ImageLab Group: Digital Library research directions

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ImageLab

Dipartimento di Ingegneria dell’Informazione
Università di Modena e Reggio Emilia, Italy
## DELOS involvement

- **Dipartimento di Ingegneria dell’Informazione**
  - **ImageLab** - imagelab.ing.unimo.it
    - Research group in Computer vision and Multimedia
  - **ISGroup** - www.isgroup.unimo.it
    - Information Systems Group

<table>
<thead>
<tr>
<th>Participants in DELOS</th>
<th>Expertise</th>
</tr>
</thead>
<tbody>
<tr>
<td>R. Cucchiara, A. Prati, C. Grana, R. Vezzani, G. Tardini</td>
<td>Computer Vision &amp; Pattern recognition, Multimedia: Universal Access, semantic transcoding, Medical Imaging</td>
</tr>
<tr>
<td>P. Tiberio, F. Mandreoli, R. Martoglia</td>
<td>Information Retrieval, XML-based indexing and query processing, NL processing</td>
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Previous experience: related projects

★ Annotation & (visual) knowledge extraction
  - 2004; (Ferrari S.p.A. Italy) “Annotation and access to Formula 1 Digital Library”
  - 2003-2004 (FCRM Italy) “Domotics for Disability”: indoor video-surveillance
  - 2004 (Australia Research Council) “Video systems supporting detection of offenders in public places”
  - 2003-2004 (Traficon, Belgium) “Vision systems for Highway traffic control”

★ Universal Multimedia Access
  - 2002-2003 (MIUR - Italy) “High performance video servers”
  - 2003-2005 (FIRB-Italy) “Performance evaluation of complex systems”

★ Medical Imaging
  - 2005-2006 (MIUR - Italy) “Automatic and Remote Diagnosis of Pigmented Skin Lesions”
  - 2002-2004 (Dept. Dermatology - Italy) “Color and shape analysis of dermatoscopic images” Content based retrieval from Image DB
  - 2003-2004 (Burnam Institute CA) Echocardiographic video classification

★ Digital Libraries
  - 2002-2004 (MIUR-CNR) “Enhanced content delivery”: xml query processing
**Tasks in Delos WP3**

- **Task 1**: Forum on Audio/Visual DLs
- **Task 2**: Demonstration and test bed
- **Task 3**: (visual/audio)Knowledge extraction, Semantic annotation, Metadata extraction
- **Task 4**: Information access, Interaction
- **Task 5**: Management of Audio/video content

Multimedia repository

Domain experts

Users

Annotated, DLs
Contribution of Unimore

Task 1 Forum on Audio/Visual DLs

Task 2 Demonstration and test bed DLs in public sectors and medical imaging

Task 3
- Computer vision techniques for automatic annotation
- Machine learning paradigms for experts’ knowledge integration
- Metadata description in MPEG 7
- An Integrated framework for object and event annotation

Task 4
- Universal access
- Semantic video transcoding
- Performance evaluation models

Task 5
- Efficient and effective techniques
- for NL and XML-based
- Query processing

Multimedia repository

Domain experts

Annotated DLs

Users

Università degli Studi di Modena e Reggio Emilia - ITALY
Dipartimento di Ingegneria dell’Informazione
Contribution of UNIMORE

★ **Task 1, 2** Forum, demonstration and test bed of Audio/Visual DLs:
  - in **public sectors** (traffic, surveillance, sport) and
  - **medical imaging** (dermatoscopic images, chirurgical videos)

★ **Task 3**: Semantic annotation and Metadata extraction
  - **Computer vision techniques** for automatic annotation (moving objects, color analysis)
  - Machine learning paradigms for experts’ knowledge integration (models for semi-automatic annotation)
  - Metadata description in MPEG 7 (experience in video surveillance)
  - **Object and event annotation**, performance evaluation and remote access
**Contribution of UNIMORE**

- **Task 4** Information access and user-DL interaction
  - A framework for Universal access and definition of user requirements and requests: content-based video adaptation with class of relevance
  - Semantic video transcoding at event and object level: definition of models and comparison
  - Performance evaluation models of user satisfaction
Examples in medical imaging DLs

1) the fruit-fly project
A video DB of echocardiography, automatically and semi-automatically annotated

2) Dermatoscopy
Analysis of color, shape, and spatial relation content-based retrieval (40,000 images)
Examples in surveillance DLs

Multimedia repository

Segmentation, annotation

Objects, Events

Annotation class of relevance management

Class of relevance

Domain experts

Annotated, DLs

Transcoding policy resolver
S-MPEG2, S-MPEG 4

Users, WSs, PhonesPDAs

Annotated, DLs

Objects, Events

Annotated, DLs

Transcoding policy resolver
S-MPEG2, S-MPEG 4

Class of relevance

Domain experts

Multimedia repository
Examples

Multimedia repository

Segmentation, people behavior annotation

Domain experts

Objects

A dog

Events

A person sitting
Examples

- **Experiments in Semi-automatic annotation:**
- Static, almost-static objects - manual MPEG7 annotation
- Moving objects and events - automatic annotation
- MPEG-7 parser
- Semantic transcoding
Examples

- Performance evaluation models with object based and event based semantic transcoding guided by user preferences

- An example: uncompressed 67 Mbps

<table>
<thead>
<tr>
<th>Format</th>
<th>Bit Rate</th>
<th>Signal-to-Noise Ratio (dB)</th>
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</thead>
<tbody>
<tr>
<td>MPEG-2</td>
<td>477 kbps</td>
<td>32.56 dB</td>
</tr>
<tr>
<td>S-MPEG 2</td>
<td>467 kbps</td>
<td>35.79 dB</td>
</tr>
<tr>
<td>MPEG-4</td>
<td>141 kbps</td>
<td><strong>31.71</strong> dB</td>
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<tr>
<td>S-MPEG 4-SP</td>
<td>146 kbps</td>
<td><strong>37.67</strong> dB</td>
</tr>
</tbody>
</table>

Same bit rate, different quality on events of interests

MPEG-4  
Semantic MPEG-4
Contribution of UNIMORE

★ **Task 5**: Management of Audio/video content

★ **Efficient evaluation of query trees in XML tree structured data collections.**
  - Use of tree signature and stack-based algorithms for an efficient tree navigation and tree matching.

★ **Definition of an EXample-based TRanslation Assistant (EXTRA) for Example-Based Machine Translation**
  - Use of techniques for word sense disambiguation in the context of ontology construction and ontology matching
  - Collaboration with LOGOS S.p.A.

★ **Techniques for query rewriting for semi-structured data in Digital Library**
  - Use of effective techniques based on both structural and semantic properties for search on multiple and topic related ontologies.
Contact

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★ D.I.I. Dipartimento di Ingegneria dell'Informazione

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