Knowledge Space of Semantic Inference for Automatic Annotation and retrieval of Multimedia Content – K-Space

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Abstract—**K-Space is a network of leading research teams from academia and industry conducting integrative research and dissemination activities in semantic inference for automatic and semi-automatic annotation and retrieval of multimedia content. K-Space exploits the complementary expertise of project partners, enables resource optimization and fosters innovative research in the field.**

Index Terms— **Semantic Inference, digital media processing.**

I. INTRODUCTION

K SPACE is a network of leading research teams from academia and industry conducting integrative research and dissemination activities in semantic inference for semi-automatic annotation and retrieval of multimedia content. K-Space exploits the complementary expertise of project partners, enables resource optimization and fosters innovative research in the field.

The aim of K-Space research is to narrow the semantic gap between low-level human content descriptions that can be computed automatically by an machine and the richness and subjectivity of semantics in high-level human interpretations of audiovisual media: The Semantic Gap. Specifically, K-Space integrative research focus on three areas: Content based multimedia analysis; Knowledge extraction and Semantic multimedia.

An objective of the Network is to implement an open and expandable framework for collaborative research based on a common reference system. K-Space research activities are designed to integrate basic research in semantic web technologies, multimedia processing, information retrieval, resource management in heterogeneous networks, semantic inference, user modelling and interaction with technological development by producing software platforms and open libraries that will be available to the cross and multimedia scientific forum, thereby achieving vertical integration.

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Horizontal integration is achieved by integrating, for a purpose, what can be disparate disciplines including image processing, information retrieval, human computer interaction and industrial activities and inclusion of the wider community is achieved through joint training schemes, joint workshops and joint education tools and courses as well as access to much of the resources such as platforms and data.

To achieve these ambitious objectives K-Space brings together a critical mass of 14 leading research institutions from 9 different countries across Europe. Each partner brings unique expertise and skills which overlap or complement to each other. The main strength of the consortium is the unification of the partners to build a Network focusing on research areas that partners will benefit from dedicated and strong integration efforts. The consortium expertise represents the know-how, commitment and competence that is absolutely necessary to undertake the technical, dissemination and further integration aspects of the Network of Excellence (NoE).

The K-Space consortium consists of Queen Mary University of London (Coordinator, UK), Universitaet Koblenz-Landau (Germany); Joanneum Research Forschungsgesellschaft mbH (Austria); Centre for Research and Technology Hellas (Greece); Dublin City University (Ireland); Centrum voor Wiskunde en Informatica (The Netherland); Groupe des Ecoles des Telecommunications (France); Institut National de l'Audiovisuel (France); Institut Eurecom (France); Univeristy of Glasgow (UK); German Research center for Artificial Intelligence (Germany); Technische Universitat Berlin (Germany); Ecole Polytechnique Federele de Lausanne (Switzerland); University of Prague (Czech Republic)..

II. OVERVIEW OF JOINT RESEARCH ACTIVITIES

The joint research activities of the network are aimed at convergence and resources optimization by exploiting important multidisciplinary aspects of multimedia knowledge extraction. This will be achieved by linking research efforts over the following three research clusters underpinning the K-Space framework.

A. Content – based multimedia analysis:

Research into tools and methodologies for low- and medium-level multimedia content analysis will be conducted. The target is to tackle the semantic gap in a bottom up approach, i.e. adapting low-level techniques for knowledge based multimedia analysis. For the results of these analysis algorithms suitable descriptor schemes for MPEG – 7 or other appropriate description standards will be developed. The research activities in this area include: Content Structuring; Moving 2D and 3D Object segmentation and Indexing; Audio/Speech Processing and Text Analysis; and Content Description. The outcome of this research activity will be tools and methodologies for low-level signal processing, object segmentation audio processing, text analysis, and audiovisual content structuring and description.

B. Knowledge Extraction

This research activity aims at studying techniques for the semantic analysis, annotation and retrieval of multimedia content The overall approach will be based on knowledge assisted content analysis and annotation using a multimedia ontology infrastructure. More specifically, semantic and low-level attributes of the objects to be objects to be detected in combination with appropriately defined rules. Semantic concepts within the context of specific domains will be defined in Ontologies, extended with qualitative attributes of the semantic objects (e.g. colour homogeneity), multimedia processing methods (e.g. colour clustering), and numerical data or low-level features (e.g. colour models, also defined in the ontology). Semantic Web technologies will be used for knowledge representation including rules to describe how tools for multimedia analysis should be applied according to different object attributes and low-level features. Areas of study include: Specification of a Multimedia Ontology Infrastructure; Knowledge assisted Multimedia Analysis; Multimedia reasoning and annotation; Context based Multimedia Mining; Intelligent User Relevance Feedback.

C. Semantic Multimedia

This research activity will focus on using and extending semantic web technologies in order to respond to the needs of multimedia analysis and knowledge extraction and thus, to facilitate the bridging the semantic gap. The rationale behind the approach is that a purely bottom up will not be sufficient to close the semantic gap, because a lot of knowledge around the use and context of multimedia sources is needed around the use and the context of multimedia sources is needed in order to bridge between low-level multimedia features and the pragmatics of its use. Research is structured along four tasks:

- Represent semantic metadata, user experience and needs to obtain bottom – up results and user context.
- Investigate how people interact with multimedia in order to derive new semantic characterizations, which may be exploited in the life cycle of the multimedia data.
- Extract knowledge from complementary sources (such as subtitles of movies or web-sites of similar multimedia

data) in order to derive additional semantic characterizations.
- Provide a mechanism to handle such additional context based characterizations, i.e. constructing, representing, querying and using them.

III. INTERMAG CONFERENCE-RELATED PAPERS

The networking and distributed interaction between partners modules is supported by suitable interfaces, database management and networking tools. The integration of these tools builds the K-Space communication infrastructure. The project will put in place the necessary software and network interfaces required to ensure that every partner has access to the research resources of other partners. In order to achieve this, the project will seek to leverage the outputs from other EU projects namely AIM@SHAPE and 3DTV. The output of this activity can be thought of as the physical instantiation of the K-Space. It will consist of distributed repositories of partners software, test data and results accessed via a central portal that supports remote use of these resources. The design, instantiation and maintenance of the distributed environment will be the full-time responsibility of a K-Space system administrator who will lead these activities supported by dedicated effort from all partners. Some of the technologies that will be considered in this activity are XML-based technologies, such as those recommended by the Web Services Activity of the W3C, Web services, JBoss etc.

IV. K-SPACE DISSEMINATION ACTIVITIES

Dissemination will be achieved by the usual mechanisms of research papers but also by issuing training material and tutorials on key topics. A thematic book will be published at the end of the funding period. Several dissemination forums, standardization bodies, international conferences and exhibitions have been identified and are targeted as part of the dissemination activities of the network. The International Conference on Semantic and Digital Media Technologies (SAMT) is the main yearly event of the Network. The main goal of this activity is to consolidate a key event in the area at European level and beyond. One important objective of this activity is to broaden participation to the point where it becomes a main conference with wide participation. The vision for SAMT is to become "The" conference in the area attracting most relevant technical papers and presentation world-wide, which is one of the important long-term legacies of K-Space.