TrainInG towards a society of data-saVvy inforMation prOfessionals to enable open leadership INnovation

MOVING

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

MOVING Project: Motivation

- 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 Project: Goals

*"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

MOVING Project: Overall approach

MOVING
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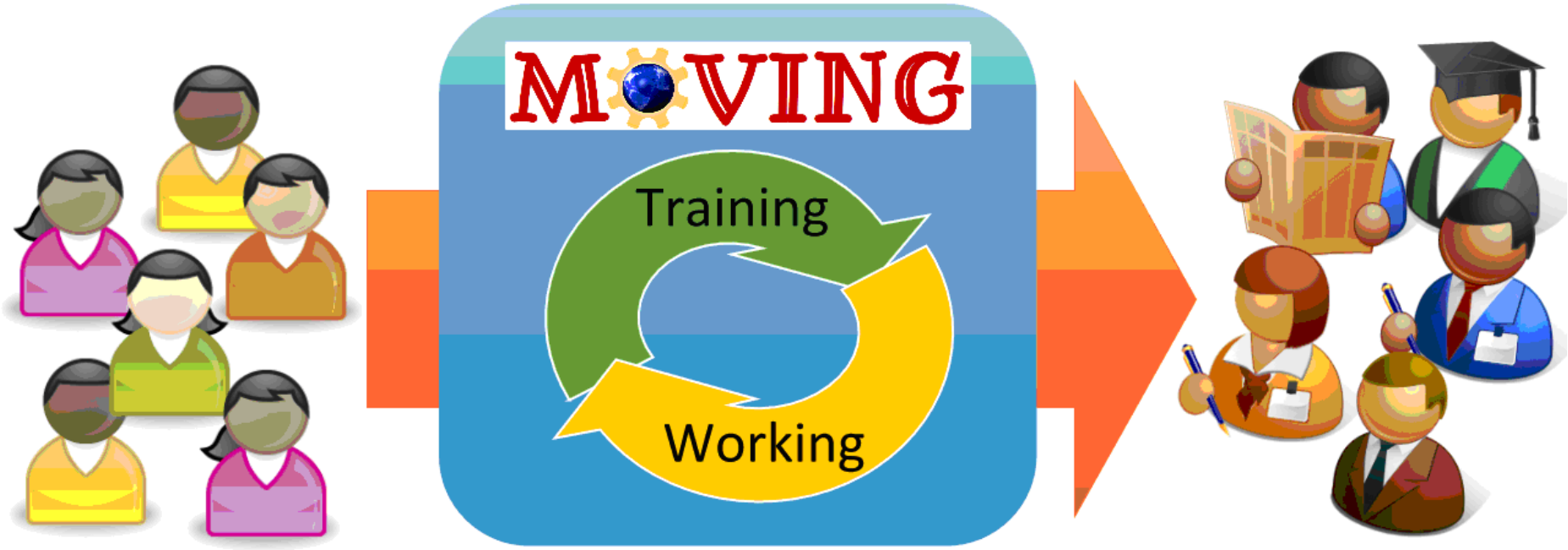


TARGET GROUPS

- 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

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

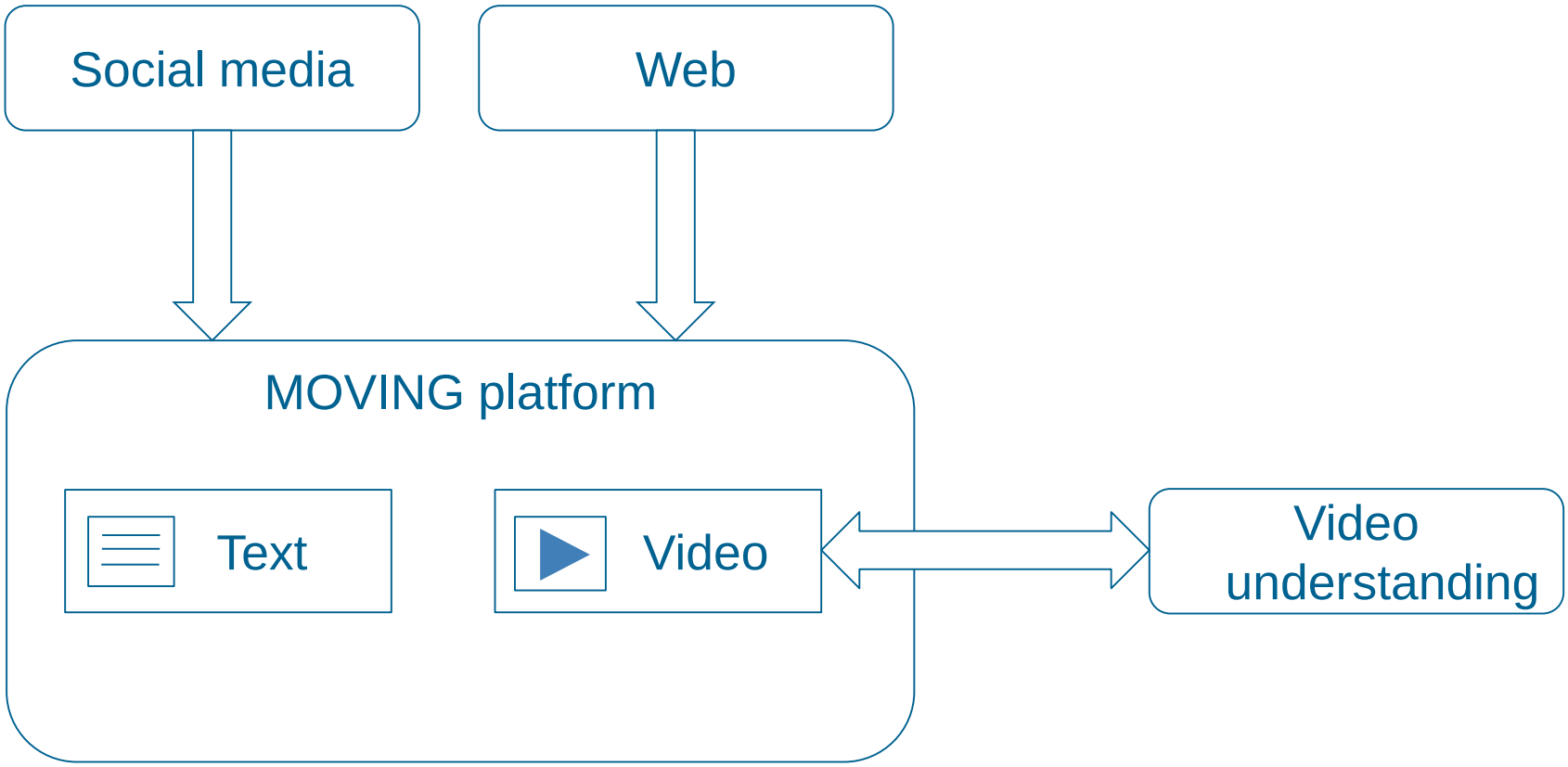
EY Building a better working world

TECHNISCHE UNIVERSITÄT DRESDEN

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
    - E.g. “https://open.hpi.de/”, “https://www.edx.org/”

OER Technologies: Harvesting data

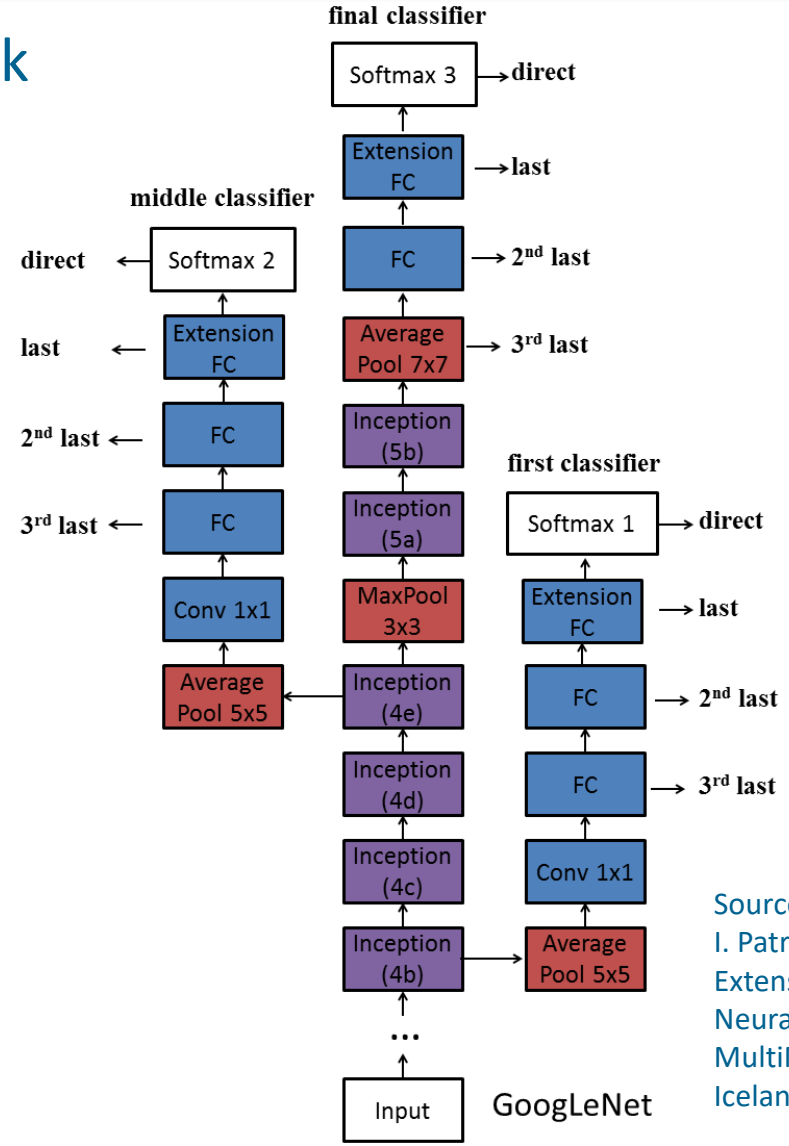


OER Technologies: Video understanding

- 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

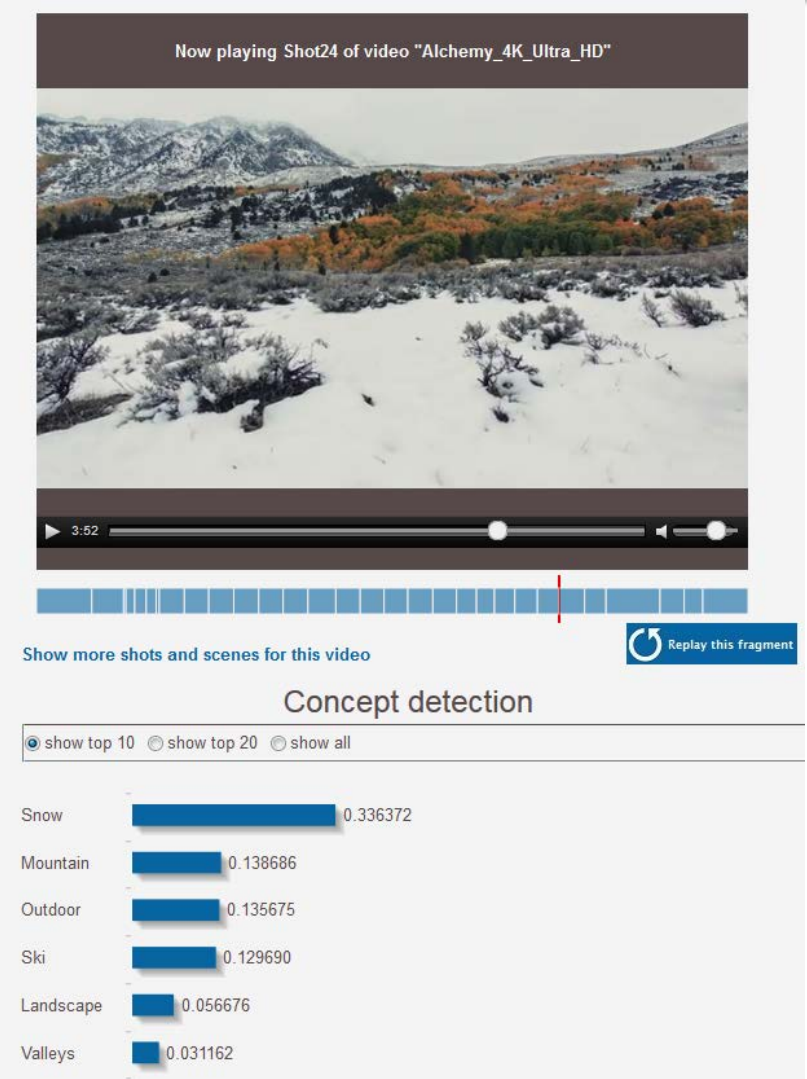
- Deep network example architecture



Source: N. Pittaras, F. Markatopoulou, V. Mezaris, I. Patras, "Comparison of Fine-tuning and Extension Strategies for Deep Convolutional Neural Networks", Proc. 23rd Int. Conf. on MultiMedia Modeling (MMM'17), Reykjavik, Iceland, Springer LNCS vol. 10132, Jan. 2017.

OER Technologies: Video understanding

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



Try it yourself at:

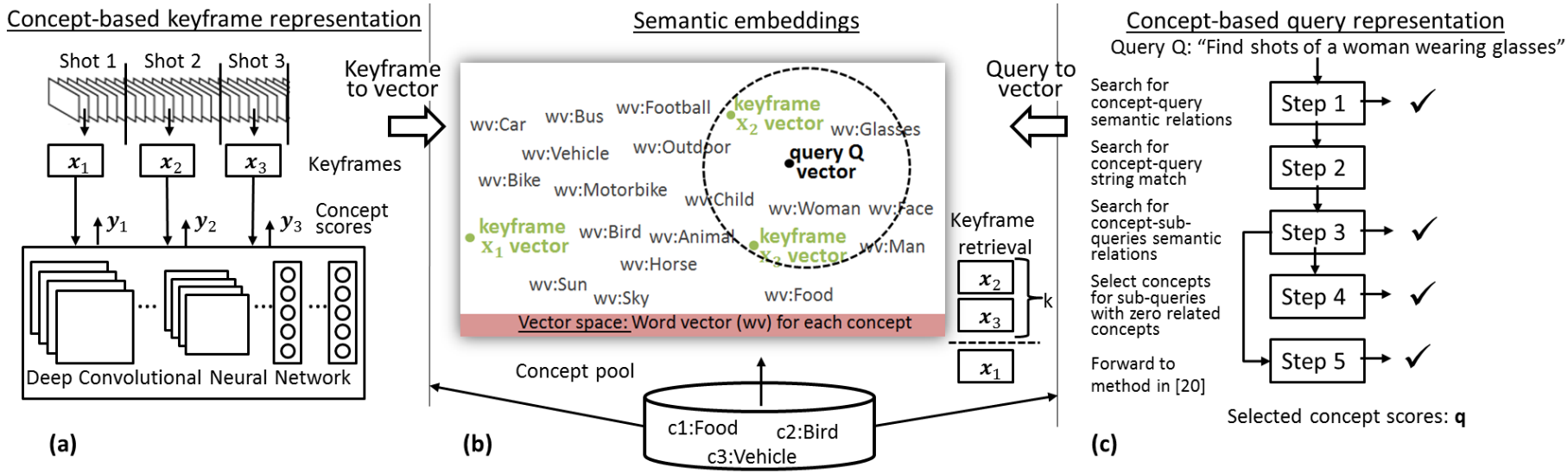
http://multimedia2.iti.gr/onlinevideoanalysis/service/start.html

OER Technologies: Video search

- Based on video analysis results
  - E.g. Concept-based retrieval of video fragments
- Video analysis alone not enough
  - Not straghtforward 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

OER Technologies: Video search

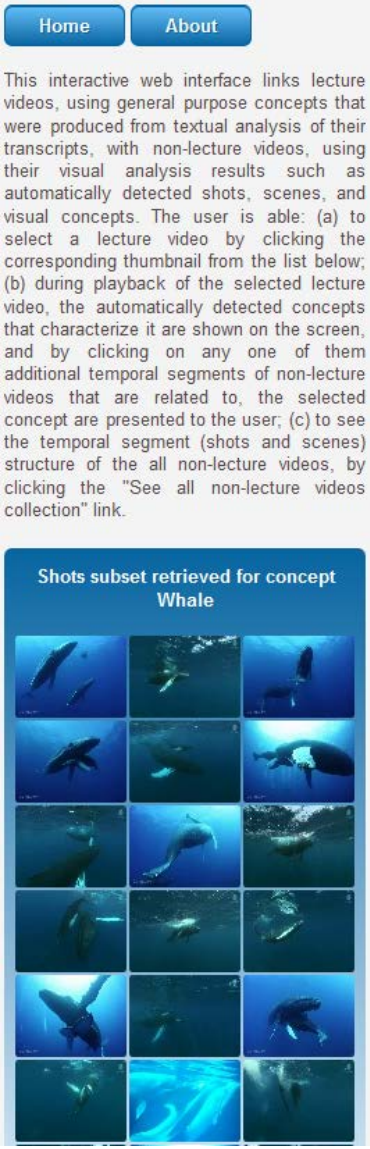
- Example approach for answering complex queries

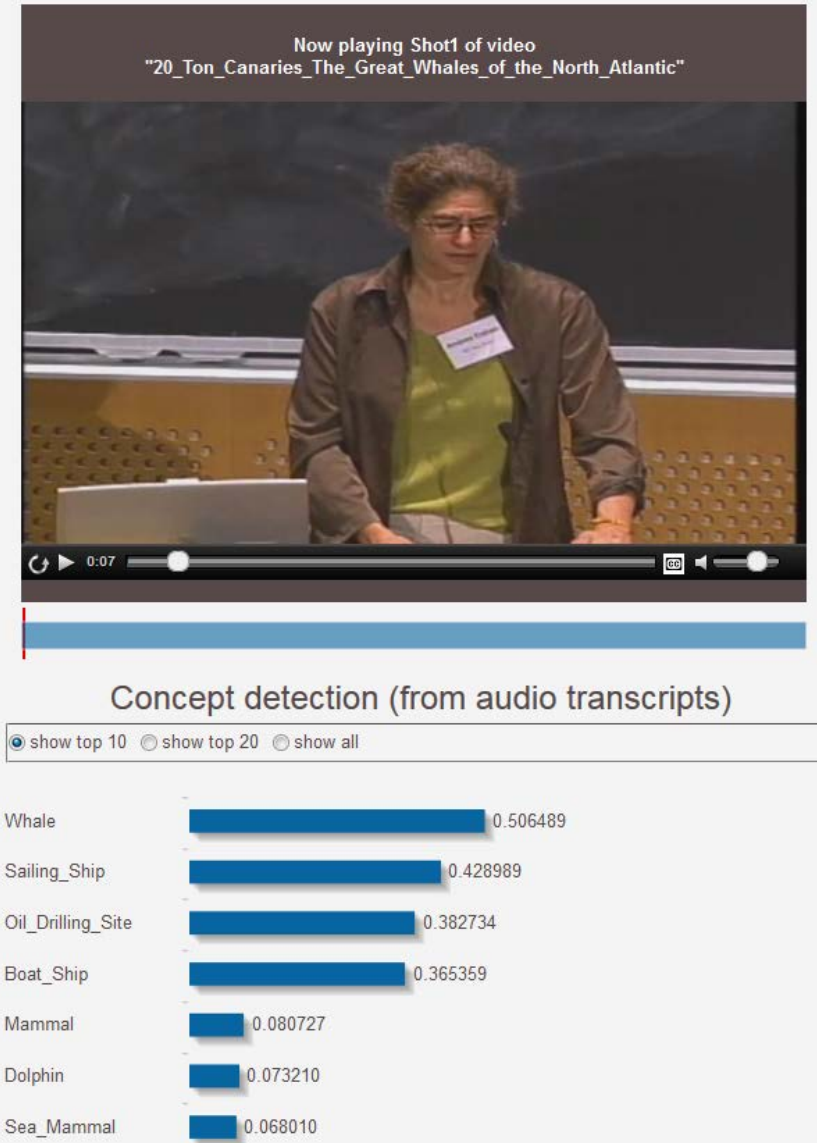


Source: F. Markatopoulou, D. Galanopoulos, V. Mezaris, I. Patras, "Query and Keyframe Representations for Ad-hoc Video Search", Proc. ACM ICMR 2017, Bucharest, Romania, June 2017.

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

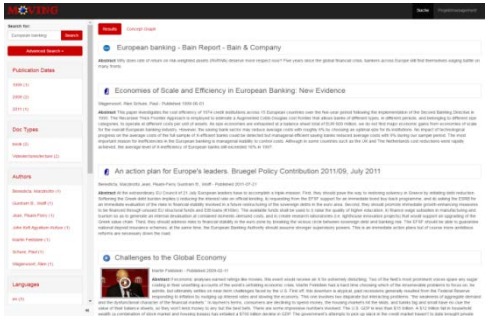




Semantic profiling

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

Query=“ Open innovation”



Management

Innovation Management

Open Innovation

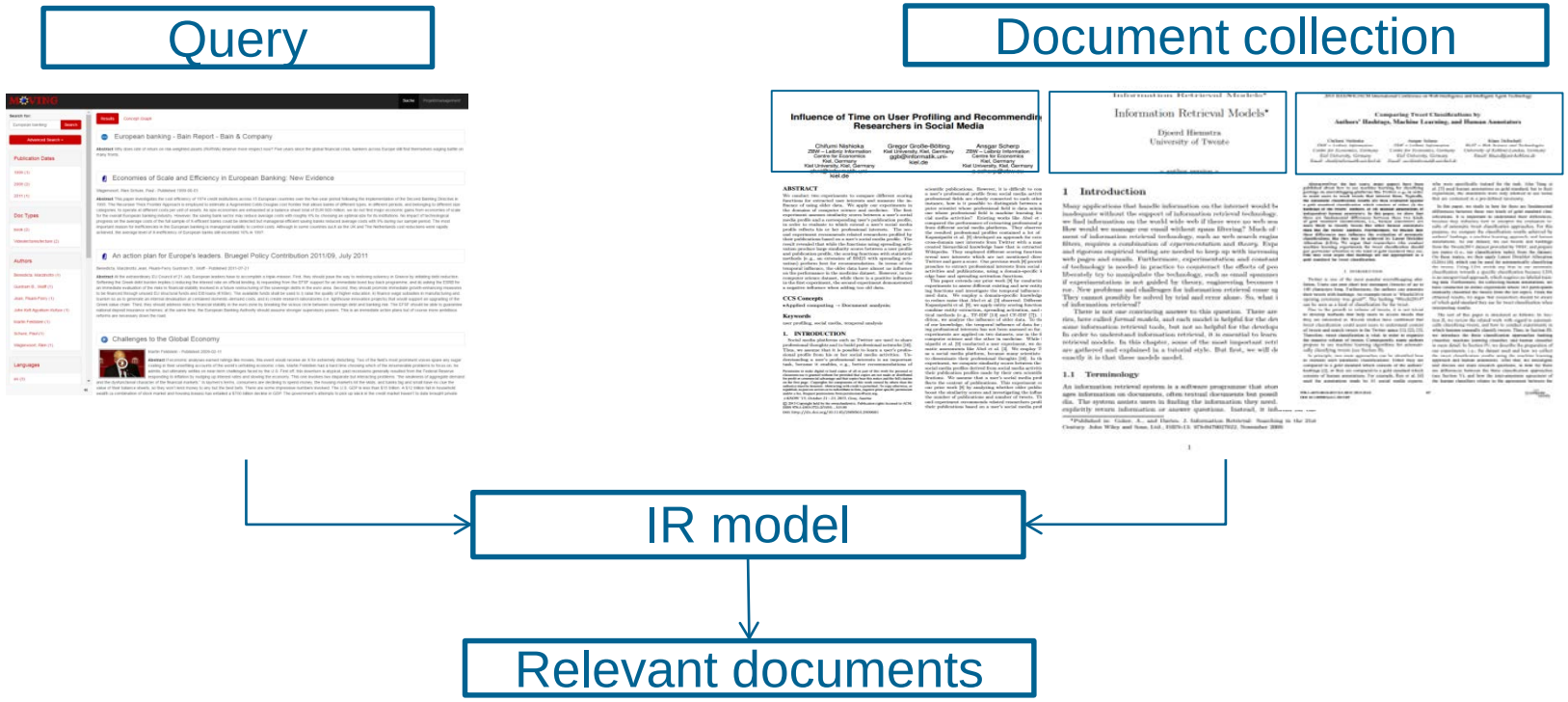
Influence of Time on User Profiling and Recommending Researchers in Social Media

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

Title = “Risk and uncertainty in **innovation management**”

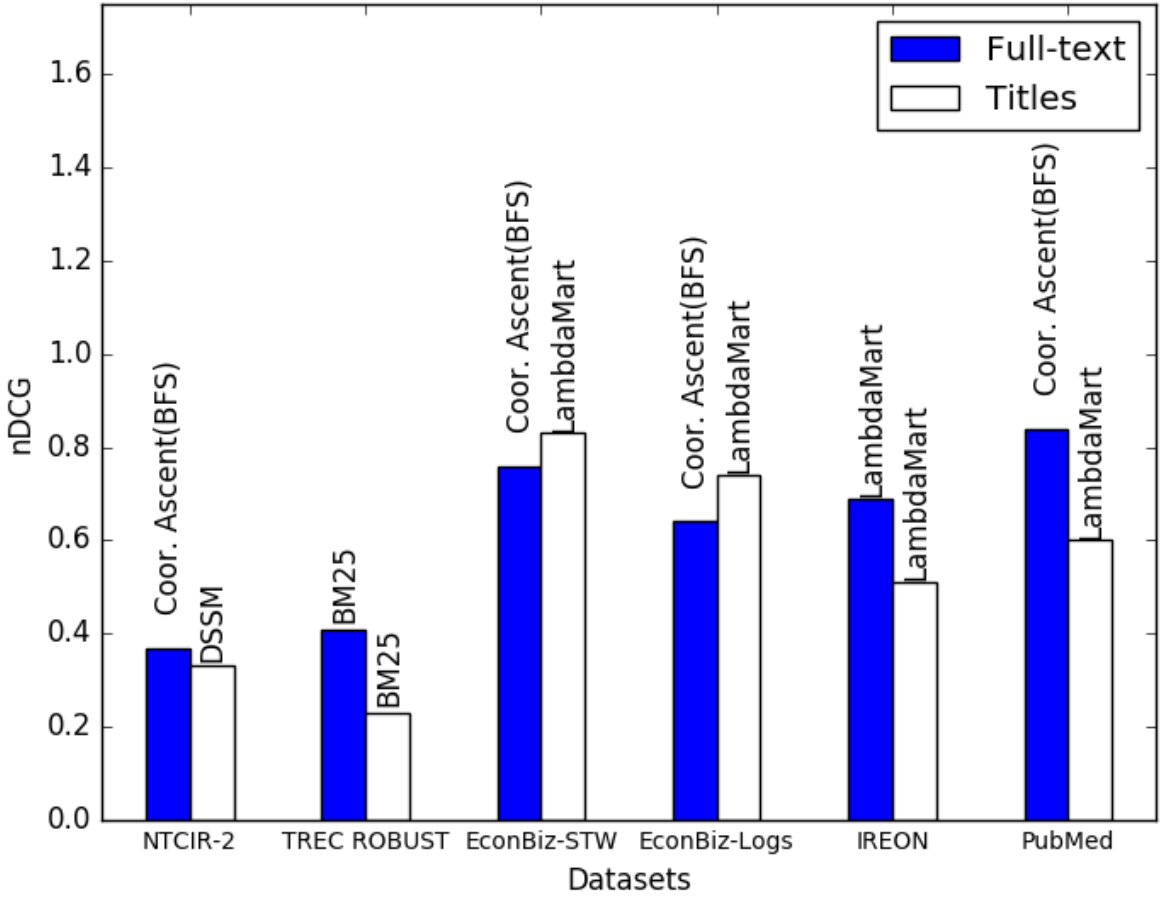
Titles vs full text in retrieval setting

- **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

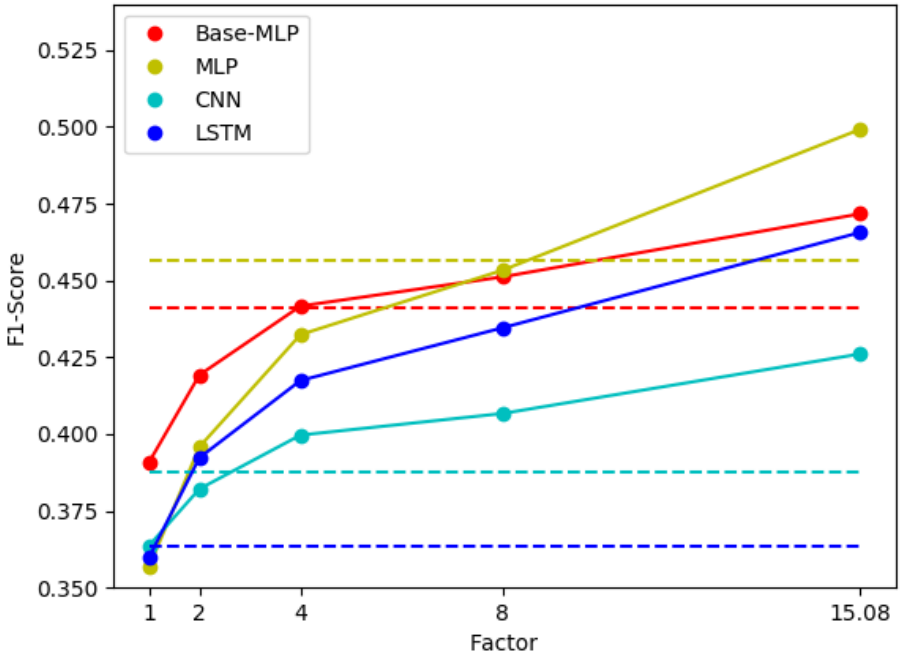


Title-based semantic document annotation

- **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).

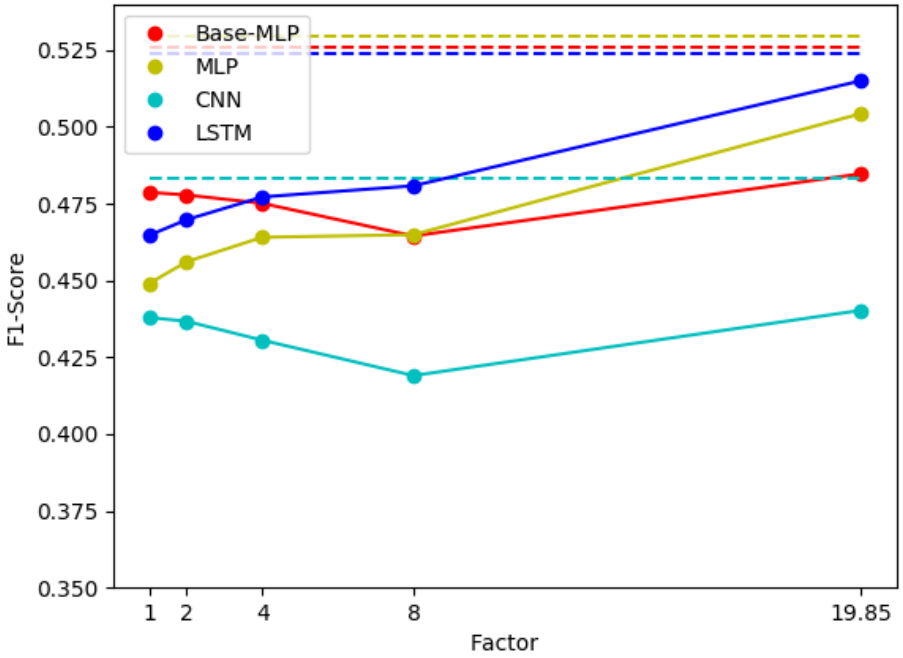
Title-based semantic document annotation

EconBiz



- All title-based methods outperform full-text ones
- Best title-based method is 9.4% better than the best full-text method

PubMed

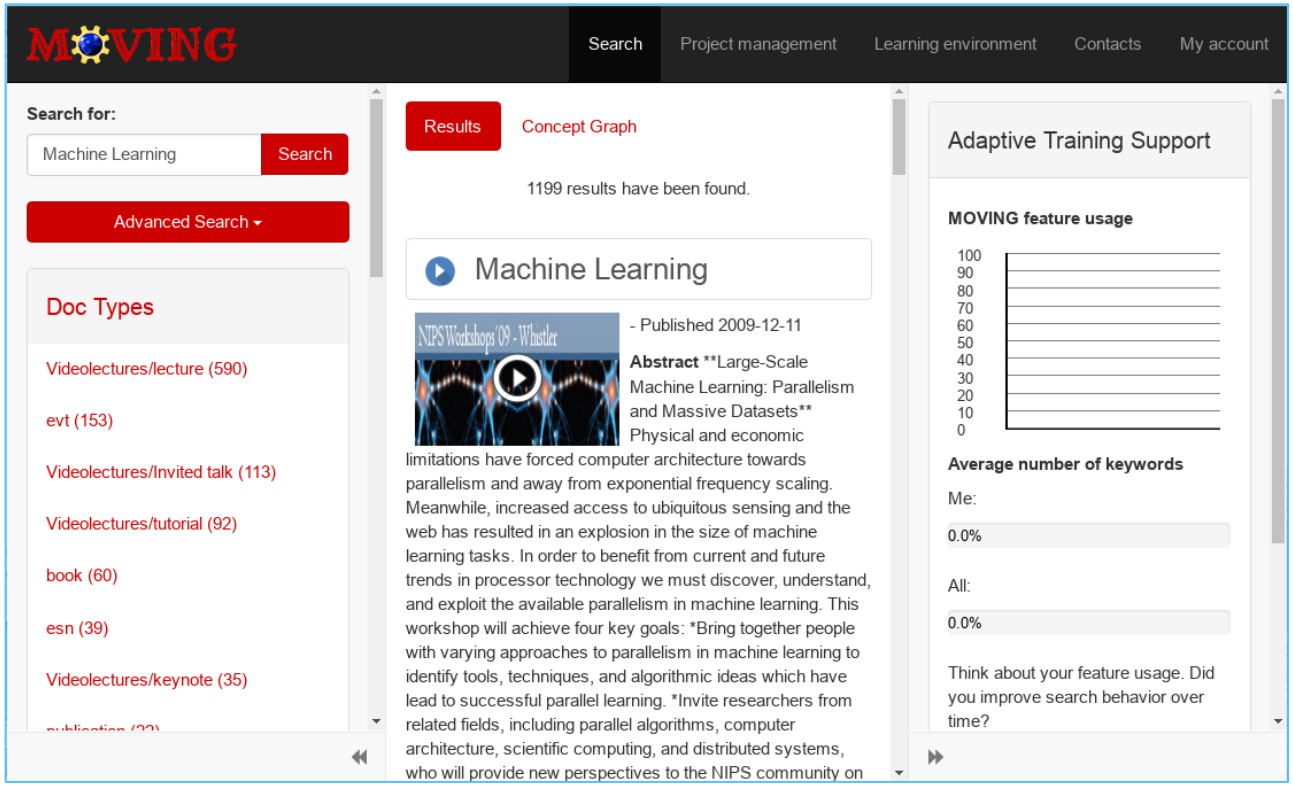


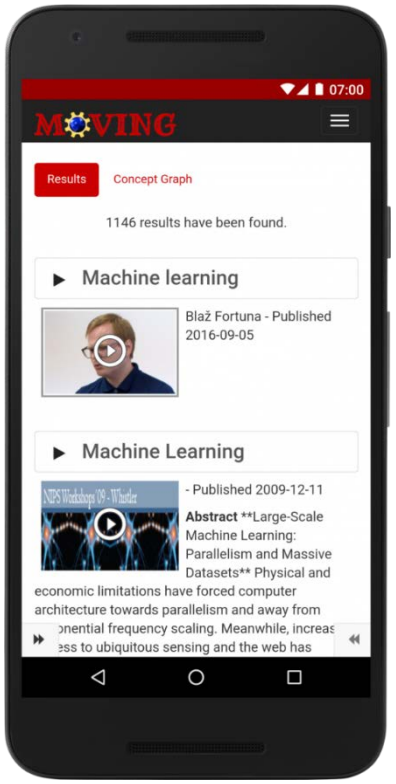
- All full-text methods outperform title-based ones
- The difference between best title-based method and best full-text method is only 2.9%

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





http://platform.moving-project.eu/

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Thank you for your attention!

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