

VK Multimedia Information Systems



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Dienstags, 16.00 Uhr c.t., V.1.08



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Video Retrieval



<http://www.uni-klu.ac.at>

- Motivation & Problems
- Features & Descriptors
- Some Methods
 - Text Based
 - Shot Detection
- Video Retrieval Evaluation
- Applications
 - Video Summaries



Motivation



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Szenario A: Ad Hoc Search - Pull Information

- Alice has heard about a recent event
 - Examples: Red Bull Air Race, etc.
- She wants to get an overview on
 1. Overview on **context**
 2. Coverage on the **outcomes & highlights**

Szenario A: Google Video



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redbull air race - Google Video - Mozilla Firefox

File Edit View History Bookmarks Tools Help LEO BEOLINGUS Gmail Bloglines News

<http://video.google.com/videosearch> LEO de<->en Google

Symbian IM-2006 Academia LAN DTD Java API Java™ Tutorials EPSS FP7: Login

Google Video U.K. BETA

redbull air race Search Advanced Video Search Web History

Top 100 Comedy Music videos Sports Animation Google Picks All Genres

Results for redbull air race All durations Sort by relevance 1 - 10 of about 273 (0.042 s) - RSS

Try your search on YouTube, Yahoo, Metacafe, iFILM, Rewer, Dailymotion

Redbull Air Race Monument Valley, Utah
8 min - 14-May-2007
Red Bull Air Race World Series Monument Valley, Utah 5/12/07
<http://www.youtube.com/watch?v=EGYioj4mG4Y>
[Watch video here](#)

Redbull Air Race Istanbul Final
10 min - 02-Jun-2007 - ★★★★★ (1 rating)
Red Bull Air Race Klasmanı "Red Bull Air Race World Series" in İstanbul'da ...
<http://www.youtube.com/watch?v=U0LxTXGlnNc>
[Watch video here](#)

RedBull Air Race İstanbul (http://cizbiz.tr.cx)
6 min - 05-May-2007 - ★★★★★ (3 ratings)
... daha fazlasını iste <http://cizbiz.tr.cx> ...
<http://www.youtube.com/watch?v=5GxjERSE6Ck>
[Watch video here](#)

Redbull Air Race 2006 Istanbul
5 min - 31-Jul-2006 - ★★★★★ (5 ratings)
Redbull Air Race 2006 Istanbul
<http://video.google.com/videoplay?docid=-1303441116156582200>
[Watch video here](#)

RedBull Air Race Qualificação
3 min - 21-Apr-2007 - ★★★★★ (1 rating)
... ABRIL DE 2007 NO RIO DE JANEIRO FOI REALIZADA A CLASSIFICAÇÃO DA 2ª ETAPA REDBULL ...
<http://www.youtube.com/watch?v=gRC2C4Ckst8>
[Watch video here](#)

FSX REDBULL AIR Race with TrackIR
6 min - 20-May-2007
FSX Training RedBull Air Race
<http://www.youtube.com/watch?v=EpcTc3F-4y4>
[Watch video here](#)

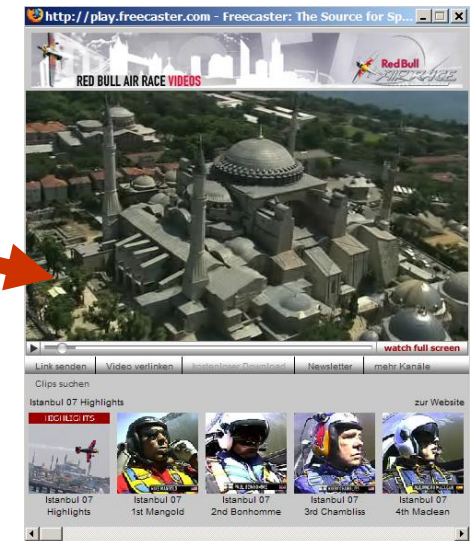
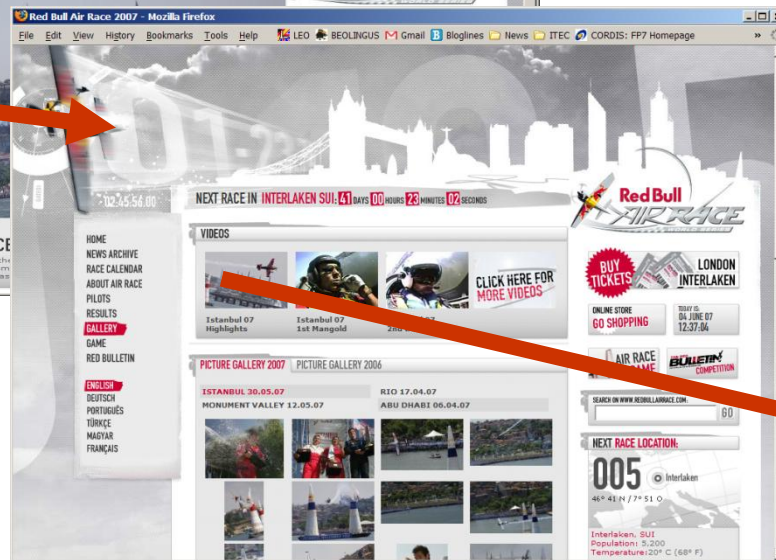
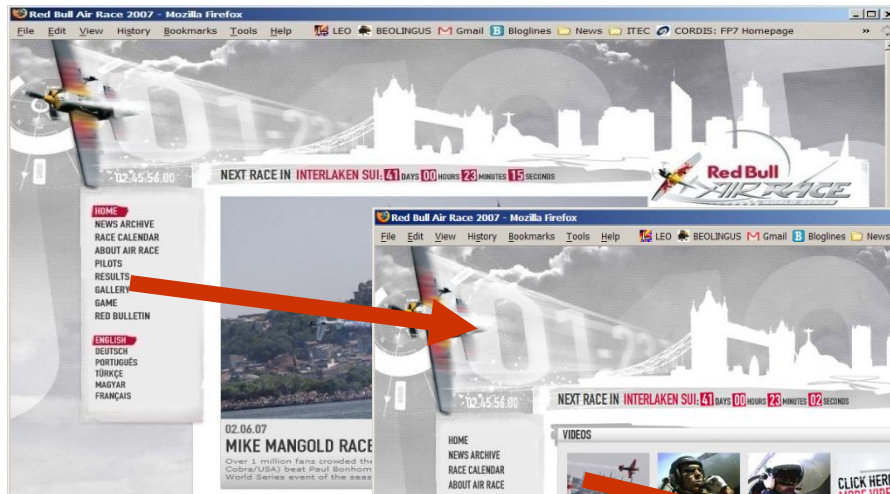
Done 0.359s Tor Disabled Adblock

systems

Szenario A: Web Site



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Szenario A: Analysis



<http://www.uni-klu.ac.at>

<i>Google Video</i>	<i>Air Race Web Site</i>
Simple (Term) Search	Navigation (Gallery -> Video)
Short and ambiguous descriptions	Clear and intuitive meta information (thumbnails)
No additional information / interlinking	Further information provided
Fast, clean and efficient interface	Frisky and colorful interface
Legal issues ...	No legal issues

Szenario B:



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Szenario B: Media Observation

- George B. wants to find everything
 - Concerning certain Persons / Communities
 - Capturing the mood of media
- This includes
 - News broadcasts (language independent)
 - YouTube, MyVideo, etc.



Problems



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- Video Retrieval is a very broad field
 - Demands differ from professionals to hobbyists
- Videos are commonly rather 'big'
 - Sighting of raw footage and search results is time consuming
 - Extraction, analysis and indexing of descriptors are challenging
- Indexing is rather complicated
 - Videos are multimodal

Example Problem: Size



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- 15 minute video -> 25 fps, 720x576
 - # frames = $15 * 60 * 25 = 22,500$
 - With 65k colors
 - Raw size = $22,500 * 720 * 576 * 2 \sim 17.4 \text{ GB}$
 - Indexed by color histogram
 - 256 colors with 256 levels each -> 16 Bit / frame
 - Size = $22,500 * 2 \sim 43.95 \text{ kB}$
 - In a video database
 - 1,000 videos -> $\sim 44 \text{ MB}$ descriptor data
 - 1,000,000 videos -> $\sim 44 \text{ GB}$ descriptor data

Video Retrieval



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Features and Descriptors



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- Visual Descriptors:
 - Additional dimension: **Time**
 - Related to audio information
- Audio Descriptors
 - Related to visual information
- Multiple Streams
 - Different languages, comments
 - Different angles / viewpoints

GOP & GOF



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Video stream is sequence of still images

- Instead of single picture
 - Group of Frames (short: GOF)
 - Group of Pictures (short: GOP)
- Color description of multiple frames
 - e.g. averaged

Temporal Segmentation



News Broadcast

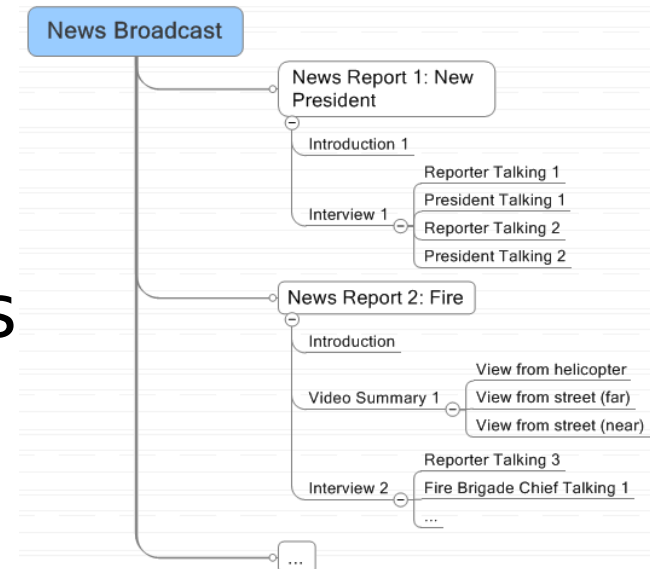


Temporal Segmentation



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- A single decomposition
 - Three different levels
 - Non-overlapping segments
- Visual and audio descriptors
 - Attached to nodes
 - Describing frames of GOF



MPEG-7



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- Multiple segmentation trees possible
- Different stream combined
- No “general description format”
 - How many segmentations / levels
 - Selection of descriptors at nodes
 - Interconnection of streams

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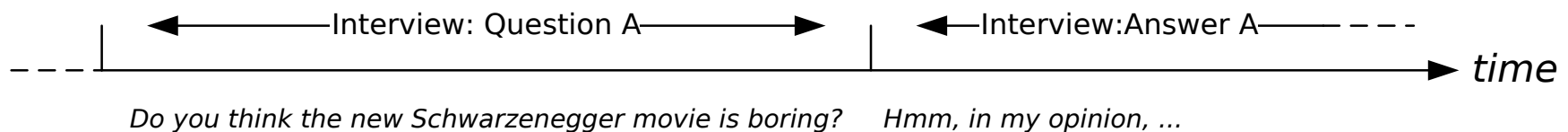


Text Based Retrieval



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- Text annotations assigned to segments
 - Transcriptions, metadata, etc.
- Retrieval is based on text
 - Inverted lists
 - Retrieval of relevant parts/documents



Text Based Retrieval: Applications



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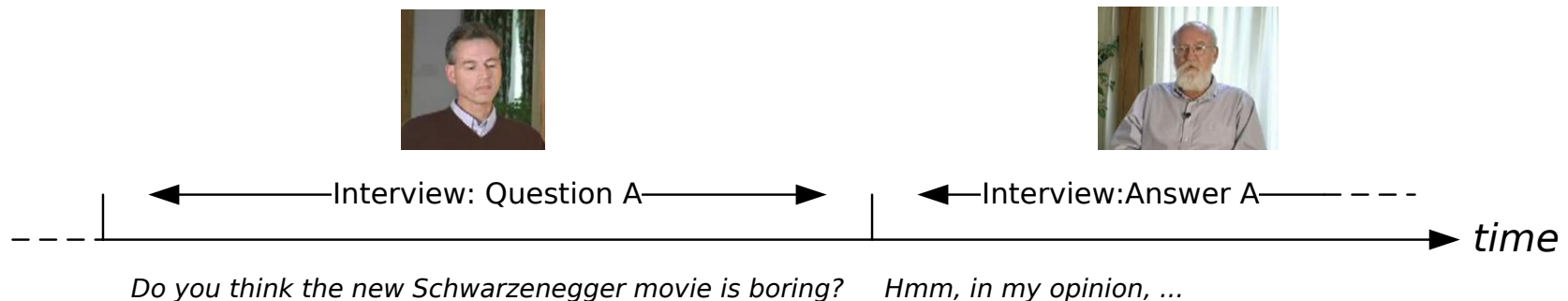
- Speech oriented videos
 - Speech recognition & manually
 - Transcription available for disabled people
 - Examples: News, Cartoons
- Metadata of videos
 - Tagging and descriptions like in YouTube
 - Manual annotations (e.g. sports videos)
 - Spotted keywords

Shot Detection



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- Automatic Segmentation of video stream
 - Find frame where new shot starts
 - Find frame describing the shot best



Different Cuts



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- Simple Cuts (elephantsdream)



- Transitions & combinations (casino royale)



Shot Detection: Methods



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- Uncompressed Domain
 - Video is decoded
 - RGB or YUV values are used for computation
- Compressed Domain
 - Characteristics of the codec are exploited

Shot Detection: Uncompressed Domain



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- Rather good methods already available
 - Detection up to 95%
 - Depends on domain
- Ad detection
 - Logo tracking in the corner of the frame
- News Broadcasts
 - Background tracking (studio environment)
- General approaches
 - Grey values / Color Histogram

Shot Detection: Uncompressed Domain



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Common Algorithm

- For each frame n
 - Extract *histogram*(n)
 - Compute distance to *histogram*($n-1$): $d(n-1, n)$
 - If ($d(n-1, n) > threshold$) report shot boundary
- Problems
 - Each frame has to be decompressed
 - Threshold is domain dependent.

Shot Detection: Compressed Domain



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- Motion Vectors
 - Investigate major direction / amount changes
- Bit Rate
 - VBR: Higher amount -> shot boundary
- Number Macro Blocks / Type
 - More I-Blocks -> shot boundary
- Position of I-Frames
 - Actually a shot detection in encoding

Video Indexing based on Shots



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- Indexing Shots instead of frames
 - Number of shots depends on the domain
 - Considerably smaller than number of frames
- What to index about a shot?
 - Identify one or more “key frames”
 - Index the key frames
- Retrieval based on shots
 - Result is “part of the video”
 - Grouping possible, weighting necessary

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Retrieval Evaluation



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- Similar to IR Evaluation
- Several different tasks
 - Depending on the forum

Retrieval Evaluation Forums



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- TRECVID
 - Indexing and searching in video DBs
- VideoCLEF
 - Video content in multilingual environments
- INEX Multimedia
 - XML (Fragments) based multimedia retrieval

TRECVID 2007



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- Shot boundary Detection
 - Automatic comparison to human annotation reference data.
- High Level Feature Extraction
 - Classification based on 39 concepts
- Search
 - Ranked list based on shots compared to test collection
 - automatic, manually assisted & interactive
- Rushes Summarization
 - Management of raw video material (near duplicate scenes, no audio etc.)
 - Evaluation by a single human judge

VideoCLEF 2008



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- Classification Task: Vid2RSS
 - Dutch television footage
 - Dual language: English & Dutch
 - Both contribute, not translations
 - Transcriptions, keyframes, metadata provided
 - Task: RSS feed for each category
- ImageCLEF
 - Image retrieval tasks

INEX Multimedia



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- Retrieving relevant document fragments with multimedia character
- Input (Query):
 - Either Text or Text & Image
- Output (Result):
 - Image or text or both
- Evaluation
 - Human assessment

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Video Summaries




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- Methods for getting the most out of a video in minimum time


Editor's Picks [more »](#)



Ram Bus
by invisibleeng
160 views




Living the Dream
by livingthedream
66 views




Politics in the Morning
by MyNameisBill
258 views


Recently Added [more »](#)



The Money
by tropfest@yourCut
6 views



HIP HOP 3
by HMAN
24 views



PublicDomainTV-Classical Marilyn-Monkey Business
by PublicDomainTV
16 views

Video Summary Example



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IMB II
Die Intelligente Multimediale Bibliothek

Search

Interface

About

Help

- X

Autor: Neuschmied, Helmut
Genre: Daily news
Duration: 00:05:07 22 frames (25 fps)
Filesize: 53694468 Bytes

Aufzeichnung der ZIB Sport Sendung vom 10.05.2002.

Semantische Objekte:

Keyframes:

Decomposition

1	Scene 0	
2	Scene 1	
3	Scene 2	
4	Scene 3	
5	Scene 4	
6	Scene 5	
7	Scene 6	
8	Scene 7	

(c) 2002 by know-Center, 39

Key Frames



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Goals

- Select appropriate frames for a summary
- Weight frames according to relevance
- Visualize in an 'optimal' way

Problems

- Which are the most relevant frames?
 - Sort out transitions, motion blurred frames
- How many are there?

Video Summaries: Animations



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- Selection of key frames
- Rotated in a loop

<http://www.myvideo.de/watch/1544203>



Video Summaries: Stripe Images



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- Only one pixel column per frame
- Concatenate the pixel columns
 - frame height = stripe image height
 - frame number is stripe image width
- Visualization Benefits
 - Size of shots, Movement
- Visualization Disadvantages
 - No 'big picture'



Video Summary Generation



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- Approaches use most salient frames
 - Based on user attention models
 - Motion, static shots, faces, etc.
 - Clustering & SVD
 - Employ dimensionality reduction
 - Find groups and take representative group members
 - The bigger the group the more important
 - Optimization
 - Minimizes sum of distances to all other frames.
 - While maximizing the distances between key frames

Exercise 04



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- Create a video summary
 - ... of *Chad Vader I – Day Shift Manager*
 - <http://www.youtube.com/watch?v=4wGR4-SeuJ0>
- Use *Video Downloader* to grab video
 - http://javimoya.com/blog/youtube_de.php
- Decide yourself which visualization you want to implement ...
 - Do not use frames displaying text
- Send me the resulting image / document

Exercise 04 Option: Stripe Image



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- Use **FFMPEG** to grab frames
 - e.g. the windows binary
 - `ffmpeg -i [invideo] -f image2 -ss frame%6d.png`
 - see e.g.
<http://wiki.cs.sfu.ca/vml/DigitalVideoHowTo>
- Use e.g. **Irfanview** to put them together
 - Batch Processing -> Crop images ...
 - Image -> Panorama image ...

Thank you ...



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... for your attention