Welcome

Video and Search Technologies for OER
Text processing and search technologies for OER

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www.moving-project.eu
Presentation overview

- Introduction to MOVING
  - Motivation
  - Goals
  - Overall approach
  - Use-cases and examples
- Video understanding and search technologies for OER
  - Harvesting data from open data sources
  - Video understanding technologies (+demo)
  - Video search and retrieval technologies
  - Example application: linking lecture and non-lecture videos for enhancing the educational experience (demo)
- Text processing and search technologies for OER
  - Semantic profiling
  - Titles vs full text in retrieval setting
  - Title-based semantic document annotation
- MOVING platform demo and hands-on session
• Information literacy: a key skill in today’s world!
  • Internet is full of valuable information, but there is “information overload”
    • Drift to majority; loss of completeness; decay of information; just too much information, e.g. global scientific output doubles every nine years (1)
  • We need advanced qualitative data analysis tools and techniques, and to know how to use them!
• ...but not so easy to acquire and maintain
  • Vocational training costs are high
    • For a service company, a training day has high direct costs per employee
    • To train a master-degree student to work on an executive position in middle-management, costs over 10 yearly salaries in total
  • Less than half of all employees of European enterprises take part in further education offers

(1) http://blogs.nature.com/news/2014/05/global-scientific-output-doubles-every-nine-years.html
“MOVING is building an innovative training platform that will enable users from various societal sectors (companies, universities, public administration) to fundamentally improve their information literacy by training how to choose, use and evaluate data mining methods in connection with their daily research tasks and to become data-savvy information professionals”

- This platform is:
  - Getting access to an extensive source inventory
  - Using search and visualisation methods
  - Generating knowledge that cannot be derived from existing solutions
  - Supporting its users through
    - A detailed and scientifically proven help system
    - An individually configurable training program
    - A community of people from different sectors of society

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MOVING Project: Overall approach

TARGET GROUPS
- Young researchers
- Compliance officers
- Public administrators
- EU citizens/residents

MOVING PROVIDES WITH
- Training and working w.r.t. data-intensive research tasks
- User guidance for self-reflection

PROJECT OUTCOMES
- Data-savvy information professionals
- Knowledgeable society

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MOVING Project: Use cases & examples

• Research on business information by public administrators
  • Understand complex situations
  • Increase compliance with current laws and regulations
  • Specific case of public administrators considered in MOVING: financial auditors

• Managing and mining research information
  • Reduce information overload
  • Assist in evaluating and selecting relevant information resources
  • Specific case considered in MOVING: young researchers and graduate students
OER Technologies: Harvesting data

- **Motivation:** huge volume of online potentially-useful materials
  - Massive open online courses (MOOCs) available on the web
  - Lecture videos on VideoLectures.net etc., non-lecture videos on YouTube and other social media platforms
  - Textual documents (e.g. scientific publications, laws) and text entries in web pages and social media platforms

- **Data crawling**
  - By topic, in social platforms (e.g. Twitter, Google+, YouTube) and on the Web (via web search, using the Google custom search API)
    - E.g. “Game Theory”, “Decision Analysis”, “Cryptography”, “Constitutional Law”
  - By specific web domain
OER Technologies: Harvesting data

Social media

Web

MOVING platform

Text

Video

Video understanding
OER Technologies: Video understanding

- Video viewing/playback
  - To a human viewer: full of meaning! (objects, actions, interactions between objects, logical temporal units, events, sentiments,...)
  - To the computer: just an endless, meaningless displaying of pixel values: ...
    153 223 062 213 135 172 076 088 115 178 155 033 026 188 181 045 098 ...

- Video understanding tech: help the computer understand the video just like humans do
  - Detect logical temporal units -> temporal fragmentation
  - Detect objects, concepts, actions, events -> annotation

- How
  - Signal processing
  - Machine learning (especially Deep Learning)
OER Technologies: Video understanding

• Deep network example architecture

OER Technologies: Video understanding

• Demo (video)
  • Fragmentation
  • Concept-based annotation
  • Concept-based search

Try it yourself at:
http://multimedia2.iti.gr/onlinevideoanalysis/service/start.html
OER Technologies: Video search

- Based on video analysis results
  - E.g. Concept-based retrieval of video fragments
- Video analysis alone not enough
  - Not straightforward to answer complex queries, e.g. “Find shots of a person talking behind a podium wearing a suit outdoors during daytime”
- Combination of text analysis and machine learning comes to the rescue
  - Detect key terms in the text; map them to concepts/objects that we can detect in the video; evaluate the match between a set of concepts (+scores) describing the textual query and a similar set of concepts describing a video

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Example approach for answering complex queries

Example application (demo)

- Linking lecture and non-lecture videos
  - Automatic analysis of audio transcripts (lecture videos)
  - Automatic analysis of visual signal (non-lecture videos)
- Find and watch relevant videos that augment the learning experience of the lecture

This interactive web interface links lecture videos, using general purpose concepts that were produced from textual analysis of their transcripts, with non-lecture videos, using their visual analysis results such as automatically detected shots, scenes, and visual concepts. The user is able: (a) to select a lecture video by clicking the corresponding thumbnail from the list below; (b) during playback of the selected lecture video, the automatically detected concepts that characterize it are shown on the screen; and (c) by clicking on any one of them additional temporal segments of non-lecture videos that are related to the selected concept are presented to the user; (c) to see the temporal segment (shots and scenes) structure of the all non-lecture videos, by clicking the "See all non-lecture videos collection" link.

Concept detection (from audio transcripts)

<table>
<thead>
<tr>
<th>Concept</th>
<th>Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Whale</td>
<td>0.606489</td>
</tr>
<tr>
<td>Sailing_Ship</td>
<td>0.428698</td>
</tr>
<tr>
<td>Oil_Drilling_Site</td>
<td>0.382734</td>
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<tr>
<td>Boat_Ship</td>
<td>0.365359</td>
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<td>Mammal</td>
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<td>Dolphin</td>
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</tr>
<tr>
<td>Sea_Mammal</td>
<td>0.068010</td>
</tr>
</tbody>
</table>

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Semantic profiling

- **Problem** Match documents to a query or user profile
- **Application** Document retrieval or recommendation

Query = “Open innovation”

Title = “Is Open Innovation Re-inventing Innovation Policy for catching up Economies”

Title = “Risk and uncertainty in innovation management”
**Question** Can titles be sufficient for information retrieval task?

**Motivation** Full-text not always available

**Goal** Develop novel IR models for search over title data vs. full text

**Method** Advanced machine learning methods, e.g. neural networks
Titles vs full text in retrieval setting

Aggregating the best nDCG values over all datasets and configurations, the best full-text-based retrieval models attains only 6.6% more than the best titles-based retrieval models.
Title-based semantic document annotation

- **Question** Can we build a novel model for semantic document annotation which use only title data and compare it to full-text based methods?

- **Motivation** For semantic subject indexing in digital libraries: much more labeled title data than labeled full-text data

- **Method** Neural networks, since they work well with very large datasets and are state-of-the-art on full-text as well.

- **Experiments**
  - Two datasets from scientific digital libraries (EconBiz and PubMed)
  - Three deep learning classifier (MLP, LSTM, CNN)
  - One baseline (Base-MLP, previous state-of-the-art).
All title-based methods outperform full-text ones

Best title-based method is 9.4% better than the best full-text method

All full-text methods outperform title-based ones

The difference between best title-based method and best full-text method is only 2.9%
Summary and outlook

- We now have well-performing technologies for
  - Collecting lots of (relevant, selected) data that is out there
  - Making sense out of these data (esp. by means of video understanding)
  - Searching for and finding the desired bits and pieces of information that we need, in an ocean of complex data (videos, texts, ...)

- In MOVING we are using these technologies
  - For developing a joint working-and-training platform
  - For applying them and the whole platform in two specific use cases (financial auditors; young researchers)

- What other uses of these technologies in the open education domain can you think of?
Platform Demo and hands-on session

An Overview of the MOVING Platform

http://platform.moving-project.eu/
Thank you for your attention!

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