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
Consortium as a Whole...

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

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
**Koç University**

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

**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

Inspired by [Le et al. 2012]
... 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

**Relevance Feedback**
refining query results by marking relevant and irrelevant elements from the result list

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**IMOTION System: Overview**

**Online**
- Query Sketch / Image
- Ranked Result List

**Retrieval Runtime**
- Query Generation
- Score Fusion and Re-ranking

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

**Input Decoder**
**Video Segmenter**
**Extraction Runtime**

**Feature Module**
- Feature Module
- Feature Module
- Feature Module

**Ranked NN List**
- SQL Query
- SQL Query
- SQL Query

**Feature Vector Database**

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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. Sahillioğlu)
    - 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


