IMOTION
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IMOTION at a Glance

• Project Title
  Intelligent Multimodal Augmented Video Motion Retrieval System
  (IMOTION)

• Project Start and Duration
  January 1st, 2014 – December 31st, 2016 (3 years)

• Project Partners
  – University of Basel (UNIBAS), Switzerland (Coordinator)
  – Koç University (Koç), Istanbul, Turkey
  – University of Mons (UMONS), Belgium
Scientific Background

• Large Multimedia Collections
  – Private use, professional applications, education

• Content-based Multimedia Retrieval
  – Manual annotations not feasible
  – Use of inherent features (colors, shapes, objects, etc.)
  – Strong focus on image features

• Video Retrieval
  – *Motion* distinguishes video from still images
  – Efficient and effective content-based retrieval of (parts of) videos based on *motion specification* is lacking

IMOTION will develop and evaluate
Innovative Multi-Modal User Interfaces for Interacting with Videos

Key Challenges & Potential Impact

Goal: Support novel types of *motion queries* in video collections

• User Interaction for Query Specification
  – Users can specify *motion paths of objects* in videos
  – via sketches, gestures, natural language, or combinations

• Machine Learning for Motion Features
  – Extraction of *high-level motion descriptors*
  – Based on *motion ontology*

• Information Retrieval & Data Management for Efficient Search
  – Index structures to jointly support *video features and motion metadata*
  – Distributed IR Engine: *Scalability* to very large collections

• Quantitative and Qualitative Evaluation
  – *User studies* based on collections released by the project consortium
Competences needed for IMOTION:

- **User Interaction**
  - Sketch-based Interfaces
  - Speech-based Interfaces

- **Information Retrieval & Databases**
  - Indexing, Retrieval Models
  - Distributed Data Management

- **Machine Learning**
  - Feature Extraction

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University of Basel

Databases and Information Systems Group (Prof. Heiko Schuldt)

- **Multimedia Retrieval**, especially for **Big Data Collections**
  - *Query Types*: Seamless Combination of Boolean Retrieval and Similarity Search [GAS 14b]
  - *Very Large Collections*: Distribution in Map/Reduce Style [GAS 14a]
  - *Video Feature Extraction* [SGS 14]
  - *Video Feature Combination* [RGS 14]
  - Cloud Data Management: Microsoft Azure Research Grant

- **User Interfaces for Multimedia Queries**
  - Sketches: Interactive Paper, Tablets, Mobile Devices
  - Gestures: IR-based gesture recognition
Intelligent User Interfaces Laboratory (Prof. T. Metin Sezgin)

- **User Interfaces for Sketch-based Motion Retrieval**
  - Identify discriminative points in a mesh representation of an object
  - *Query*: Sketch of a curve that represents a path between the feature points during desired action
  - *Retrieval*: select sequences in which this path occurs. Comparison between sketch and DB objects

- **Multimodal Interaction**
  - Sketch Interfaces
  - Speech Interfaces

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Koç University

University of Mons

Research Center for Creative Technologies (Dr. Stéphane Dupont)

- **Deep Neural Networks (DNNs)**
  - Feature extraction / regression / classification schemes to support multimedia information retrieval using motion
  - Set-up of workflow to enable DNNs (ConvNets) on video

- **Machine Learning for Multimedia Retrieval**
  - *Unsupervised* learning (feature extraction): learning representations of content
  - *Supervised* learning (classification): recognize concepts and actions
  - *Supervised* learning (regression): map sketch queries with real content features

- **Large-scale Video Machine Learning**
  - 5D data
  - *DeconvNets auto-encoders* for video
... Consortium as a Whole

- Small, but highly complementary consortium

IMOTION Workplan

- WP 1 (all)
  - Requirements
- WP 2 (UMONS)
  - Feature Extraction
- WPs 3 & 4 (Koç)
  - UI for Query Specification
- WPs 5 & 6 (UNIBAS)
  - Query Execution
- WP 7 (all)
  - Build and continuously update integrated system
**IMOTION System: Query Types**

- **Query-by-Sketch** using a rough hand-drawn sketch
- **Query-by-Sketch with Query-by-Example** by adding/removing parts from sample image
- **Query-by-Example** based on query image or a result object
- **Query-by-Motion** motion of objects across frames via flow fields

**IMOTION System: Overview**

**Online**

- Query Sketch / Image
- Ranked Result List

**Offline**

- Semantic Image Features
- Motion Features
- Color / Edge Features
- ...

**Features**

- Input Decoder
- Video Segmenter

**Extraction Runtime**

**Ranked NN List**

**SQL Query**

**Result**

**Score Fusion and Re-ranking**

**Query Generation**

**Retrieval Runtime**

Relevance Feedback: refining query results by marking relevant and irrelevant elements from the result list.
IMOTION@VSS 2015

• Participation at the 4th Video Search Showcase competition [RGS’15]
  – Part of the Multimedia Modeling Conference (MMM)
  – Two types of search tasks
    ▪ Visual Known Item Search (sketches and/or captures)
    ▪ Textual Search (to be addressed via sketches)
    ▪ Both tasks performed by experts and by novices
  – IMOTION finished in second place overall (1’213 points vs. 1’223 points), and has been clear winner of the visual search task

Project Management ...

• Project has started on January 1st, 2014
• Staffing
  – UNIBAS
    ▪ 1 PostDoc for 2 years (C. Tănase)
    ▪ 2 PhD students for 3 years (I. Giangreco, L. Rossetto)
  – Koç (staffing will be completed in next PhD student intake)
    ▪ 1 PostDoc for 2 years (Y. Sahilioglu)
    ▪ 2 PhD students for 3 years (NN, NN)
  – UMONS
    ▪ 1 PhD student for 3 years (O. Seddati)
• Internal project meetings
  – February 2014 kick-off in Basel
  – September 2014 in Mons
  – January 2015 in Istanbul
  – Plus bilateral meetings for the VSS preparation
... Project Management

- Student/scientists exchanges
  - eNTERFACES 2015 in Mons (August 2015): four week on-site collaboration

- Financial reporting
  - Nothing to report (all partners in plan)

- Dissemination, Infrastructure, Collaboration
  - Project Website: imotion-project.eu
  - Repository, mailing list, etc. has been set up
  - Consortium Agreement has been signed

- Sustainability
  - Project deliverables published as scholarly papers
  - IMOTION software in open source license
  - Collections and evaluation metrics released to the research community
    OSVC: Open Short Video Collection

IMOTION Publications


