-4, Florence, March 25th, 2002
- Meeting WG.1-4, Budapest, Oct 12th, 2002
- Meeting WG.1-4, Ljubljana, Slovenia, Sep 22nd, 2003
- Meeting WG.1-4, Thessaloniki, Greece, May 6th, 2004
- WG Coordination Meeting, Bordeaux, France, June 24-25, 2004
- Meeting WG.1-4, Ankara, Turkey, Nov, 4th, 2004
- WG Coordination Meeting Neuchatel Switzerland, Apr., 22-23, 2005
- Meeting WG.1-4, Trondheim, Norway, May 27th, 2005

4.5 Short-term scientific missions

No.	Scientist	Nationality	Date	Host	Topic
1.	Mircea S. Romantan (UTCluj)	Romania	Oct,14-Nov, 13, 2002.	CNIT, Italy	Video streaming using a web browser and camera control.
2.	George C. Porumb (UTCluj)	Romania	Oct.,14-Nov., 13th, 2002.	CNIT, Italy	Video streaming using a web browser and camera control.
3.	Alenka Kavcic (UniLj)	Slovenia	Nov,6 – Dec, 6, 2002.	UC3M	Personalization of content presentation /navigation based on user modeling for a tele-education platform
4.	Tiberiu L. Muntean (UTimisoara,Rom.)	Romania	Dec,1,2002– Mar,30,2003.	UBordeaux	Digital Audio Watermarking.
5.	David Izquierdo (UBordeaux)	Spain	July, 01-15, 2003.	CVUT	Detection and tracking of real objects.
6.	Igor Perkon (UTrieste)	Italy	Sept,15–Oct, 10, 2003	UniLj	Soft boundaries detection in medical images.
7.	Igor Perkon (UTrieste)	Italy	Nov, 3 – 28, 2003	UniLj	Soft boundaries detection in medical images.
8.	Peter Filo (TUKE)	Hungary	June, 1-30, 2004	BUTE	Software transform based image indexing tool development
9.	Tiberiu Monteaun (UTimisoara, Rom)	Romania	June, 1-30, 2004	UBordeaux	Digital Audio Watermarking
10.	Anna Ukovich (UTrieste)	Italy	June, 6-18, 2004	Univ of Thessaloniki	Feature selection for CBIR and standard descriptors
11.	Filippo Stanco (UTrieste)	Italy	June, 13-27, 2004	UFlorence	Virtual restoration and ubiquitous fruition of vintage photographic prints
12.	Ozgur Deniz Onur (METU)	Turkey	Aug,15- Sep, 12th, 2004.	NTNU	Multimedia Adaptation for Resource Limited Mobile Devices
13.	Anna Ukovich (UTrieste)	Italy	May, 8-22, 2005	ITI	Clustering algorithms for the reconstruction of shredded documents

14.	Jan Turan (TUKE)	Slovak Rep.	May, 1-31, 2005.	BUTE	Multimedia signal procesing applications of the family of projecting transforms.
15.	Bogdan Orza (TUCluj)	Romania	May, 5-31, 2005	UTrieste	Algorithms for digital restoration of ancient images
16.	Sorin Cristea (TUCluj)	Romania	May, 5-31, 2005	UTrieste	Algorithms for digital restoration of ancient images
17.	Constantin Emilian David (TUIasi)	Romania	April 4-25, 2005	Uni-NE	Image preprocessing for smart interfaces, in particular for face authentication

4.6 Scientific visits

Visit from a delegation (including 20 diploma students) of UL, FE Ljubljana (Prof. J. Tasic), Slovenia, to Uni-Neuchâtel (Dr. M. Ansorge), Switzerland, on May 15, 2002.

Visit from a delegation (including 15 diploma students) of UL, FE Ljubljana (Prof. J. Tasic), Slovenia, to Uni-Neuchâtel (Dr. M. Ansorge), Switzerland, on Dec. 1st, 2003.

5. RESULTS

We are facing a fast process of convergence of multimedia and hypermedia technologies, i.e. personal mobile terminals, television, video and computer technologies. In the converging worlds of telecommunications, broadcasting and the Internet, multimedia content management is a key factor in making the delivery of end user services efficient. The exploding quantity of available information calls for more friendly, more efficient and secure management framework.

The service user becomes an active participant, freely selecting the range and presentation form of information. The concept of a friendly and secure communication service requires dedicated underlying technology, which is yet to be developed. Fundamental signal processing methods are needed, following the requirements of real-time metadata extraction, feature matching and multimedia transcoding. Especially for mobile computing, power consumption and computing efficiency of the equipment is also critical. Advanced signal processing methods may also be used in digital rights management, providing mechanisms for secure reusability of digital items, particularly in audio, image and video. Data hiding algorithms, first known to be used as a hidden embedded signature of multimedia objects, may in fact be used as a carrier for any additional information about the object in question.

The COST 276 Action has been initiated to encourage the basic research directions as identified above, and to integrate the acquired knowledge in future multimedia communication applications. The activities and results on the COST 276 Action are presented here according to working groups. The results are described quoting references within the section Dissemination of results.

5.1 WG 1: Multimedia information, knowledge and data management.

During the first workshops, a list of key topics to deal was identified:

- Multimedia content description for indexing
- Knowledge structures: representation and indexing

- Compromises between indexation and classification/personalization
- Adaptation of Knowledge Management (KM) functions to information push and pull in Tele-communication networks
- Classification /personalization tools and techniques
- Data and information mining in Telecommunication networks

Analysing the state of the art and active technologies in this area was part of the initial work. The invited talk by M. Temboury [W1.1], describing a KM project in Telefónica, from Spain, provided a practical perspective of KM. Another scenario for KM is described in [W1.2]. After a successful start of activities, the most important results can be categorised as follows:

5.1.1   Image Retrieval

There are several activities in this area covering complementary topics: Image Similarity [W3.12] (Univ. of Timisoara), Image Indexing [W3.21] [W6.2] (TUCluj), Invariant Transformations for Image Retrieval [W4.19] [W8.18] (TUKE).

Specific image retrieval methods were developed by Uni-NE, that presented new low-complexity image matching and retrieval methods operating in the compressed domain [W6.16], and UC3M, that investigated image retrieval systems that learn from user interaction [W8.5]. METU, Turkey, is also working on image retrieval methods based on MPEG-7 features [W6.17] [W6.18].

Although most work was focused on images, indexing and retrieval technologies were also studied for other multimedia records [W4.21] [W6.2].

5.1.2   P2P systems

UniLj and UC3M investigated new Peer-to-Peer (P2P) systems. Some review work during the first year [W1.3] [W2.1] was useful to identify multimedia content management problems. UniLj further explored interactive services based on a serverless topology [W1.8, W3.5]. The research results in this field are shown in the undergoing EC projects, like ShareIt and P2People [EU.8, W5.8, W6.22, W6.7]. UC3M was mainly focused on information retrieval applications of P2P multi-agent systems (also related with WG2 activities). During 1st Workshop, a contribution was presented exploring some symmetries between information pull and push tasks [W1.5]. Further work was presented in [W3.7] and [W7.3]. Other applications of classification and data mining technologies to KM are analysed in other works from this group [W2.2, W2.3].

5.1.3   E-Learning

After the presentation by UniLj of some results on Knowledge Structures for student modelling during the 1st workshop [W1.4], a cooperation activity with UC3M was initiated. The short term visit by Alenka Kavcic to UC3M was dedicated to the implementation of these student models to a Multimedia Education platform [EU.4] under development in UC3M. Other activities of UC3M in e-learning applications was presented in [W7.15]

TUCluj have been very active on several topics related to the application of multimedia communications to e-learning management [W3.1] [W3.10] [W5.9] [W7.13] [W7.25] [W8.22]. Also, some results on e-learning environments and applications were presented by BUTE [W4.17], METU [W7.14], TUKE and CNIT [W8.10].

5.1.4   Others

Finally, other partners that are not included in this WG developed some work that may be of potential interest to WG1. See, for instance, references [W2.4-7], or the Medical application scenario explored by TUCluj, Romania [W6.12][W7.7]. Some other references that illustrate the active participation of many members in this WG are [W3.8] [W3.9] [W3.10] [W4.17] [W4.19] [W6.2] [W6.6].

There has been also some activity in identification of multimedia data. However, since this topic is closely related to others in WG4, after the WG meeting in Ljubljana, it was moved to WG4.

As a conclusion, in spite that the topics WG1 are very wide, most activity was concentrated in three main sub-areas, which has given rise to very active discussions and interchanges of ideas between partners during the workshops.

5.2 WG2: Agent architectures, technologies and metadata descriptors.

The identified topics of the WG2 include mainly:

- Intelligent Agent Systems
- Agent architectures for agent communication and agent mobility
- Agent technologies for data delivery, retrieval and system management
- Multi-agent Systems
- Pull and Push of Information

The main application area of agent technologies considering Action 276 was multimedia content management in communication services, with emphasis on use of intelligent agents in telecommunications, multi-agent pull and push of information, intelligent communication environments and personalised data management services.

The working group has organised an invited paper by P. Marrow, entitled "Intelligent Agents in Telecommunications" and presented at the first workshop held in Leganés (Spain). The other presentation to be explicitly mentioned is a presentation of Prof. A. Vlaicu "Intelligent Agent Systems", in the frame of the 2nd workshop, held in Florence, aiming to inform about the state-of-the-art research in the field of intelligent agents for telecommunications and some prospect about possible future developments in this field. A roundtable on the same subject was proposed by A. Vlaicu, on the same topic, but the initiative was not finalized due to organisational restrictions.

The group has also carried out important research, and the results have been published in the form of scientific papers. In this respect, two papers were presented during the first year, one at the 1st workshop ("Coexistence of Information Pull and Push in a Multi-Agent System", presented by the team of UC3M) [W1.5], and another one at the workshop celebrated in Florence ("Intelcom – Intelligent Communication Environment Using Multiagent Systems", presented by the team of A. Vlaicu, from TUCluj). The working group was more active in the following years [W3.7] [W3.9] [W3.10] [W3.11] [W7.3]. The application of intelligent agents in a notice and takedown process has been studied by UFlorence [DeRosa03]. The agent technology is also enabling personalised data management services like multimedia browsing and selection [W3.30]. The medical applications on patient databases have been shown in [W6.12] and [W7.7].

The activity in this working group was smaller than that of the remaining WG's. It has also been identified that for most issues known agent-based technologies fulfil the requirements well and have been used as such in the WG1, therefore less effort in scientific research of agent technologies has been put in than expected at the beginning of the Action.

5.3 WG3: Technologies for personalised multimedia communications and interfacing.

The ongoing work within the WG3 has covered:

- Technologies for user interface personalisation;
- Technologies for personalised multimedia communication.

The research directions were focused on study of processing methods (concepts and algorithms, software and hardware implementation techniques) and potential applications (application scenarios, interfaces for 3G + 4G mobile communication devices and services, interfaces for intelligent ambience and smart home, interfaces for environment observation and control suiting to disabled/elderly persons).

The features expected to support personalisation include smart interfacing (Multimodal and multisensorial dialogue modes, user and application-driven interfacing for miniature /portable devices), mobility (ubiquitous service availability provision to user) and flexibility by means of various device/service settings, behaviour adaptation according to user's needs and capability to (remotely) update the device/service functionality. A crucial issue for service ubiquity is low-power consumption; dedicated algorithms and hardware architectures/platforms are required often leading to full custom solutions.

The research activities can be grouped into four categories, with most active Action members listed in parenthesis.

5.3.1 Basic methods:

Basic signal processing methods are planned to be used in the domain of personalised interfacing especially as a source of data identification (voice and image recognition). The results belonging to the group include specific filter implementations for personalized interfaces (CVUT), feature extraction using analog Gabor filters (TUIasi), transform based invariant associative image memory for multimedia (TUKE), shape description, image understanding and recognition (UniLj) [Zaletelj02, Kosir02, Zaletelj02b], and invariant image recognition system based on the Trace transform [W5.16] (TUKE).

5.3.2 Interfacing and personalisation methods:

The research results include specialised user interface technologies (interfaces in grid environments (IRB)), which may include elements of adaptability to each individual user (user profilation and personalization using the vector-space approach (UC3M) [W1.5], human-machine voice communication interfaces for personalised interactive multi-modal systems with practical realisation at Expo2002 (EPFL), management of personalised service response in a heterogeneous communication environment (UniLj)). Important part of personalised interfacing

is user identification and authentication (face authentication for mobile communicators, information management in biometric identification systems (EPFL)).

5.3.3 *Hardware implementation techniques*:

For real-time service performance on a varied, particularly on mobile platforms hardware implementation techniques may be crucial. The implementation studies included hardware-oriented algorithms and circuits for low-power motion estimation and deinterlacing (UTrieste) [Fermo02], [Tenze02], low-complexity architectures and algorithms for motion estimation (UniNe), low complexity algorithms architectures and algorithms for video noise reduction (UTrieste) [Tenze04] and efficient parallel SoC design (UniLj) [Zajc02, Sernec02,Zajc02b]. Other implementation studies include motion estimation for MPEG4 based on object trajectory (BUTE) and implementation of Gabor filters on linear cellular neural networks (TUIasi).

5.3.4 *Application-driven interfaces*:

Application studies of personalised multimedia terminal interfacing were dedicated to personalized interfaces in smart cars (CVUT), personalised interfaces for blood transfusion control in medical applications (UniLj) and personalized interfaces for distance education (BUTE). Video transmission over GPRS networks (UFlorence) is listed here as a practical example of multimedia communication system that benefits from the Action partnership.

It was observed that links to specialists in ergonomics would probably be desirable, so as to improve the design and operation of user interfaces, and to ensure user acceptance.

5.4 WG4: Personalised Advanced methods for Signal, Video, speech and sound processing and coding.

The purposes of the WG4 are the following:

- Developing new approaches in the field of medium processing.
- Exchanging information and knowledge about advanced methods for medium processing.

For such a purpose, the topics addressed in this working group mostly consist in improving or creating algorithms and architectures for advanced methods for medium processing, i.e. audio and speech processing (modelling, coding, enhancement and watermarking, etc.) and video processing (coding, enhancement and watermarking, etc.).

The research activities undertaken by the partners during the three first years can be grouped into six categories, namely:

5.4.1 *Watermarking*

New watermarking methods, especially considering the robustness to data compression for any media (audio, speech, image and video) have been studied. Particular activities include audio watermarking (University Bordeaux I), image watermarking for image authentication (UFlorence), data hiding using Trellis Coded Quantization (METU), watermarking of 3D data (UFlorence) and studies of watermark robustness against geometrical attacks (UFlorence). The

impact of video watermarking on the visual quality has also been evaluated (UFlorence1). Application oriented results include data hiding algorithms for medical image authentication and labelling (UFlorence). The use of watermarking technologies for data embedding other than rights management (e.g. for video error concealment) has also been considered. A data hiding algorithm for H.264 video stream has also been implemented (UFlorence)

5.4.2 Image analysis and processing

Important work has been performed in the domain of image restoration, particularly for culturage heritage applications. Examples include work on image registration on cultural heritage applications (UFlorence), edge detection algorithms on cultural heritage images (UFlorence) and digital restoration of antique photographic prints and books – alteration of the ink, discoloration, removing scattered reddish-brown (the color of a fox) spots on the surface of paper, etc. - (UTrieste). Architecture for reconstructing shredded documents, by considering the possible use of MPEG-7 descriptors for the strip content description has also been proposed (UTrieste, Italy).

Specialised methods can be used in order to improve visual quality of the displayed image. The activities included interpolation algorithms for matrix displays (co. Philips Research Monza, European patent), the use of output processing stage (before the visualization device) that improves visual quality of the output and generalised image interpolation and dithering methods. On the other hand also data acquisition methods need technological improvements; a study on dynamic range processing for CMOS image sensors has been done.

Algorithms for general image format conversion, analysis and scaling (UTrieste) and transcoding technology based on JPEG 2000 (NTNU, Norway) have also been studied.

In the medical domain, extraction of the shape of objects with uniform intensity but unconnected surrounding edges with applications to segmentation of the vocal cords in medical images for automatic detection of throat cancer has been investigated (UniLj).

5.4.3 Video processing

In the domain of digital video processing, mostly compression (transcoding technology based on H.264 (NTNU), low-bitrate video compression method using 3D wavelet transform and SPIHT algorithm (BUTE) and mesh-based motion compensation) and segmentation (spatio-temporal segmentation for real rigid-object tracking (UBordeaux)) have been studied. A feasibility study of the real-time implementation of an algorithm for high dynamics video data (UTrieste) has been performed. A novel noise reduction system for video sequences, based on a simple and accurate estimation algorithm, which is used to enable a filter in a suitable set of rational and median operators [Tenze04] was also suggested (UTrieste).

5.4.4 General signal processing

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[1] Univ. of Florence is involved in an important European NoE in Cryptology "ECRYPT", ", European NoE in Cryptology, 6th Framework EU Projects, Feb. 2004 – Jan. 2008. It also belongs to "Excellence National Center": Media Integration and Communication Center – MICC.

The activities were dedicated to new stochastic 1-D, 2-D and N-D models (analysis of sinusoidal model with stochastic magnitudes for speech enhancement and analysis (UBordeaux), stochastic 2-D models for texture analysis and synthesis (UBordeaux)) and to advances in filter design (implementing and designing FIR notch filter for signal processing (CVUT)). The beginnings of knowledge-based signal processing methods have also been introduced (signal processing and implementation techniques for users' personal terminals in advanced multimedia data and knowledge management for personal multimedia communication systems and services. (UBelgr)). Under this domain, speech processing research (speech enhancement (UBordeaux / Uni-NE, analysis of autoregressive parameter estimation in a noisy environment for speech enhancement and coding (UBordeaux), new methods for dereverberation of speech (UBordeaux)) can also be classified.

In the area of information technology we witness tremendous expansions of new data and knowledge management technologies as well as services supported by these technologies. It is expected that in the next years everyone will have access to his own powerful multimedia based personalised electronic assistant. We will be able to talk, point to or just look at the electronic device and thus have more commands, programs, and facilities available than we can imagine. The behaviour of our assistants will not remain bound to a specific home, office or portable electronic device, it will, as a virtual secretary, remain available regardless of a device we will currently be using.

The results shown mainly illustrate current activities at the COST 276 Action. The challenge of personalisation, ubiquity and universal mobility is, however, a target for many experts around the globe, and a must on the step towards the information society for everyone.

6. **DISSEMINATION OF RESULTS**

6.1 Publications and Reports

Books / book chapters / Journals (ordered by year/name)

[Ramponi99] G. Ramponi, "Warped distance for space-variant linear image interpolation,"', *IEEE Transactions on Image Processing*, vol. 8, no. 5, pp. 629-639, May 1999.

[Caldelli02] R. Caldelli, M. Barni, F. Bartolini, A. Piva, "Object Watermarking for MPEG-4 Video Protection", Telecommunications Review: Special Issue on Digital Multimedia Contents & Security, vol. 12, no. 5, October 2002, Seoul, Korea, pp. 695-710.

[Caldelli03] R. Caldelli, G. Macaluso, F. Bartolini and M. Barni, "Near-lossless image authentication transparent to near-lossless coding" *Internal Report no. DET-01-03 del Dipartimento di Elettronica e Telecomunicazioni dell'Università di Firenze*, June 2003.

[Cappellini03] V. Cappellini, M. Barni, M.Corsini, A. De Rosa, A. Piva, "ArtShop: an art-oriented image processing tool for cultural heritage applications", *The Journal of Visualization and Computer Animation*, 2003, vol. 14, Issue 3, July 2003, pp. 149-158.

[Scognamiglio03] G. Scognamiglio, G. Ramponi, and A. Rizzi, "Enhancement of coded video sequences via an adaptive nonlinear post-processing," *Signal Processing: Image Communication*, vol.18, no.2, Feb. 2003, pp.127-139.

[Barni04]   M. Barni, F. Bartolini, A. Piva, "Performance Analysis of ST-DM Watermarking in Presence of Non-additive Attack ", *IEEE Transactions on Signal Processing, Supplement on Secure Media*. Vol. 52, Issue 10, Part 2, pp.:2965-2974, Oct. 2004

[Cappellini04] V. Cappellini, H. Maitre, I. Pitas, A. Piva, "Image Processing for Cultural Heritage", *Special Issue of IEEE Transactions on Image Processing*, vol. 13, no. 3, March 2004, pp. 273-276.

[Piva04]   A. Piva, R. Caldelli, and M. Barni, "Video Watermarking: Approaches, Applications, and Perspectives," in *Intelligent Watermarking Techniques*, J. S. Pan, H.-C. Huang, and L. C. Jain editors, World Scientific Publishing Company, Singapore 2004, Chapter 19, pp. 561-592.

[Shahidi04]   R. Shahidi, C. Moloney and G. Ramponi, "Design of Farthest-Point Masks for Image Halftoning", *EURASIP Journal on Applied Signal Processing*, vol.2004, no.12, 15 Sept. 2004, pp.1886-1898.

[Tenze04]   L. Tenze, S. Carrato, and S. Olivieri, "Design and real-time implementation of a low-cost noise reduction system for video applications", *Signal Processing*, Vol. 84, pp. 453-466, Mar. 2004.

[Bartolini05] F. Bartolini, R. Caldelli, A. Piva, "Self recovery authentication of images in the DWT domain", *Int. Journal of Image and Graphics*. Vol. 5, No. 1, pp. 149-166, Jan, 2005.

Chapters in COST #254+276 Book: J. F. Tasič, M. Najim, M. Ansorge (eds.),
***Intelligent Integrated Media Communication Techniques*, Kluwer, 2003**

[Book.1]   U. Burnik, M. Pogačnik, "Content and Presentation Adaptation in Hypermedia Systems"

[Book.2]   Honglin Yi, et al., "Annotation, Storage, Retrieval and Analysis of Digital Video"

[Book.3]   Koprinska, S. Carrato, "Segmentation Techniques for Video Sequences in the Domain of MPEG-Compressed Data"

[Book.4]   D. Simitopoulos, et al., "Digital Watermarking for the Copyright Protection of Compressed Video"

[Book.5]   M. Barni, et al., "Robust Watermarking of Video for Copyright Protection

[Book.6]   N.V. Boulgouris, et al., "Error-Resilient Coding for Multimedia Communications"

[Book.7]   B. Marušič, et al., "Wavelet Centric Video Coding and Coding Artifact Concealment"

[Book.8]   J. Bracamonte, et al., "Bit-Rate Control for the JPEG Algorithm", pp. 263-301.

[Book.9]   Drygajlo, "Man-Machine Voice Enabled Interfaces"

[Book.10]   Drygajlo, "Speech Coding and Recognition in Noisy Environments for Communication Terminals"

[Book.11]   S. Tanner, et al., "Low-Power Micro-Cameras for Mobile Communication Devices", pp. 361-401.

[Book.12]   K. Skala, et al., "Retrospective of the Distributed Media Server Technology"

Proc. of 1st COST #276 Workshop, Leganés-Madrid, Spain, Nov. 2001.

[W1.1]   M. Temboury, "Knowledge Management in a Multinational Company", invited talk.

[W1.2]   J.L. Abia, F. Galán-Soteres, "Description of a Collaborative Engineering Knowledge Scenario".

[W1.3]   B. Marusic, J. Tasic, "P2P Networking: New Prospectives for Information and Knowledge Management".

[W1.4]   A. Kavcic, "Enhancing Educational Hypermedia: Personalization through Fuzzy Logic".

[W1.5]   H.Y. Molina-Bulla et al., "Coexistence of Information Pull and Push in a Multi-Agent System".

[W1.6]   G. Biundo, S. Grassi, M. Ansorge, F. Pellandini, "Spectral Quantization for Wideband Speech Coding".

[W1.7]   M. Naveira, R. Arosa, M. González, L. Castedo, "A PC Platform for the Development of MPEG-2 Interfaces for ATM Networks".

[W1.8]   M. Pogačnik, J.F. Tasič, "Interactive and Personalized Television of the Future.

[W1.9]   U. Burnik, J. Tasic, "Resource-Oriented Imaging Technologies for Mobile Terminals".

[W1.10]   A. Fermo, G.L. Sicuranza, V.Pahor, "Analysis of Different Motion Estimation Algorithms for Low Power Mobile Communication".

[W1.11]   J. Zhang and A. Perkis, "A Media Research Engine for Universal Multimedia Access (UMA)"

[W1.12]   M. Barni, F. Bartolini, R. Caldelli, V. Cappellini, A. De Rosa, A. Piva, "Amplitude Modulation for Readable Watermarks".

[W1.13]   A. Vlaicu, A. Turcu, R. Fotea, R. Vescan, B. Orza, "Project Management Application for Web-based Environments".

[W1.14]   L. Tenze, A. Fermo, S. Carrato, "A High Quality Edge and Motion Sensitive Deinterlacer".

[W1.15]   A. Košir, J.F. Tasič, "Formal System for Digital Image Scene Analysis: Principles".

[W1.16]   P. Vera, N. Ruiz, D. Martínez, M. Rosa, F. López, "Matching Pursuit Based Audio Coding Approach".

[W1.17]   J. Turán, P. Farkas, D. Siskovicová, M. Benca, "Hough Transform Based Invariant Feature Extractor".

[W1.18]   S. Tran Minh, K. Fazekas, A. Gschwindt, J. Benois-Pineau, J. Turan, "MPEG 4-Like Codec Scheme for Advanced Multimedia Communication: Proposals and Comparison".

[W1.19]   D. Simitopoulos, S. A. Tsafaris, N. V. Boulgouris, M.G. Strintzis, "Fast Compressed Domain Watermarking of MPEG Multiplexed Streams".

Proc. of 2nd COST #276 Workshop, Firence, Italy, March 2002.

[W2.1]   M. Pogacnik, J.F. Tasic, "An Approach to Search of Audio-Visual Content in Peer-to-Peer environments".

[W2.2]   J. Cid-Sueiro, R. Alaiz-Rodríguez, "Enhancing Data Filtering By Unlabeled Data And Active Learning".

[W2.3]   A.Navia-Vázquez, R. Díaz-Rodríguez, J. Cid-Sueiro, and A. R. Figueiras Vidal, "Building Databases By Mining The Web: Validating Tasks And Technologies"..

[W2.4]   Ján Turán - Luboš Ovseník - Ján Turán, Jr., K. Fazekas, "STIR and MPEG4 Based Invariant Associative Image Memory"..

[W2.5]   P. Bures, "Automation In Tribodiagnostics"..

[W2.6]   B. Kovář, M. Vlček, "Vehicle Recognition In Front Of Moving Car".

[W2.7]   B. Kovář, P. Paclík, "Road Sign Recognition System".

[W2.8]   J. Turán, P. Farkas, D. Siskovicová, M. Benca, "Hough Transform Based Invariant Feature Extractor".

[W2.9]   S. Tran Minh, K. Fazekas, A. Gschwindt, J. Benois-Pineau, J. Turan, "MPEG 4-Like Codec Scheme for Advanced Multimedia Communication: Proposals and Comparison".

[W2.10]   M. Vlcek, P. Zahradnik, "Two-Dimensional FIR Asteroidal Filters".

[W2.11]   A. Jere, M. Meza, J. F. Tasic, "A Mobile Multimedia Terminal Application and Architecture".

[W2.12]   F. Bartolini, R. Caldelli, V. Cappellini, A. De Rosa, A. Piva, "Watermarking for MPEG-4 Applications".

[W2.13]   D.D. Giusto, F. Massidda, C. Perra, "Fast Tracking for Head-Shoulder Video Sequences".

[W2.14]   G. Prati, E. Del Re, S. Pupolin, L. S. Ronga, M. Marchese, D. Adami , P. Castoldi, S. Vignola, "The Teledoctorate Project: A CNIT Experience".

[W2.15]   F. Davoli, S. Zappatore, "The Labnet Project: Infrastructure and Software Architecture".

[W2.16]   A. Vlaicu, M. Topa, C. Porumb, M. Romantan, S. Gordea, "Intelcom - Intelligent Communication Environment Using Multiagent Systems".

[W2.17]   M. Leban, B. Marusic, "The Impact of Internet Technology on Interactive Television".

Proc. of 3rd COST #276 Workshop, Budapest, Hungary, Oct. 2002.

[W3.1]   C. Porumb, B. Orza, S. Gordea, S. Catana, S. Cristea, M. Topa, "Integrated Environment for Distance Education".

[W3.2]   J. Zhang, A. Perkis, "Multimedia Adaptation for Delivery and Presentation".

[W3.3]   A. Drygajlo, P. J. Prodanov, "Voice Enabled Communication Interface for Expo Tour Guide Robots".

[W3.4]   S. Gordea, B. Vigouroux, A. Vlaicu, "Texture Analysis for Images of Radius and Calcaneum using Fourier Transform".

[W3.5]   M. Meža, B. Marušič, J.F. Tasič, "Overview of Network Topologies and P2P Network Concept".

[W3.6]   U. Burnik, J.F. Tasič, "Adaptive Service Quality in Personalised Interactive Communication Systems".

[W3.7]   A.B. Rodríguez-González, J. Cid-Sueiro, A. Navia-Vázquez, A. Gallardo-Antolín, H.Y. Molina-Bulla, F.J. Valverde-Albacete, A.R. Figueiras-Vidal, "Exchanging User Profiles to Connect Peers in Distributed Systems".

[W3.8]   C. Rusu, S. Muresan, B. Orza, C. Porumb, A. Vlaicu, "CTMED PORTAL: Application for Hosting and Administration Web-Sites and Virtual Store".

[W3.9]   A. De Rosa, F. Bartolini, A. Piva, V. Cappellini, "An Intelligent Agents Platform for a Notice and Takedown Procedure Management".

[W3.10]   C. Porumb, S. Catana, S. Cristea, A. Vlaicu, "Information Management using Multi-Agent Platform Systems".

[W3.11]   D. Zinca, V. Dobrota, C.M. Vancea, G.l Lazar, "Protocols for Communication Between QoS Agents: COPS and SDP".

[W3.12]   M. Mocofan, R. Vasiu, "Algorithm Based on Image Similarity for Content Search in an Image Database".

[W3.13]   M. Jalobeanu, "The Evaluation of Web Sites Credibility".

[W3.14]   M. Lutovac, D. Tošić, "Symbolic Signal Processing and System Analysis".

[W3.15]   M. Mocofan, R. Vasiu, "On Testing MPEG Codecs for Multimedia Application".

[W3.16]   Ján Turán, Martin Benča, "PLD Implementation of Novel Algorithm of Incremental Hough Transform".

[W3.17]   J. Turán, D. Šiškovičová, P. Farkaš, P. Filo, "Parameter Estimation Using Continuous Kernel Hough Transform".

[W3.18]   E. Lupu, P.G. Pop, Z. Feher, "Speaker Verification Rate Study Using the TESPAR Coding Method".

[W3.19]   M. Giurgiu, "Maximization of Mutual Information for Training Hidden Markov Models in Speech Recognition".

[W3.20]   R. Major, M. Borda, C. Iovan, "A Secure and Robust Image Digital Watermarking".

[W3.21]   M. Romantan, B. Vigouroux, B. Orza, A. Vlaicu, "Image Indexing using the General Theory of Moments".

[W3.22]   G. Biundo, S. Grassi, M. Ansorge, F. Pellandini, P.-A. Farine, "Design Techniques for Spectral Quantization in Wideband Speech Coding".

[W3.23]   S. Grassi, M. Ansorge, F. Pellandini, P.-A. Farine, "Distributed Speaker Recognition Using the ETSI Aurora Standard".

[W3.24]   J. Turán, L. Ovseník, "A Design Web-Based Multimedia Courseware: Applied Photonics".

[W3.25]   D. Simitopoulos, D. Koutsonanos and M.G. Strintzis, "A Watermarking Method Resistant to Geometric Attacks".

[W3.26]   H. Cai, E. Grivel, M. Najim, "Speech Enhancement Using AR Model Driven by White Noise with Time-Varying Variance".

[W3.27]   T. Muntean, E. Grivel, M. Najim, "Watermark Space Partition for Digital Audio Blind Watermarking".

[W3.28]   B. Enyedi, L. Konyha, K. Fazekas, "Using Wavelet Transform for Guiding Observation Cameras and Efficient Data Storage".

[W3.29]   S. M. Tran, L. Konyha, B. Enyedi, K. Fazekas, A. Gschwindt, J. Turan Jr., "Deployment of Constrained Delaunay Mesh in VOP Shape Coding".

[W3.30]   M. Pogacnik, J.F. Tasic, "A Personalised Selection of Video Items for Wide Audience".

[W3.31]   B. Kepenekci, F. Boray Tek, G. Bozdagi Akar, "Occluded Face Recognition by using Gabor Features".

[W3.32]   A. Yılmaz, A. Aydın Alatan, "Robust Video Transmission using Data Hiding".

[W3.33]   E. Gürses, G. Bozdagi Akar, Nail Akar, "Performance of H.263+ Scalable Video over a Diffserv Network".

[W3.34]   E. Esen, Ö. Önür, M. Sosyal, Y. Yaşaroğlu, A. Aydın Alatan, "A MPEG-7 compliant Video Management System: BilVMS".

[W3.35]   B. Kovar, "Logo Appearance Detection and Classification in a Sport Video".

Proc. of 4th COST #276 Workshop, Bordeaux, France, March-April, 2003.

[W4.1]   W. Puech , "Safe transfer of image based on color transformation for watermarking"

[W4.2]   F. Autrusseau and J. P. Guédon, "Perceptual image watermarking using a secure mojette transmission scheme".

[W4.3]   V. Mezaris, N. V. Boulgouris, I. Kompatsiaris, D. Simitopoulous and M. G. Strintzis, "Segmentation and content-based watermarking for image indexing".

[W4.4]   Ch. Cavaro-Menard and A. Simon, "Watermarking applications appropriated to medical imaging a study of watermark methods adapted to medical images".

[W4.5]   A. De Rosa, F. Bartolini, V. Cappellini and A. Piva, "Watermarking systems for hidden annotation in medical images".

[W4.6]   C. Baras, P. Dymarski and N. Moreau, "Spread spectrum modulations and alternative receiver scheme in an audio watermarking system".

[W4.7]   A. Yilmaz and A. Alatan, "Data hiding aided Robust H.263 + Transmission".

[W4.8]   A. Koz and A. Alatan, "Video watermarking using temporal sensitivities of Human visual system".

[W4.9]   M. Barret, H. Bekkouche, J. L. Collette and J. Oksman, "Adapted lifting schemes for lossless image coding".

[W4.10]   O. Derrien and P. Duhamel, "Compression of stereophonic audio signals with the MPEG-2/4 advanced audio coder (AAC): a new algorithm for MS system".

[W4.11]   D. Izquierdo, Y. Berthoumieu and Ph. Marchegay, "Spatio-temporal segmentation for real rigid-object tracking".

[W4.12]   P. Fonseca, F. Perreira and P. L. Correia, "Using MPEG-7 descriptions to create video summaries".

[W4.13]   E. Gurses, N. Akar and G. Bozdagi Akar, "A novel architecture for layered video streaming over TCP/IP".

[W4.14]   U. Burnik and M. Pogacnik, "Personalised content and presentation for ubiquitous communications services".

[W4.15]   P. Zahradnik and M. Vlcek, "Progress in the analytical design of optimal equiripple comb FIR filters".

[W4.16]   S. Marsi, A. Fermo, G. Sicuranza and S. Carrato, "Low power architecture for a motion detection algorithm".

[W4.17]   L. Konyha, B. Enyedi, S. M. Tran and K. Fazekas, "E-Learning – multimedia education".

[W4.18]   J. Turan, D. Siskovicova and P. Filo, "Invariant object recognition based on trace transform".

[W4.19]   J. Turan, J. Turan jr and K. Fazekas, "Invariant image retrieval based on STIR Transform".

[W4.20]   G. Biundo, M. Ansorge, F. Pellandini and P. A. Farine, "Perceptual weighting for ACELP wideband speech coder".

[W4.21]   M. Alonso, B. David and G. Richard, "A study of tempo extracting algorithms from polyphonic music signals".

[W4.22]   T. Muntean and M. Najim, "Analysis of watermarking and attack algorithms for audio signals".

Proc. of 5th COST #276 Workshop, Prague, Czech Republic, Oct. 2003.

[W5.1]   M. Klíma, "Subjective quality of image information in multimedia".

[W5.2]   V. Mezaris, I. Kokpatsiaris, and M.G. Strintzis, "Still image objective segmentation evaluation using ground truth".

[W5.3]   S. Carrato, "A Pseudo-Retinex approach for the visualisation of high dynamic range images".

[W5.4]   M. Givan, B. Vigouroux, A.Clement, and A. Vlaicu, "Study of the germination dynamic plants using advanced image processing".

[W5.5]   F. Stanco, G. Ramponi, and L. Tenze, "Removal of semitransparent blotches in old photographic prints".

[W5.6]   B. Kovář, and J. Přikryl, "Lens undistorsion methods for automotive applications".

[W5.7]   P. Bureš, "Lane departure warning –vehicle support system".

[W5.8]   A. Jere, M. Meža, B. Marušič, and J. F. Tasič, "Peer to peer user oriented collaborative and search platform based on JXTA protocol".

[W5.9]   M. Romantan and A.Vlaicu, "Information management in a distance education environment".

[W5.10]   M. Ansorge and T. Henk, "On the design of Digital Hilbert Transformers by transformation of real lowpass filters", pp. 44-51.

[W5.11]   P. Páta, "Karhunen-Loeve transform as a based of BOOTES image data coder".

[W5.12]   R. Špetík, "Spectral analysis of non-stationary signals using Zolotarev polynomials".

[W5.13]   S. Grassi, M. Ansorge, F. Pellandini, and P.-A. Farine, "Implementation of automatic speech recognition for low-powered miniaturized devices", pp. 59-64.

[W5.14]   M. Meža, J. F. Tasič, A. Jerel, M. Breskvar, and P. Rožman, "Mobile multimedia terminal in blood transfusion practice".

[W5.15]   Ö. D. Önür and A. A. Alatan, "Optimal video adaptation for resource constrained mobile devices based on utility theory".

[W5.16]   J. Turán, D. Šiškovičová, "Object parameter estimation using Trace transform feature extraction", 5th COST 276 Workshop, Prague, Czech Republic, 2003, 79-83.

Proc. of 6th COST #276 Workshop, Thessaloniki, Greece, May 2004.

[W6.1]   M. Vlcek and P. Zahradnik, "Fast Design of 2-D Narrow Bandstop FIR Filters".

[W6.2]   P. Panagiotopoulos, M. Falelakis and A. Delopoulos, "Efficient Semantic Search using Finite Automata".

[W6.3]   A. Piva and R. Caldelli, "Watermarking for Image Authentication and Content Recovery".

[W6.4]   I. Perkon, A. Kosir, G. Sicuranza and J. F. Tasic, "A Simple Level Set Method for Vocal Cords Segmentation".

[W6.5]   S. Marsi, S. Carrato. G. Ramponi, and B. Crespi, "Video dynamic range compression for logarithmic CMOS imagers".

[W6.6]   I. Koprinska, J. Clark and S. Carrato, "VideoGCS - A Clustering-Based System for Video Summarization and Browsing".

[W6.7]   A. Jere, M. Meza, B. Marusic and J. F. Tasic, "Video Transmission over JXTA Based Peer-to-Peer Network".

[W6.8]   C. Porumb, S. Porumb, B. Orza, S. Cristea and A. Vlaicu, "Intelligent and Personalized Graphical User Interface in e/mCommerce Systems".

[W6.9]   M. Tkalcic and J. F. Tasic, "A Framework for a markup language for the definition of scalable user interfaces".

[W6.10]   P. Prodanov and A. Drygajlo, "Bayesian Networks Based Signal Fusion for User Goal Identification in Human-Robot Dialogues".

[W6.11]   M. Meza, M. Pogacnik, M. Tkalcic, A. Jere, M. Breskvar, P. Rozman, I. Bricl, J. F. Tasic and M.Leban, "Description of pilot implementation of telemedicine system in blood transfusion practice".

[W6.12]   A. Cordos and A. Vlaicu, "Resource management in medical imaging centers".

[W6.13]   B. Kovar, J. Prikryl and M. Vlcek, "Flexible License Plate Recognition System".

[W6.14]   P. Bures and M. Svitek, "Traffic information dissemination into heterogeneous systems".

[W6.15]   S. M. Tran, M. Preda, K. Fazekas and F. J. Preteux, "Improvement of the temporal constraint in MPEG-4 BIFS".

[W6.16]   J. Bracamonte, M. Ansorge, F. Pellandini and P.-A. Farine, "Low Complexity Image Matching in the Compressed Domain by using the DCT-phase".

[W6.17]   G. B. Akar and K. K. Guner, "MPEG-7 Compliant ORDBMS Based Image Storage and Retrieval System".

[W6.18]   M. Soysal and A. A. Alatan, "Combining Region-based MPEG-7 Experts for Reaching Semantics".

[W6.19]   J. Zhang, A. Perkis and N. D. Georganas, "H.264/AVC and Transcoding for Multimedia Adaptation".

[W6.20]   S. Dobravec and J. F. Tasic, "MUFFINS – The "MPEG-21 vision" becoming a reality".

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[Ukovich05b]   A. Ukovich, G. Impoco, G. Ramponi, "A Comprehensive Tool to Measure the Performance of Dynamic Range Reduction Algorithms," *IEEE International Workshop on Imaging Systems and Techniques, IST 2005*, Niagara Falls, Canada, 13 May 2005.

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6.2 Conferences and Workshops

Action Meetings and Workshops:

8 Workshops took place during the Action:

Workshop	Date	Location	Organiser	Web Site
1st	Nov, 27-29, 2001	Madrid, Spain	A. R. Figueiras-Vidal (UC3M)	http://www.tsc.uc3m.es/~cost276/
2nd	March, 25-26, 2002	Florence, Italy	V. Cappellini, Alessia De Rosa (UFlorence)	http://lci.det.unifi.it/Events/Cost276/cost276.html.
3rd	Oct, 11-12, 2002	Budapest, Hungary	K. Fazekas (BUTE), A. Vlaicu (TUCluj), L. Goras (TU Iasi)	http://cyberspace.mht.bme.hu/cost/cost276/Home.htm
4th	March,31 – April.1st,2003	Bordeaux, France	M. Najim, Ubordeaux	http://www.tsi.u-bordeaux.fr/cost276/workshop.html
5th	Oct., 2-3, 2003	Prague, Czech Rep.	M. Vlcek, CVUT	http://cost276.fd.cvut.cz/
6th	May, 6-7, 2004	Thessaloniki, Greece	M. G. Strintzis, ITI	http://media.iti.gr/cost276/
7th	Nov., 4-5, 2004	Ankara, Turkey	G. Bozdagi-Akar, METU	http://mmrg.eee.metu.edu.tr/cost276
8th	May, 26-28, 2005	Trondheim, Norway	A. Perkis, NTNU	http://www.q2s.ntnu.no/cost276/

A MC meeting and WG meetings were celebrated during each workshop. Besides of them, three WG coordination meetings were celebrated at different locations:

Meeting	Date	Location	Organiser
WG meeting at EUROCON	Sept., 22, 2003	Ljubljana, Slovenia	J. F. Tasic (UniLj)
WG coordination meeting	June 24-25, 2004	Bordeaux, France	M. Najim (UBordeaux)
WG coordination meeting	Apr, 22-23, 2005	Neuchatel, Switzerland	M. Ansorge (Uni-NE)

Related Activities:

Special workshop for the youth

- V. Cappellini, A. De Rosa organised together with COST 276 MC members and Fondazione R. del Bianco a Workshop on "Information and Knowledge Management for Integrated Media Communication to Support the *Fly Youth* Portal" on Dec. 1-8

2003 in Florence, sponsored by *Fondazione Romualdo Del Bianco* in Florence, Dec. 1-8, 2002.

- During the Workshop, professors with their students discussed about the possible universal multimedia portals and approaches. The foundation covered lodging and space for the Workshop where COST #276 members leaded the program activities. According the last day meeting of all participants such meetings for the youngsters should become regular events organised by COST and Fondazione R. del Bianco. Each COST 276 country should contribute on next meetings with 1 or 2 researchers.

Invited Talks

- M. Najim, University of Bordeaux I, France, "Limitations of the autoregressive models from 1-D to the 3-D case" Invited talk presented on May 26th, 2004, at the Institute of Microtechnology, University of Neuchâtel, Switzerland.
- M. Najim, University of Bordeaux I, France, "Mono- and Bi-Dimensional Parametric Modelling: From Speech Signal Enhancement to Texture Characterization" Invited talk presented on May 8th, 2002, at the Institute of Microtechnology, University of Neuchâtel, Switzerland.
- M. Ansorge, F. Pellandini, S. Tanner, J. Bracamonte, P. Stadelmann, J.-L. Nagel, P. Seitz, N. Blanc, C. Piguet, "Very Low Power Image Acquisition and Processing for Mobile Communication Devices", Keynote paper, *Proc. IEEE Int'l. Symposium on Signals, Circuits & Systems, SCS 2001*, July 10-11, 2001, Iasi, Romania, pp. 289-296.
- M. Ansorge, F. Pellandini, J. Bracamonte, S. Tanner, P. Stadelmann, "Advances in Very Low-Power Image Sensing and Compression for Multimedia Mobile Communicators", Invited paper, *Proc. EURASIP Conf. on Digital Signal Processing for Multimedia Communications and Services, ECMCS 2001*, Sept. 11-13, 2001, Budapest, Hungary, pp. 141-150.
- M. Ansorge, S. Tanner, X. Shi, J. Bracamonte, J.-L. Nagel, P. Stadelmann, F. Pellandini, P. Seitz, N. Blanc, "Smart Low-Power CMOS Cameras for 3G Mobile Communicators", Invited paper, *Proc. 1st IEEE Int'l. Conf. on Circuits and Systems for Communications, ICCSC'02*, June 26-28, 2002, St-Petersburg, Russia, pp. 216-225.
- M. Ansorge, J.-L. Nagel, P. Stadelmann, P.-A. Farine, "Biometrics for mobile communicators", Invited paper, *2nd IEEE Int'l. Conf. on Circuits and Systems for Communications*, *ICCSC'04,* June 30-July 2, 2004, Moscow, Russia.

Invited Talks at COST #276 workshops

- M. Temboury, "Knowledge Management in a Multinational Company", invited talk, 1st Workshop, Leganés-Madrid, Spain, Nov. 2001.
- P.Marrow (BTexact, UK), "Intelligent Agents in Telecommunications", invited talk, 1st Workshop, Leganés-Madrid, Spain, Nov. 2001.
- A. Tewfik (Minnesota University, USA), "Transmitting, personalizing and protecting multimedia contents", 4th Workshop, Bordeaux, France, March-April, 2003.
- Th. Kailath (University of Stanford, USA), "Effective maximum likelihood decoding with polynomial expected complexity", 4th Workshop, Bordeaux, France, March-April, 2003.
- A. Tewfik (Minnesota Univ., USA), "Generalized ultra wideband communications: Theory and practice", 4th Workshop, Bordeaux, France, March-April, 2003.

- V. Hlaváč (CTU, Prague, Centre for Machine Perception), "3D reconstruction and panoramic vision, a contribution of the Center for Machine Perception in Prague", 5th Workshop, Prague, Czech Republic, Oct., 2003.
- T. Declerck (Computational Linguistic Department, University of Saarland), Possible Contributions of Human Language Technology to Multimedia Content Indexing", 6th Workshop, Thessaloniki, Greece, May, 2004.
- S. Herrmann (Institute for Integrated Systems, Munich University of Technology), "Building a Content Based Search Engine around the MPEG-7 Reference Software", 6th Workshop, Thessaloniki, Greece, May, 2004.
- F. Pereira, (IST), "MPEG-21 Standard: Developing and Integrating Multimedia Technologies", 7th Workshop, Ankara, Turkey, Nov, 2004.
- J. Bormans (IMEC, Belgium): "Quality of Experience for Personal Multimedia Communication Devices" , 8th Workshop, Trondheim, Norway, May, 2005.
- T. Svendsen (NTNU, Norway): "Speech technology - why, what and where?" , 8th Workshop, Trondheim, Norwey, May, 2005.

Special Sessions

- "**Speech and Audio Processing Devices and Applications**" organized by Uni-NE (M. Ansorge), and EPFL (M. Drygajlo), for the European Conf. on Circuits Theory and Design ECCTD'01, Espoo, Finland, August 28-31, 2001, with explicit link to COST 254, and COST 276.
- "**Nonlinear signal processing methods, devices, and applications**" organized by Uni-NE (M. Ansorge), CSEM S.A. Zürich, Switzerland (Prof. Seitz), and TUIasi (L. Goras), for the IEEE Int'l. Symp. on Signals, Circuits and Systems, SCS 2001, Iasi, Romania, July 10-11, 2001, with explicit link to SCOPES, COST 254, and COST 276.
- "**Low-Power Algorithms and Architectures for Image and Video**" organized by Uni-NE (M. Ansorge), and UniTrieste (G. Ramponi), for the XI European Signal Processing Conference, EUSIPCO 2002, Toulouse, France, Sept. 03-06, 2002, with explicit link to COST 276.
- "**Special Session on COST #276**" organized by UniLj (Prof. J. Tasic), for the IEEE International Conf. on the Computer as a Tool, EUROCON 2003, Ljubljana, Slovenia, Sept. 22-24, 2003.
- "**Special Session on COST #276**" to be organized by UniLj and Uni-NE (Prof. J. Tasic, Dr. M. Ansorge), for the IEEE International Conf. on the Computer as a Tool, EUROCON 2005, Belgrade, Serbia and Montenegro, Nov. 21-24, 2005 (*in preparation*).

Publications

- **Book:**

  J. Tasic, M. Najim, M. Ansorge (Eds.), *Intelligent Integrated Media Communication Techniques*, Kluwer Academic Publishers, Boston, MA, USA, Nov. 2003, ISBN 1-4020-7552-9 (440 pages).

  (book chapters are listed in refs [Book.1] to [Book.12] above).

In conclusion, after having specified their respective contributions to the WGs, the Partners started working and presenting progressing results in the frame of COST 276 Workshops. Moreover, cooperation between Partners is being organized based on activities similarity/ complementarity, whereas external scientific networking was already quite active to establish contacts and contribute to the visibility of COST. Finally, future cooperation with COST 275 (biometrics-based recognition of people over the internet), COST 278 (spoken language interaction in telecommunication), and the COST 219bis follow-up concerned by telecommunication technologies for disabled/elderly, are considered.

6.3 Web site

COST 276 Action web site:

There are currently two pages related to COST276 activities, that provide general description and documents of the Action, links to participants, MoU, minutes, MC material, etc.

- **http://cyberspace.mht.bme.hu/cost/cost276**
- **http://cost276.fe.uni-lj.si**

For working group 4, the following page is dedicated:

- **http://www.tsi.u-bordeaux1.fr/Cost276/COST.html**

6.4 Scientific and Technical Cooperation

COST 276 / SCOPES cross-programme cooperation: A cooperation between Uni-NE (Dr. Ansorge), CSEM S.A. Zürich (Prof. Seitz), Switzerland, and TUIasi (Prof. Goras), is carried out in the framework of the programme SCOPES (Scientific cooperation between Eastern Europe and Switzerland) supported by the Swiss National Science Foundation and financed by the Swiss Federal Department of Foreign Affairs under Grant SCOPES 7RUPJ062381 (Oct. 2000 – Dec. 2003). This cooperation is explicitly connected to COST 276.

Within this cooperation, four stays have been carried out :

Stays 1+2:   Two stays from TUI to IMT Uni-Neuchâtel from April 1st to June 26, 2001 (Mr. Radu Cezar Matei and Mr. Eugen Romeo Ghinea);
Stays 3+4:   Two stays from TUI to IMT Uni-Neuchâtel from Sept. 2nd to Nov. 26, 2001 (Mr. Tiberiu Dinu Teodorescu and Mr. Victor Andrei Maiorescu).
Stays 5+6:   Two stays from TUI to IMT Uni-Neuchâtel from Aug. 1st to Sept. 30, 2002 (Dr. Tiberiu Dinu Teodorescu and Mr. Victor Andrei Maiorescu).

Finally, an Intensive Course on *Advanced Signal Processing* was organized in Iasi / Romania from May 9 to May 13, 2005 (lecture course, exercises, laboratory, seminars).

TU Kosice and TU Budapest cooperate under this COST Action in the following fields:

- o   Transform methods for multimedia signal processing

- o Invariant image associative memory design
- o Content-based MPEG4-like video coding methods
- o Multimedia tele-education material development
- o NATO supported project in the multimedia signal processing field.

University of Florence is or has been involved in:

- "Excellence National Center": MEDIA INTEGRATION AND COMMUNICATION CENTER. Research and experimentation concern three main topics:
  - o Multimedia Communication
  - o Information Protection
  - o Information Access and Human-Machine Interaction
- TRADEX (TRial Action for Digital object EXchange). IST-1999-21031, Oct. 2000 – April 2002.
- RIGHTS WATCH. IST-1999-10639 Jan. 2001 – December 2002.
- EVAN (Electronic Imaging & The Visual Arts Networking). IST-2000-26409, Jan. 2001 – Dec. 2002.
- MESMUSES (Metaphor for Science Museums). IST-2000-26074. Feb. 2001. July 2003.
- ORION (Object Rich InformatiOn Network). IST-2001-39122. July 2002. June 2003.
- "MINERVA" (MInisterial NEtwoRk for Valorising Activities in digitisation) IST-2001, March 2002 – Feb. 2005.
- "Culture tech", EU-INDIA Cross Cultural Project, January 2004 - December 2006.
- "ECRYPT", European Network of Excellence in Cryptology, 6th Framework EU Projects, Feb. 2004 – Jan. 2008.
- "BRICKS", (Building Resources for Integrated Cultural Knowledge Services) Integrated Project, 6th Framework EU Projects, Jan. 2004 – June 2007.

University of Ljubljana is or has been involved in:

- IST Content4All, "Cross-platform Tools for Community Content Publishing", September 2004 – November 2006
- IST Tiramisu, "The Innovative Rights and Access Management Inter-platform SolUtion", November 2003 – November 2005
- IST P2People, "P2P "Common Interests" Search Engine and Collaboration Platform", Jula 2002 – January 2004.
- IST Share It, "Content Sharing in home-to-home networks", December 2001 – February 2004
- IST Muffins, "MUltimedia Framework For INteroperability in Secure (MPEG-21) environments", July 2002 – December 2003
- IST MyTV "Personalized Services for Digital Television", January 2000 – December 2001
- P0-0515-1538, "Algorithms and applications for digital multimedia signal and data transmission and processing", national research programme, January 1999 – December 2003.
- P2-0246, "Algorithms and optimization methods in telecommunications., national research programme", January 2004 – December 2008.
- National and industry projects with local partners like Iskra Sistemi, National Blood Transfusion Centre etc.

6.5 **Transfer of results**

TU Kosice and TU Budapest are members of National Commission for normalization and standardization in the field of multimedia.

7. **ECONOMIC DIMENSION**

Participating entities per participant could be estimated as:

- o 1 scientist .... 60,000 EUR
- o 1/2 technician ..... 20,000 EUR
- o 2 Ph.D. students . 60,000 EUR
- o 1/5 secretary .... 8,000 EUR

148,000 EUR

The amount for (2001-02) full costs of all participants together could be estimated to 22 x 148,000 = 3,256,000 EUR. This is the overall estimated resource requirement of the participating institutions.

The amount for (2002-03) full costs of all participants together could be estimated to 22 x 148,000 = 3,256,000 EUR. This is the overall estimated resource requirement of the participating institutions.

The amount for (2003-04) full costs of all participants together could be estimated to 23 x 148,000 = 3,404,000 EUR. This is the overall estimated resource requirement of the participating institutions.

The amount for (2004-05) full costs of all participants together could be estimated to 25 x 148,000 = 3,700,000 EUR. This is the overall estimated resource requirement of the participating institutions.

The funds received from the Commission for each year and for the entire duration of the action, along with those utilized for each item are listed below:

Funds received:

	1st year	2nd year	3rd year	4th year	Total
Secretariat	8000	12000	18000	18000	56000
Publications	0	3000	6000	0	9000
Workshop and Seminars	10000	10000	10000	5000	35000
MC meetings	17000	33000	17761(*)	46800	114561
Short Terms missions	6000	6000	6000	8000	26000
Other	0	0	0	0	0
Total	41000	64000	57761	77800	240561

Funds utilized:

	1st year	2nd year	3rd year	4th year	Total
Secretariat	8000	12000	18000	18000	56000
Publications	0	2231,58	2180,96	0	4412,54
Workshop and Seminars	7189,36	5780,30	4452,76	4994	22416,42
MC meetings	18906,20	19967,62	16627,91	43304,01	97995,74
Short Terms missions	0	6000	11145	9750	26895
Other	0	0	0	0	0
Total	34095,56	45979,50	52406,63	76048,01	208529,70

(*) It does not include a special funding of 18.039 € to cover travel expenses and daily allowances during the transition period from the EC to the ESF. Only 11740,11 € out of this amount was used (to reimburse expenses at 5th workshop in Prague and 1st WG coordination meeting, in Ljubljana).

8. SELF EVALUATION

The COST #276 consortium has been constituted by an important group of research teams with a strong background in signal, image and video processing technologies (which is reflected on the wide amount of publication results concerning long term basic research in these technologies). Over the past years, the groups became conscious of the importance of (1) integrating basic technologies to build advanced multimedia systems, and (2) shifting the main focus from data and information, to users and knowledge. Most partners are involved in the application of basic technologies to multimedia communication scenarios where users may need to search, share, provide or access to information and knowledge, and servers and terminals should be equipped with recognition and interpretation capabilities: e-learning, medicine, cultural heritage, etc. New scenarios require integrating technologies, and this requires integrating the research expertise of different groups.

With this starting point, the consortium tackled information and knowledge management problems from the basis of powerful multimedia information processing tools. COST#276 has been an opportunity for researches to interchange new results on basic technologies, and to contact researchers with some expertise in other multimedia technologies or applications. In this respect, each COST #276 Workshop was an excellent forum to present and discuss new results and ideas, and to identify complementary expertises and common interests. The importance of the latter should not be underestimated: besides any countable result of the Action period, COST #276 has played an essential role in the identification of key topics and potential partnerships that will be reflected in the joint cooperation of COST #276 research groups in upcoming project proposals.

In summary, from the scientific viewpoint, the amount and diversity of publication results emanated from the activity of the research groups shows that the main objective of COST #276 stated in the MOU, namely, to develop advanced multimedia data and knowledge management technologies for personal multimedia communication systems and services has been satisfactorily fulfilled.

The 4 year period has also served to learn some lessons to improve and take the maximum benefit of future cooperation projects. The importance of involving a critical mass of research groups with some activity on the main lines of the Action should be stressed. COST #276 was organized on 4 working groups in charge of the 4 main lines stated in the MOU, but the distribution of partners has not been completely balanced. The experience has shown that WG's with a critical mass of research

teams have taken the maximum benefit of the opportunities of the action, in terms of participation in Workshop, publication results, short term visits, and joint publications.

Short Term Scientific Missions have been identified as one of the key instruments to promote fruitful cooperation. Insofar as the cooperation possibilities were identified, the demand of STSMs increased (13 out of 18 short term missions were carried out during the second half of the Action period). The consortium has made an important effort to make these missions possible, as shown by the fact that the budget for STSMs was significantly surpassed during the 3rd and 4th years.

Here, we would again like to emphasise on the importance of COST Action instruments on building the network of research centres, in order to share common results and make complementary actions in a prosperous research area. In this sense, we understand COST as an incubator of visionary research directions, which is proven to be successful also in Action #276. For a concrete realisation of systems and solutions which might arose from these activities there exist numerous EU instruments; many Action partners are already using them intensively (as quoted in Section 6.4).

From the organizational point of view, COST #276 has been affected by the transition period from EC to ESF, as probably all other actions. Besides of this, maybe some lack of clarity in some aspects of the rules of procedure should be solved. As a guideline, simple, clear and fixed rules of procedure are very helpful to facilitate the management issues. The effort by ESF to establish fixed rules and conditions by including them as annexes to annual agreements is to be appreciated.

EVALUATION
9.1 Evaluation panel and evaluation procedures

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The evaluation was based on the examination of the documents available at the websites of COST Action 276 and of the Action's Final Report and was conducted by using e-mail. The Final workshop and the final MC Meeting in Trondheim in Norway were attended by Marko Jagodic and Afonso Ferreira.

9.2 Results versus objectives

The main objective of the Action was to develop advanced multimedia data and knowledge management technologies for personal multimedia communication systems and services, including specific signal processing and implementation techniques for users' personal terminals. In addition, some critical system features were examined, like system integration and personification of services, enhanced by implementation trials and demonstrations of advanced personal services.

The obtained results do not only match the objectives outlined at the start of the Action, many of them do reach beyond the originally set goals thus proving the decision to take on this Action was correct. The Action also provided exceptional opportunities for active exchange of ideas and solutions among the experts from many different R&D areas: information and computer science, telecommunications, fundamental signal processing and VLSI hardware design. From the achievements reached it can be expected with great certainty that many of them will be realized as very important if not essential parts of future communication systems.

All the achievements were very well documented and disseminated through publishing in journals, in proceedings of conferences and workshops and also through the book issued by Kluwer Academic Publishers, although this latter was mainly a dissemination activity stemming from the previous Action COST 254.

9.3 Outcome and achievements

The converging worlds of telecommunications, broadcasting and the Internet enable the introduction of very valuable and helpful new services. In order to make the delivery of such services to end users simple, efficient, and secure requires extremely capable multimedia content management as well as new supporting technologies. For real-time metadata extraction, feature matching and multimedia transcoding, new signal processing methods are needed. Advanced signal processing methods would also significantly simplify the management of digital rights. Data hiding algorithms, usually used as a hidden embedded signature of multimedia objects, have potential to carry other relevant information about the object in question. And last but not least the computing efficiency and power consumption of devices, especially the mobile ones, should be continuously improved.

The participants in the Action not only succeeded to carry out the basic research in every of the above mentioned areas, but also to integrate the acquired knowledge into some very innovative multimedia communication applications. The areas with the most significant achievements are the following:

— image retrieval: new low-complexity image matching and retrieval methods operating in the compressed domain; image retrieval systems that learn from user interaction
— P2P systems: interactive services based on a serverless topology; information retrieval applications of P2P multi-agent systems
— e-learning: knowledge structures for student modelling for multimedia education platform; the application of multimedia communications to e-learning management

— intelligent agents in telecommunications: overview and status analysis
— multi-agent pull and push of information: overview and status analysis
— personalised data management services: the medical applications on patient databases

— basic methods: feature extraction using analogue Gabor filters; invariant image recognition system based on the trace transform; shape description, image understanding and recognition
— interfacing and personalization methods: interfaces in grid environments; management of personalised service response in a heterogeneous communication environment; information management in biometric identification systems
— hardware implementation techniques: hardware-oriented algorithms and circuits for low-power motion estimation and deinterlacing; motion estimation for MPEG4 based on object trajectory; low-complexity architectures and algorithms for motion estimation
— application-driven interfaces: personalized interfaces in smart cars; personalised interfaces for blood transfusion control in medical applications; personalized interfaces for distance education

— watermarking: audio watermarking; image watermarking for image authentication; data hiding algorithms for medical image authentication and labelling; data hiding algorithm for H.264 video stream
— image analysis and processing: the use of MPEG-7 descriptors for the strip content description, edge detection algorithms on cultural heritage images; Transco ding technology based on JPEG 2000
— video processing: low-bit rate video compression method using 3D wavelet transform and SPIHT algorithm; spatial-temporal segmentation for real rigid-object tracking; a new noise reduction system for video sequences
— general signal processing: stochastic 2-D models for texture analysis and synthesis; analysis of autoregressive parameter estimation in a noisy environment for speech enhancement and coding; the initiation of knowledge-based signal processing methods

Important results of the Action were published and well disseminated through papers, presentations and reports in world wide known journals, at international conferences and workshops (see point 9.7 for a more detailed overview of dissemination). Some were also part of the book "Intelligent Integrated Media Communication Techniques"

issued by Kluwer Academic Publishers, which contained chapters stemming from the previous Action COST 254.

9.4 Impact of the Action

It happens very seldom that such a variety of scientist and engineers get together to share a vision and to pursue the same direction of research and development. The result was a rather unique network of scientists and R&D institutions not only from Europe but also from other parts of the world with strong ambitions to continue their work together. Their influence on the future development of smart multimedia communication systems in Europe will be substantial and will undoubtedly help to improve the industrial competitiveness of European industry in this area

9.5 European added-value

The COST framework is an almost ideal long-term research vehicle to prepare ground to generate and systematically test new ideas and also try to realize them to the extent they can be used as a basis for the development of new products. It enables the participating research institutions to pool resources in a way that would not be possible otherwise. This has been the case also with COST 276 Action. The achievements of COST 276 already have had a positive impact on projects within FP5 and FP6. A sample list of such projects:

— IST P2People, "P2P "Common Interests" Search Engine and Collaboration Platform", July 2002 - January 2004.
— IST Content4All, "Cross-platform Tools for Community Content Publishing", September 2004 - November 2006
— IST Tiramisu, "The Innovative Rights and Access Management Inter-platform SolUtion", November 2003 - November 2005
— IST Share It, "Content Sharing in home-to-home networks", December 2001 - February 2004
— IST Muffins, "MUltimedia Framework For INteroperability in Secure (MPEG-21) environments", July 2002 - December 2003
— ORION (Object Rich InformatiOn Network). IST-2001-39122. July 2002. June 2003.
— MINERVA (MInisterial NEtwoRk for Valorising Activities in digitisation) IST-2001, March 2002 - Feb. 2005.
— ECRYPT, European Network of Excellence in Cryptology, 6th Framework EU Projects, Feb. 2004 - Jan. 2008
— BRICKS, (Building Resources for Integrated Cultural Knowledge Services) Integrated Project, 6th Framework EU Projects, Jan. 2004 - June 2007.

This may well continue within the FP7. The dissemination of results through the Action workshops was essential for faster synergy with other forms of the European research in the IST and related areas.

9.6 Coordination and management

This kind of Action with 25 participating institutions from 18 countries can be successful only in the COST type of the research framework. It provides the necessary flexibility to maintain the initial R&D direction in spite of incidence of disrupting interests caused by changes in the objects of research which were difficult to predict at the beginning of the Action. Combining MC meetings with workshops showed to be very useful tool to cope with this kind of problems. Short-term scientific missions (17) proved to be also useful for the overall coordination of the Action.

The MC was quite efficient in the management of COST 276 Action despite sometimes rather difficult coordination of diverse interests and risks involved. The Chair of the MC gave the impression that he was overloaded sometimes, even missing the crucial last TIST Annual Review Meeting in June/July 2005. The intelligent use of the inherent flexibility of the COST research framework and modes of operation helped considerably in this respect.

9.7 Dissemination of results

The dissemination of results of COST 276 Action was wide spread and quite efficient in the form of scientific reports and of papers published in well known international journals as well as in conference and workshop proceedings. The exchange of information on achieved results among signatories of the Action was done predominantly through active participation at the workshops of the Action (8 workshops with 183 presentations) while the diffusion to others and around the world was carried out mainly through participation at the international conferences and workshops (83 presentations at more than 20 events also in form of special sessions) and through papers published in the international journals and magazines (9 publications, all stemming from Italian researchers). It was noted that the Final Report mistakenly reported a journal paper from 1999 and an Internal Report as a journal publication. Finally, it seemed very strange that only the Italian partners within the Action were able to publish their results in international journals.

The Action had 2 websites (http://cyberspace.mht.bme.hu/cost/cost276 and http://cost276.fe.uni-lj.si) containing most of the relevant information and documents, part of it confidential and open only to the participants of the Action. WG 4 had in addition its own website http://www.tsi.u-bordeaux1.fr/Cost276/COST.html. Unfortunately, this proliferation of websites made it very difficult to find useful information concerning the Action. A better managed, central website would have been preferable.

Very important achievement is also the book "Intelligent Integrated Media Communication Techniques" issued by Kluwer Academic Publishers, which is, however, partly based on the results of COST 254 Action. The book is an excellent message to the world-wide scientific community involved in research of intelligent communication techniques for integrated media.

9.8 Strengths and weaknesses

The most important strength of the Action is the multitude of achievements in information and knowledge management supporting integrated media communications, resulting in abundance of new promising ideas calling for further research, development and implementation in marketable products.

Equally important strength is established network connecting not only researchers, developers and industry but also quite different subject areas trying to find really new solutions by integrating the multiplicity of knowledge, experience and insight,

Inability to focus on fewer topics and more in-depth research into a smaller selection of research subjects could be considered as a weakness. The above mentioned multitude of achievements makes it very hard to judge the real added value of the Action. Indeed, the list of publications gives the impression that the Action was just an uncoordinated collection of a multitude of researchers.

It should be noted, though, that such focussing may have been difficult with so many different players working together for the first time. Among 19 signatories of COST 276 Action only 8 were also signatories of COST 254 Action which can be considered as the forerunner for a part of the Action 276 research programme. More exact focussing may be easier to realize with a tighter management in a follow up Action and in other European R&D projects like FP7 and similar.

9.9 Recommendations

The participants of COST 276 Action already prepared a proposal for a new COST Action in the area of content understanding for smart multimedia systems. The choice of the research subject is a good one because content understanding in the sense of automatic content recognition, descriptor creation and adaptive user modelling is still not well enough explored and understood problem in the development of multimedia communication services.

The achieved results of the Action speak for an integrated research effort in the area of information and knowledge management for multimedia communications. On the other hand, they also show that such effort must be very focussed and well coordinated.

10 TC REMARKS

As it is stated in the MoU the Action was oriented towards long-term basic research while recognizing the iterative nature of developments in this field due to the rapid development cycles of new technologies. Therefore the aim of the Action was not to come up with an integrated and working demo of all the technologies tested but rather to develop a vision of future application possibilities based on these technologies and to build a network of competent R&D institutions and individuals capable and strong enough to create ground-breaking applications with good industrial potential.

With this in mind the success story is the creation of such an R&D network within Europe capable of competing with the rest of the world in the area of information and knowledge management for integrated media communications the importance of which is continuously growing world wide.