VK Multimedia Information Systems

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Dienstags, 16.00 Uhr c.t., E.2.69

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Results Ex-03

Nach Form

Nach Semantik
## Farbhistogramm:

1. Img2  
2. Img7  
3. Img5  
4. Img3  
5. Img4  
6. Img6

<table>
<thead>
<tr>
<th></th>
<th>rot</th>
<th>weiß</th>
<th>schwarz</th>
<th>gelb/orange</th>
<th>grün</th>
<th>violett</th>
<th>grau</th>
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<td>5</td>
<td>10</td>
<td>15</td>
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<tr>
<td>Img6</td>
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<tr>
<td>Img7</td>
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<td>7</td>
<td>6</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>7</td>
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</table>
Nach Farbe:

Nach Formen:
Video Retrieval

- Applications
  - Video Summaries
  - Ex-04

- Indexing
  - Spatial Indexes
  - MDS - FastMap
  - Clustering
Video Summaries

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

Editor’s Picks

- Rain Bus by invisibleLondon
  188 views

- Living the Dream by livingthedream
  66 views

- Politics in the Morning by Mylameis1111
  215 views

Recently Added

- The Money by tropfest@yourCut
  6 views

- HIP HOP 3 by IMAN
  20 views

- PublicDomainTV-Classics Marilyn-Monkey Business by PublicDomainTV
  10 views
Video Summary Example

IMB II

Autor: Neuschnied, 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
Key Frames

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

- Selection of key frames
- Rotated in a loop

http://www.myvideo.de/watch/1544203
Video Summaries: Animations
Video Summaries: Stripe Images

- 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 Summaries: Compositions

- List of relevant frames
  - Visualization based on relevance
  - Smaller previews less relevant
Video Summaries: Mosaics

- Most relevant frame
  - Displayed using frames
Video Summary Generation

• 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

- 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

- 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 ...
Video Retrieval

● Applications
  • Video Summaries
  • Ex-04

● Indexing
  • Spatial Indexes
    • MDS - FastMap
  • Metric Indexes
    • Clustering
Indexing Visual Information

- Text is indexed in inverted lists
  - Search time depends on # of terms
- Visual information expressed by “vectors”
  - Combined with a metric capturing the semantics of similarity
  - Inverted list does not work here
  - An “index of vectors” is needed
Indexing Visual Information

- Vectors describe “points in a space”
  - Space is n-dimensional
  - n might be rather big
- Metric describes distance between points
  - E.g. L1 or L2 …
- Query is also a vector := point
  - Searching for points (vectors) near to query
- Idea for index:
  - Index neighbourhood …
Spatial Indexes

Using equally sized rectangles (Optimal for L1 …)
Spatial Indexes

Using overlapping rectangles …
Spatial Indexes

● Common data structures
  • R Tree
    • R*, R+, ....
    • Overlapping rectangles
    • Search is a rectangle
  
  • Quadtree (Octtree)
    • Equally sized regions, subdivided
    • 4 quadrants or 8 octants
    • Search selects quadrants
R-Tree
Quadtree
Spatial Indexes: Drawbacks

- Data structures must minimize
  - false negatives (→ maximizes recall)
  - false positives (→ search time)
- Descriptors, metrics & parameters need to be selected at index time
  - Searches combining multiple descriptors are a complicated issue
- Work best for small $n$
  - MDS has to be applied ...
Multidimensional Scaling (MDS)

- Reducing the dimensions of a feature space
  - E.g. From 64 dimensions to 8
  - Without loosing too much information about neighbourhoods

- Applications in multimedia retrieval
  - Indexing based on coordinates
  - Spatial Indexes:
    - Data structures to find nearest neighbours fast
Multidimensional Scaling (MDS)

- **Interpolation: FastMap**
  - Linear in terms of objects
  - Used e.g. in IBM QBIC

- **Iterative: Force Directed Placement**
  - Iterative optimization of initial placement
  - Cubic runtime
FastMap

- For Each dimension $d$
  - Find Pivots (the most distant objects)
  - For each object, which is not a pivot
    - Interpolate position between pivots in this dimension
    - Next object
- Next Pivot
FastMap

Pivot 1

d(pivot1, p3)

x-position of p3

d(pivot2, p3)

Pivot 2
FastMap

y-position of p3
FastMap: Pivots
How to find optimal pivots?

- Select one object randomly -> $P_1$
- Select Object $P_2$ with maximum distance from $P_1$ to $P_2$
- If $d(P_1, P_2) < t$
  - Set $P_1 = P_2$
  - Goto (2)

Normally no threshold is used but this is done $x$ times.
Force Directed Placement

- All objects are assigned coordinates
- For each object $o$
  - Movement vector $v = 0$
  - For each object $p$
    - Calculate repulsion & attraction forces between $o$ & $p$
    - Compute movement vector $v(o, p)$ depending on the forces
    - $v = v + v(o, p)$

1. If overall movement is still high goto 2.
FDP: Parameters

- Gravity as overall attraction
  - Prevents uncontrolled spread
- Overall repulsion
  - Prevents coming objects from coming too close
- Minimum distance
  - If objects are on the coordinates
- Spring parameters
  - Repulsion stronger close up
  - Attraction stronger if far away
FDP
Demo

- Emir
Vielen Dank ...

... für die Aufmerksamkeit