Harvest Project: La Vie

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PASCAL & Harvest

- PASCAL = Pattern Analysis, Statistical Modeling and Computational Learning
  - A Network of Excellence funded by the EU
  - Promotes the use of ML in domains such as:
    - Machine Vision
    - Speech
    - Haptics
    - Brain-Computer Interface
    - Natural Language Processing
    - Information Retrieval
    - Textual Information Access
    - Multimodal integration
- Harvest Programme
  - Demanding channel to increase the impact of PASCAL on society and the economy
  - Applied research projects by teams of 4-8 persons for a duration of 30-90 days
  - Some piece of software as the main objective

Project La Vie

- PASCAL Harvest founded project
  - La Vie = Learning Adapted Video Information Enhancer
- Main goal:
  - To provide users with recommendations on suitable lectures for their needs
- Key components:
  1. Text extraction and information retrieval
  2. Enrichment
  3. Topic and user modeling
  4. Recommendation
  5. Visualization
- We concentrated on English language only!

Text extraction

- Sets of scripts:
  - Retrieving metadata information from internal VL database
  - Retrieving textual information from Wikipedia, DBLP and Google (abstracts and/or articles)
  - Extracting text from slides (PPT, PDF or JPGs using OCR)
  - Extracting text from transcriptions
- Each lecture is represented as:
  - BoW - Bag of words (from text extraction)
  - BoC - Bag of categories (categories that a particular lecture belongs to)
- Reduced dictionary size from approx. 2 million to 300.000 words
  - Filtering out words that appear in less than 3 different lectures

Enrichment

- Using Enrycher
  - See http://enrycher.ijs.si/
- Trained with our data and taxonomy (categories)
- Proved to be not very usable
  - Categories specified manually by VL admins are much better than automatic categorization
  - Not many usable entities or keywords returned
- Using Enrycher would only make sense if manual tagging was not possible

Topic and user modeling (1)

- User's history
  - Set of lectures a user has seen
    (represented by a BoW and BoC computed over all lectures that user has seen)
- Lecture content
  - Semantically similar lectures
- Collaborative filter
  - Users that viewed similar lectures

Topic and user modeling (2)

- **7 features:**
  1. Lecture popularity
     - Number of visits
  2. Content similarity
     - $BoW(L_c) \cdot BoW(L_p)$
  3. Category similarity
     - $BoC(L_c) \cdot BoC(L_p)$
  4. User content similarity (computed on the fly)
     - $BoW(Hist(U)) \cdot BoW(L_p)$
  5. User category similarity (computed on the fly)
     - $BoC(Hist(U)) \cdot BoC(L_p)$
  6. Co-visits
     - Number of times of L_c and L_p viewed in the same browsing session
  7. User similarity
     - Number of users who have watched both L_c and L_p

L_c = current lecture

L_p = proposed lecture

U = user

1 table has approx. 70 million entries (for features 2,3,6 and 7)

Speedups

- Most of the data from the database is stored in Web service memory
  - Currently around 9 GB
- Lecture similarity features (2,3,6 and 7, from the biggest table) are being retrieved from the database
  - Speedup using the PostgreSQL CLUSTER command (query with approx. 10.000 rows: 27 s → 6 ms)
- Distributing load between 2 or more instances of the Web service
  - Using **Pound** load-balancer

Recommendation (1)

- Using SVM classifier for training:
  - Positive samples: two months of clicks using current recommender
  - Resulting feature weights:

Feature	Weight
Lecture popularity	-0.00003
Content similarity	0.00452
Category similarity	0.00148
User content similarity	0.02724
User category similarity	0.04167
Co-visits	0.00187
User similarity	0.01519

Recommendation (2)

- Final recommendation
  - A linear SVM classifier was used to rank all possible recommendation links:

$Given\ L_c\ and\ U$:

$For\ all\ Lp \neq L_c$:

$\vec{x}$ ... *feature vector computed for the triplet (Lc, L_p, U)*

$$\text{score}(\vec{x}) = \vec{w} \cdot \vec{x} = \sum_{n=1}^{7} w_n \cdot x_n$$

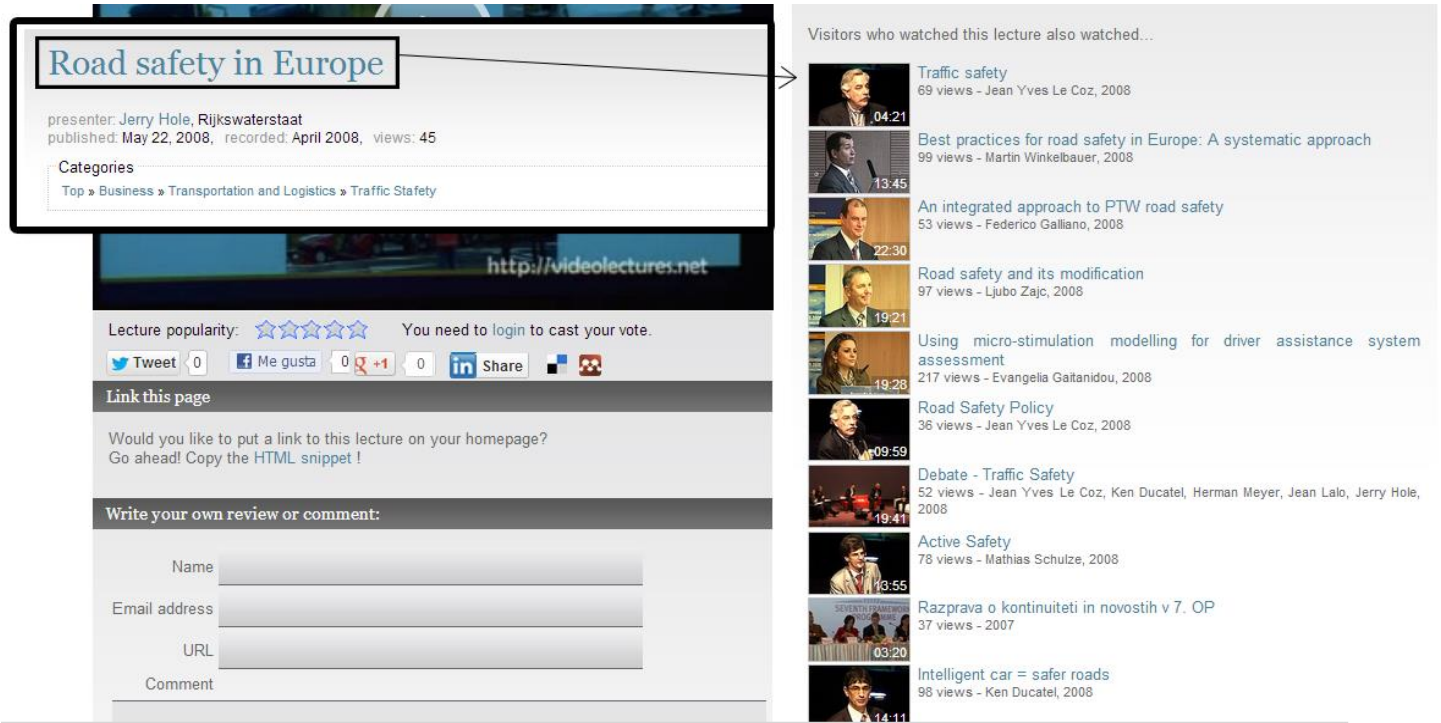
  - Lectures with top 10 scores are recommended

Recurring tasks

- Daily update
  - At night, updates database with
    - New lectures added to VL
    - New users (both registered and anonymous)
    - New user history (new lectures viewed)
    - Removing anonymous users being offline for more than 14 days (expired cookies)
- Monthly update
  - Once per month or whenever a considerable amount of lectures have been added to VL
  - Generates a new fixed vocabulary
  - A new database is created (this task requires approx. 3 days)

Evaluation

- Evaluation
  - Using coin flipping between old and new recommender
  - Counting the number of clicks
- Try http://dev.videolectures.net/
  - Our recommendations have */?ref=r00:* in links



Visualization

- Using Document Atlas
  - Showing clusters of similar lecture categories
  - Size of dots depends on number of visits
  - Clicking on a dot opens a list of lectures from that category
- Try http://scienceatlas.ijs.si/videoatlas/