

The *K-Space* Network of Excellence: on the Way to 'Semantic' Multimedia

Research Project Presentation

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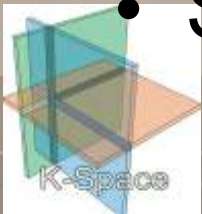
Agenda

- Basic data about the project
- Main research directions
- Integration and dissemination activities
- Selected research achievements



K-Space project status

- FP6 IST project – Network of Excellence
- Started Jan 1, 2006, ends Dec 31, 2008
- Total EU funding 5.55 MEuro
- 14 partners (UK,FR,DE,AT,CH,IR,NL,GR,CZ)
 - 7 universities
 - 6 public research centres
 - 1 content provider
- Website: <http://www.kspace-noe.net>
- See also flyer available in paper form



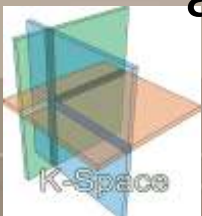
K-Space main focus

- Bringing the semantic web and multimedia communities closely together
- This is reflected in the structure of technical WPs
 - WP3 Content-based multimedia analysis
 - Proceeding from low-level video/audio/image analysis to simpler semantic descriptors (esp. MPEG-7)
 - WP4 Knowledge extraction
 - From semantic object detection to application of high-level concepts (ontologies) and follow-up inference using rules
 - WP5 Semantic multimedia
 - Development of Semantic infrastructure relatively independent of media type, such as RDF stores and language extensions
 - WP6 Integration of software tools
 - Esp. wrt. joint participation in the TRECVID contest



Non-technical activities

- **Academic exchanges** of PhD students and researchers
- Temporary placements of PhD students to **industrial** environments
- Repository of **teaching resources**
- Organisation of an annual **conference** (called SAMT), **summer school** (called SSMS) and joint **Master/PhD programme**
- Dissemination of results using, among other, a six-monthly **newsletter (available!)**
- Joint contribution to **standards** (W3C, MPEG, JPSearch)
- Establishment of a permanent **scientific society** for this area, called SMaRT



Role of Czech partner

- The Czech partner, University of Economics, Prague
 - is involved in 3 out of 4 technical WPs
 - coordinates 3 tasks ('sub-WPs')
 - industrial placement of PhD students
 - research on exploiting textual resources complementary to multimedia
 - dissemination via newsletter, poster and brochure
 - contributes to 9 out of 16 technical tasks



Research achievements

- Follows a selection of research outcomes of K-Space, with special regard on activities in which UEP is heavily involved
 - Design of a system of multimedia ontologies
 - Semantic merging of image regions using fuzzy rules
 - Mining web resources complementary to sports video
 - Intra-frame similarity computation using LSI
 - Two additional research streams are presented at this conference in the form of posters
 - Kolínský, Nemrava, Svátek: *Ukladanie výsledkov extrakcie informácií do IPTC hlavičiek športových obrázkov*
 - Schenk, Petrák: *Sesame RDF Repository Extensions for Remote Querying*



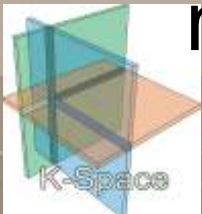
Multimedia ontology

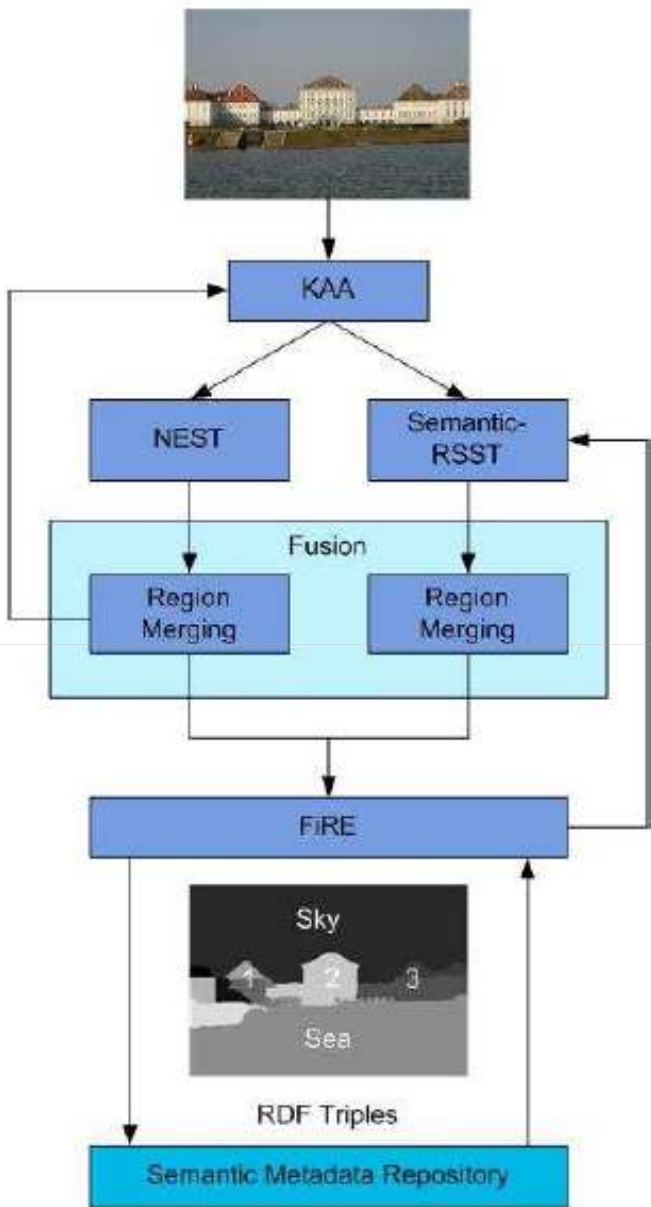
- The COMM (core ontology for multimedia) has been designed according to the following principles
 - Compliance with MPEG-7 standard
 - Suitability for semantic web reasoning
 - Adoption of patterns from foundational ontologies (DOLCE)
 - Modularity, extensibility (for different media and domains)
- Used in the KAT annotation tool
 - Different MM objects can be manually or semi-automatically annotated according to COMM



Semantic region merging

- In image analysis, different regions are automatically identified, and assigned semantic classes according to their low-level properties
- UEP's rule-based system NEST is used to evaluate the similarity between adjacent regions based on the initial segmentation and fuzzy labeling of regions
- Its results are then used for merging the most similar regions





Semantic region merging



Znalosti 2008, Bratislava



Semantic region merging



Znalosti 2008, Bratislava



Semantic region merging

Questionnaire - A_06_7x8NDomSim_compositional_w04w01w-02.xml

Attributes

+ A cliff	n	0,457
+ A sand	n	0,561
+ A sea	n	0,481
+ A sky	n	0,868
+ A plant	n	0,430
+ A person	n	0,075
ANorth1 cliff	n	
ANorth1 plant	n	
ANorth1 person	n	
ANorth1 sand	n	
ANorth1 sea	n	
ANorth1 sky	n	
ANorth2 cliff	n	
ANorth2 plant	n	
ANorth2 person	n	
ANorth2 sand	n	
ANorth2 sea	n	
ANorth2 sky	n	

What is the value of numeric attribute
A_cliff

Value:

Give the value in the range!

Why

Save answers

Certainly yes

Irrelevant

Certainly no

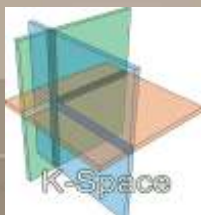
Unknown

Postpone Answer

Confirm Answer

OK

Case description
segment2: South1(segment6), West1(segment8),
NorthEast1(segment3)



Semantic region merging

Result - A_06_7x8NDomSim_compositional_w04w01w-02.xml

Propositions

Name	Min weight <	Max weight	Status	Type	Comment
SIMILAR(A_AWest1)	0,699	0,699	final	goal	
SIMILAR(A_ANorthEast1)	0,300	0,300	final	goal	
SIMILAR(A_ANorth1)	0,000	0,000	final	goal	
SIMILAR(A_ANorth2)	0,000	0,000	final	goal	
SIMILAR(A_ANorth3)	0,000	0,000	final	goal	
SIMILAR(A_ANorth4)	0,000	0,000	final	goal	
SIMILAR(A_ANorth5)	0,000	0,000	final	goal	
SIMILAR(A_ANorth6)	0,000	0,000	final	goal	
SIMILAR(A_ANorth7)	0,000	0,000	final	goal	
SIMILAR(A_ASouth2)	0,000	0,000	final	goal	
SIMILAR(A_ASouth3)	0,000	0,000	final	goal	
SIMILAR(A_ASouth4)	0,000	0,000	final	goal	
SIMILAR(A_ASouth5)	0,000	0,000	final	goal	
SIMILAR(A_ASouth6)	0,000	0,000	final	goal	
SIMILAR(A_ASouth7)	0,000	0,000	final	goal	
SIMILAR(A_AEast1)	0,000	0,000	final	goal	
SIMILAR(A_AEast2)	0,000	0,000	final	goal	
SIMILAR(A_AEast3)	0,000	0,000	final	goal	
SIMILAR(A_AEast4)	0,000	0,000	final	goal	
SIMILAR(A_AEast5)	0,000	0,000	final	goal	
SIMILAR(A_AEast6)	0,000	0,000	final	goal	
SIMILAR(A_AEast7)	0,000	0,000	final	goal	

Comment

Show
 Goals
 All propositions

Change answers

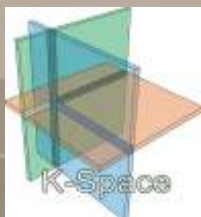
How

Show
 only positive
 only negative
 all

Export results

Save answers

Close



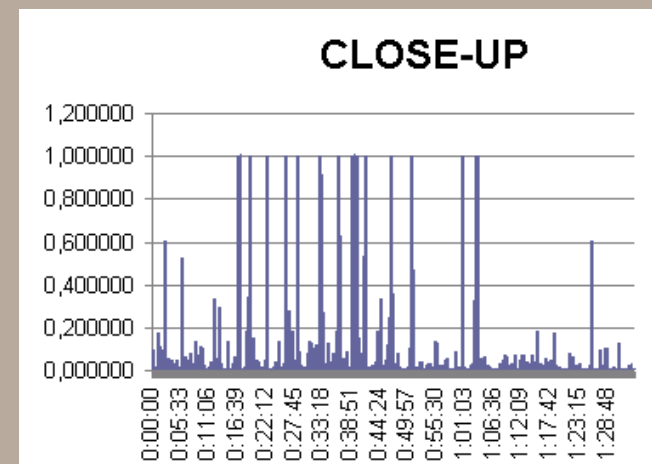
Mining complementary resources

- For a given video (or image) there are typically various resources providing complementary information, e.g.
 - captions, subtitles
 - speech transcripts
 - web texts describing the same event or dealing with the same topic
- The application in the football domain attempts to combine
 - analysis of audio/visual signal
 - text detection and OCR in the video
 - mining online match reports
 - ontology-based reasoning (fuzzy description logics) over the concepts thus detected



Analysis of complementary resources

- Audio/video analysis
 - 6 available detectors
 - Crowd image
 - Speech-Band Audio Activity
 - On-Screen Graphics Tracking
 - Motion activity
 - Close-up
 - Field Line orientation



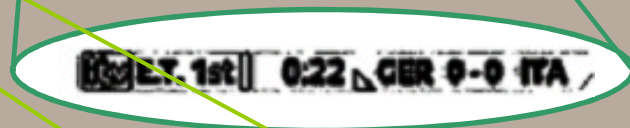
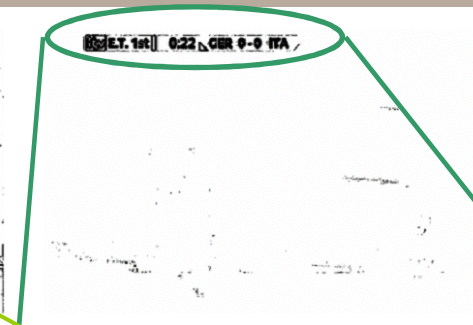
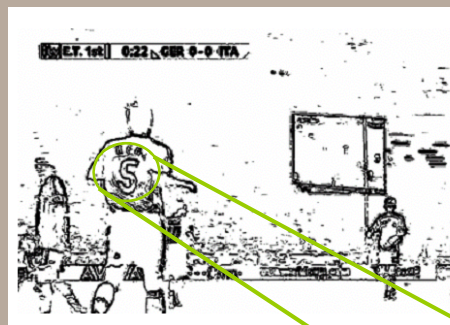
	CROWD	AUDIO	LINE	MOTION	CLOSE-UP
0:18:37	0,000000	0,369307	6	0,215026	0,000924
0:18:38	0,000000	0,369307	2	0,354922	0,000000
0:18:39	0,000000	0,214665	8	0,318653	0,000063
0:18:40	0,000000	0,214665	4	0,305699	0,000821
0:18:41	0,000000	0,228942	16	0,937823	0,000000
0:18:42	0,000000	0,561879	18	0,707254	0,006678
0:18:43	0,000000	0,561879	18	0,145078	0,000000
0:18:44	0,000000	0,561879	18	0,212435	0,003646
0:18:45	0,000000	1,000000	18	0,194301	0,000000



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Analysis of complementary resources



- Text detection and OCR analysis
 - mainly used to synchronise video time with match time



Analysis of complementary resources

- Tabular resources
 - Basic Match Information
 - List of players, goals, cards, etc.
 - Meta Information
 - Location, Attendance, Date, etc.

Match Stats: Italy v France

Match 64
World Cup Final
Date: Sun 9th Jul 20:00 (GMT+0200)
Venue: Berlin
Attendance: 69000

 **Italy** (1) (1) 1 aet [5 pen]
19 **Materazzi**, Marco


01 **Buffon**, Gianluigi
19 **Zambrotta**, Gianluca 
05 **Cannavaro**, Fabio
23 **Materazzi**, Marco
03 **Grosso**, Fabio
16 **Camoranesi**, Mauro (86 Del Piero)
21 **Pirlo**, Andrea
08 **Gattuso**, Gennaro
20 **Perrotta**, Simone (61 Iaquina)
10 **Totti**, Francesco (61 De Rossi)
09 **Toni**, Luca

Substitutes

15 **Iaquinta**, Vincenzo
04 **De Rossi**, Daniele
07 **Del Piero**, Alessandro

Match Officials

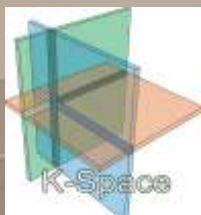
Referee: ELIZONDO Horacio (ARG)
Assistant 1: GARCIA Dario (ARG)
Assistant 2: OTERO Rodolfo (ARG)
4th Official: MEDINA CANTALEJO Luis (ESP)
5th Official: GIRALDEZ CARRASCO Victoriano (ESP)

 **France** (1) (1) 1 aet [3 pen]
7 **Zidane**, Zinedine (pen)

16 **Barthez**, Fabien
19 **Sagnol**, Willy 
15 **Thuram**, Lilian
05 **Gallas**, William
03 **Abidal**, Eric
22 **Ribery**, Frank (100 Trezeguet)
04 **Vieira**, Patrick (56 Diarra)
06 **Makelele**, Claude 
10 **Zidane**, Zinedine 
07 **Malouda**, Florent 
12 **Henry**, Thierry (107 Wiltord)

Substitutes

18 **Diarra**, Alou
20 **Trezeguet**, David
11 **Wiltord**, Sylvain



Analysis of complementary resources

- Information extraction from web-based minute-by-minute reports



3. Min. Erster Schuss zum Warmwerden für Jens Lehmann: Totti mit einem Freistoß aus 40 Metern. Der deutsche Keeper sagt "Danke" und pflückt die Kugel gelassen aus der Luft.

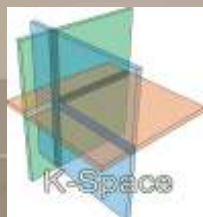


MATCHINFO

id	rule
MIO	playeraction_2

OUT:s_playeraction

INMATCH	s_match	
SPORTACTIONLOC	sportgeographicarea	
SPORTACTIONPOINT	sa_point	
CONFIDENCE	90	
SPORTACTIONOBJ	sportevent	
COMMITTEDON	s_footballplayer	
SPORTACTIONTYPE	pass	
SPORTACTIONDESCR	"beautiful pass"	
COMMITTEDBY	s_footballplayer	"Gullit"



Analysis of complementary resources

- Cross-media analysis using fuzzy description logic

$$\begin{aligned} \mathcal{T} = \{ & \text{Goal} \equiv \text{Scoregoal} \sqcap (\exists \text{consistOfAudio}), \\ & \text{LongPass} \equiv (\text{Pass} \sqcup \text{Kick} \sqcup \text{Shot}) \sqcap (\exists \text{consistOfMotion}), \\ & \text{CornerKick} \equiv \text{Cornerkick} \sqcap (\exists \text{consistOfMotion}) \sqcap (\exists \text{consistOfEndOfField}), \\ & \text{SubstitutionD} \equiv \text{Substitution} \sqcap (\exists \text{consistOfMotion}) \sqcap (\exists \text{consistOfMiddleField}), \\ & \text{HardFoul} \equiv \text{Booked} \sqcap (\text{Foul} \sqcup \text{Tackle}) \\ & \quad (\exists \text{consistOf} \sqcap (\text{CloseUp} \sqcup \text{Audio})), \\ & \text{OffSide} \equiv \text{Offside} \sqcap (\exists \text{consistOfEndOfField}), \\ & \text{ScoringOpportunity} \equiv \text{Scoringopportunity} \sqcap (\exists \text{consistOfEndOfField}) \\ & \quad \sqcap (\text{Clear} \sqcup \text{Shot} \sqcup \text{Kick} \sqcup \text{GoalKeeperDive} \sqcup \text{Block} \sqcup \text{Save}), \\ & \text{ScoringOpportunityFoul} \equiv \text{ScoringOpportunity} \sqcap \text{Foul}, \\ & \text{ScoringOpportunityCornerKick} \equiv \text{ScoringOpportunity} \sqcap \text{CornerKick} \} \end{aligned}$$


Intra-video similarity

- In the TRECVID contest, a part of the task is to detect the similarity of frames within one broadcast, so as to identify e.g. news shots from the same studio
- This is achieved by applying a similarity-measuring method based on LSI – Latent Semantic Indexing

Query formulation tool.



P1010121.JPG (1)



P1010120.JPG (0.92905)



P1010123.JPG (0.30908)



P1010122.JPG (0.73904)



P1010119.JPG (0.65435)



P1010104.JPG (0.64545)



P1010124.JPG (0.63674)



P1010143.JPG (0.6112)



P1010093.JPG (0.35934)



P1010130.JPG (0.30336)



P1010126.JPG (0.26658)



P1010094.JPG (0.26556)



P1010144.JPG (0.24506)



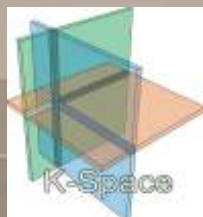
P1010139.JPG (0.23614)



P1010109.JPG (0.2253)

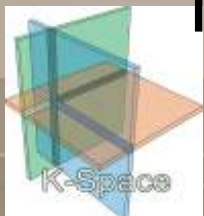


P1010127.JPG (0.20828)



Summary

- The K-Space project, during its first two years, produced a high number of research results that could immediately be adopted by more applicative projects
- The third year, 2008, is focused on even closer integration of research, and on supporting a smooth start of the SMaRT society, which is going to be a persistent follow up to K-Space



Thanks for your attention

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

Home Objectives Results Partners Links Repository Contact **Member Login**

Headlines

- 4th K-Space Newsletter
- 1st K-Space Jamboree Workshop
- K-Space Summer School 2007
- 3rd Newsletter of K-Space
- 2nd Newsletter of K-Space
- [Click here for previous headlines](#)

SAMT - 2007

The 2nd international conference on Semantics And digital Media Technologies (SAMT) will be held in Genova from the 5th to the 7th December 2007, at the Jolly Hotel Marina. The international conference on Semantics And digital Media Technologies (SAMT) targets to narrow the large disparity between the low-level descriptors that can be computed automatically from multimedia content and the richness and subjectivity of semantics in user queries and human interpretations of audiovisual media - The Semantic Gap.

SAMT started out as two workshops, EWIMT 2004 and EWIMT 2005, that quickly achieved enormous success in attracting high-quality papers and over 100 participants from across Europe and beyond. Last year EWIMT turned into the full-fledged conference SAMT, addressing integrative research on new knowledge-based forms of digital media systems. SAMT brings together those forums, projects, institutions and individuals investigating the integration of knowledge, semantics and

Student of the month - January

Simon Schenk

Simon Schenk is a research and teaching assistant at the Information Systems and Semantic Web Group of University of Koblenz-Landau. He is working towards his PhD degree under the supervision of Prof. Dr. Steffen Staab. Before, he has worked as a consultant for Capgemini. He studied at NORDAKADEMIE University of Applied Sciences, Germany and Karlstads Universitet, Sweden and received his diploma in Computer Science and Business Management from NORDAKADEMIE in 2004. His diploma thesis about Peer-to-Peer Applications for knowledge management was awarded the *Innovation Award 2005* by CeBit, Steria Mummert Consulting and Handelsblatt. In K-Space, Simon is the contact person for Koblenz University and leader of workpackage 5: semantic multimedia. His work is focused around querying and rule based reasoning with RDF data, using a mechanism called *Networked Graphs*. His work related to K-Space has been published at the following conferences: WWW 2006, ESWC 2006, KI 2007, I-KNOW 2006 and Znalosti 2008.

