From Technology-Inspired towards Utility-Centered Multimedia Information Retrieval

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MIR: MM content access in a broad scope
Where it all started …
Extracting meaning from data

Meaningless “1”s and “0”s

Multimedia Data

Semantic Gap

Image/audio signal processing, computer vision
Speech analysis
Text document analysis
Machine learning

Multimedia Content Analysis (MCA)

Meaning of Data

- Shot & scene boundaries
- Face
- Anchorperson
- TV News
- …
MIR around mid 2000s

Amazing growth of MCA

NIST TRECVID

Video Olympics

Interestingness/relevance

Affect curve

Romance

Comedy

Aroused

Unpleasant

Pleasant

Calm

Feature set

Feature set

Feature set

Feature set

Feature set

Feature set

Content coherence time curve

Segment i

Segment i+1: Meeting in a restaurant

Segment i+2

Video

Clip

Clip

Clip

Clip

Clip

Clip

Concept Detectors

Anchor

Snow

Soccer

Building

Outdoor

Image Database

Text Queries

Find shots of snow.

Find shots of soccer matches.

Find shots of buildings.
What also happened mid 2000s

Discovering the CONTEXT

- Basic idea
- Relying on the information derived from the (social, web, use) context to generate annotations for multimedia items
Games with the purpose

Von Ahn, IEEE Computer 2006
Tag Recommendation

Sigurbjörnsson & van Zwol, WWW 2008

User 1
Sagrada Familia
Barcelona
Recommended tags
Gaudi
Spain
Catalunya

User 2
Sagrada Familia
Gaudi
Spain
Architecture
Catalunya
Church

User 3
Barcelona
Spain
Europe
Gaudi
Catalunya
Travel

International Workshop on Search Computing, 25-26 September 2012, Brussels, Belgium
Image Classification using Web Graph

Mahajan & Slaney, ACM Multimedia 2010

Image source: M. Slaney, IEEE Multimedia Magazine, April-June 2011
Trend: CONTENT + CONTEXT

Triple-Synergy Paradigm

www.petamedia.eu

Social Network

User

recommendation

chat

tagging

downloading

rating

viewing

comments

Item

MCA

Automatic indexing

user preferences

user’s search intent

relations among users (friendship, trust)

authority distribution

similarity between users

item relevance

item quality (e.g. trivial?)

implicit relations among multimedia items

implicit links between items and tags

verification/enhancement of text-search or MCA results

tag relevance
Affective MCA in a Social Context

Smits & Hanjalic, IEEE Multimedia 2010

Soccer video

Best Educated Guess (BEG) on “soccer highlights”

MCA

Users in the loop

Tags

Generic affective MCA solution concept

- Full automation
- Applicable to entire domain
- Constant (predictable) performance
- Inherently imperfect!!

Collaboratively enhanced soccer highlights

objective

subjective

Personal Preferences

- Profile
- Interest
- Use context

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Recommendation using Social Graph

Konstas et al., SIGIR 2009

Bu et al., ACM Multimedia 2010

Hypergraph

+ MCA

Item

tag presence/relevance

#downloads

friendship

Tag presence/relevance

u_1, t_1, e_1, t_2, u_2, t_3, e_2, e_3
Where are we now?

Resource integration

Social Context

- MCA 1990s
- Semantic gap

- Late 2000s
- Friendship
- #downloads
- Tag presence/relevance
- Tag presence/relevance
- Item

Mid 2000s

Utility Gap

Content I like ...

... anytime ...

... and anyplace!
Utility gap

Hanjalic, IJMIR, October 2012

- The gap between the expected and de facto usefulness of MIR systems

- Where does the gap come from?
  - Development and evaluation of MIR solutions insufficiently biased towards users
  - Departing from what we CAN do and not so much from what we SHOULD do
  ➔ Technology inspired approach
Technology-inspired approach

Expectations versus reality: An example

- Visual search reranking
  - Approaches focusing towards optimizing the MAP, while the user is interested in the performance of the individual query
  - Why not focusing on the problem of detecting whether to rerank or not?

“If MAP is your criterion, are you solving a relevant problem?”
(after Slaney, IEEE Multimedia, 2011)
Utility-by-Design

Hanjalic, IJMIR, October 2012

• Understanding the user’s information need
  • Not only the “what” but also the “why” behind the search request

• Addressing the information need in all its complexity
  • From “simple” object/entity search towards really exciting search problems

• Maximizing the value offered to the user
  • From technically relevant towards maximally informative results

• Explaining the retrieval results
  • Can a search engine admit it does not know the answer and still help the user to find the right answer?
Search Intent: An Example

- Tutorial video (~ Learn something)
- Entertainment show (~ Being entertained)
- Informational show (~ Getting informed)
Search intent: Two sides of a coin

- **User** side
  - Discovering what the user had in mind when inserting the query
  - Search intent inference

- **Collection** side
  - Discovering what multimedia item would respond well to a given inferred intent
  - Search intent classification
Search intent classification

Example approach


• Discovering intent categories through social-Web mining
  • Inspired by Broader’s Taxonomy of Web Search, done by analyzing expressions of information needs from Yahoo! Answers and via crowdsourcing

• Five discovered categories
  • Information (improving the knowledge about a topic)
  • Experience - Learning (acquiring skills, learning “how” by experience)
  • Experience - Exposure (watching how people experience situations)
  • Affect – watching a video to change one’s mood
  • Object – using a video as a “tool” or to serve a particular purpose

• Discovering features for automatically inferring intent category
  • Style, vocabulary and phrases in the spoken content, patterns in tempo, duration and frequency of video shots
Really exciting search problems?

• Give me all recently uploaded videos about XYZ!
  • The emphasis is on ABOUT!

• Where was this photo/video taken?
  • No constraints!

• Give me more YouTube results like this one!
  • ...by taking my local, affective and “deep” personal context into account

• I want to know more about this location!
  • How to get the application like Google Goggles to always work well?
From relevant to **useful** search results

*Hanjalic, IJMIR, October 2012*

State-of-the-Art MIR → **SOPHISTICATION** → Useful MIR

- Technical relevance
- Matching to User’s Search Intent
- Focus on Non-Trivial Results
- Diversification

**user-informed and user-oriented**
User-Informed Summarization of Image Collections via Crowdsourcing

Rudinac, Larson, Hanjalic, submitted to IEEE Trans. on Multimedia

Which photo is more likely to be selected by the users than others?
Explainability of the search output

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- Usefulness of a search results list is measured by the extent to which it helps the user in her further actions

- We can’t guarantee optimal results list, but we can try to provide information
  - how reliable the results are and
  - where the imperfections/ambiguity come from

- Information can be
  - offered to the user to guide the query adjustment or selection of an alternative search mechanism
  - used internally by the search engine to make decisions in ambiguous info-spaces
Predicting Web MM Search Failure


• What are typical failure-prone queries?
• Can we predict such queries?
• Approach by
  • analyzing the search log
  • deriving information from the log to capture patterns of query (re)formulation and the click-through data in a search session
To take away

- **Continue to benefit from resource integration**
  - Imperfection (algorithm) \(\Rightarrow\) Adequateness (user)

- **Make your approach more user-informed**
  - Great potential of crowdsourcing still waits to get exploited!
  - Great challenges of deploying crowdsourcing input in developing automatic MIR solutions

- **Keep the user central and avoid technology-push pitfalls**
  - User (interaction) data still under-represented compared to multimedia data
  - Evaluate user experience and not algorithmic performance alone
Thank you

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