VK Multimedia Information Systems

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Dienstags, 16.oo Uhr c.t., E.2.69

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Results Ex-03

Nach Form

Nach Semantik

Results Ex-03

Farbhistogramm:

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

	rot	weiß	schwarz	gelb/orange	grün	violett	grau
Img1	45	45	10	0	0	0	0
Img2	10	55	5	10	15	5	0
Img3	30	3	2	35	0	0	30
Img4	15	10	15	0	0	0	60
Img5	0	40	25	10	0	25	0
Img6	0	20	10	0	0	0	70
Img7	80	7	6	0	0	0	7

Results Ex-03

Nach Farbe:

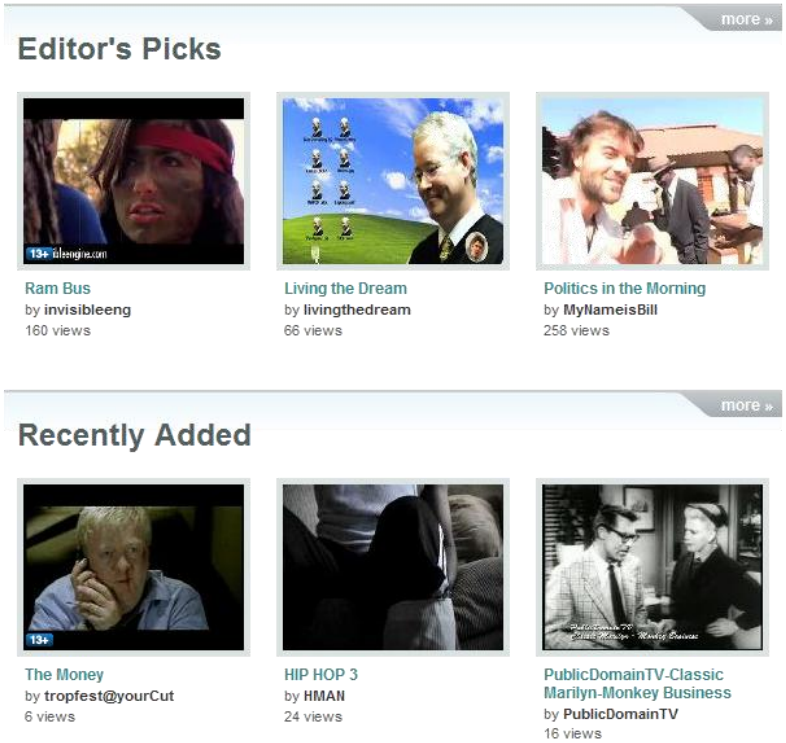
Nach Formen:

Video Retrieval

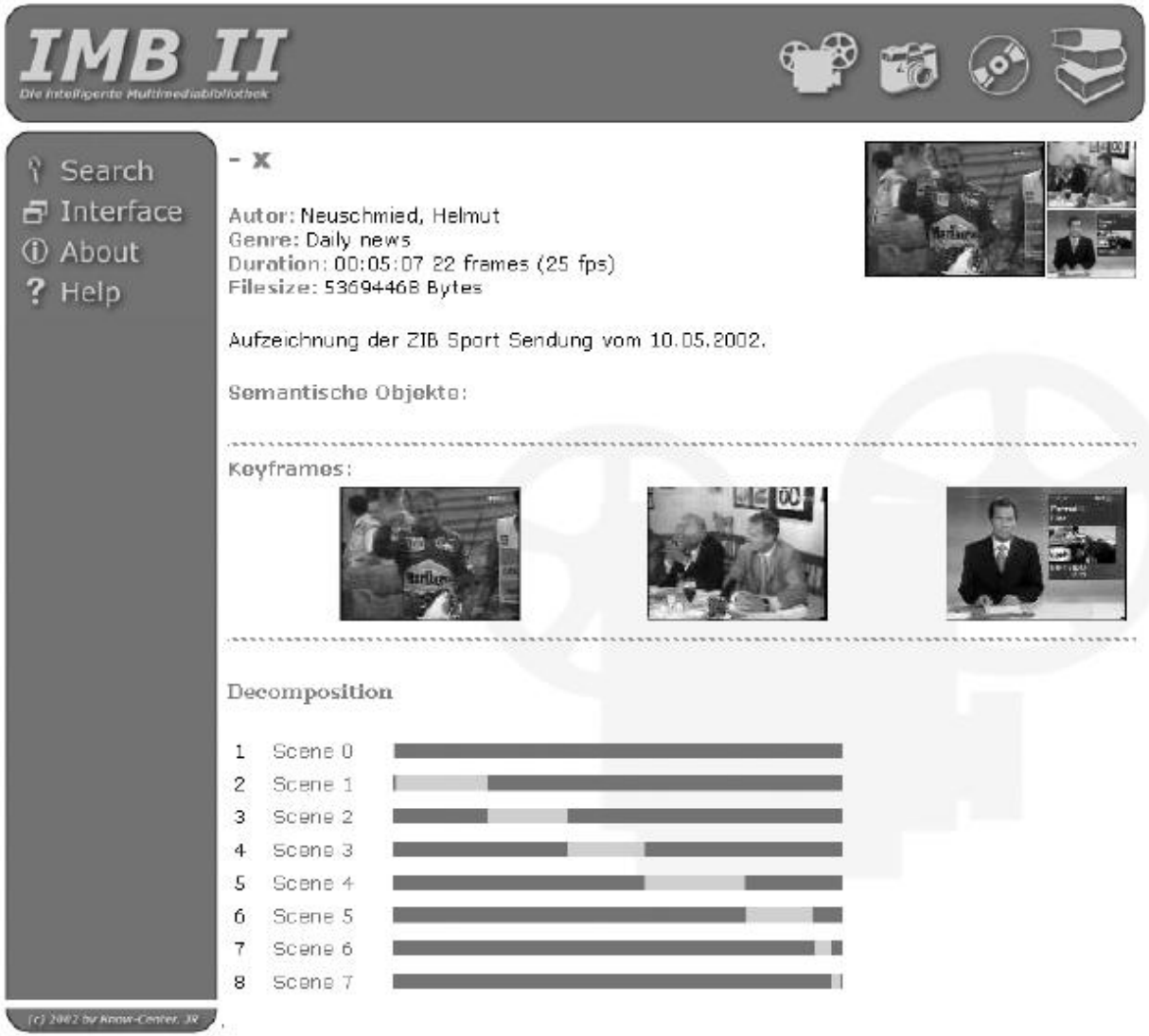
- Applications
  - Video Summaries
  - Ex-04
- Indexing
  - Spatial Indexes
  - MDS - FastMap
  - Clustering

Video Summaries

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



Video Summary Example



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 heigth
  - 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

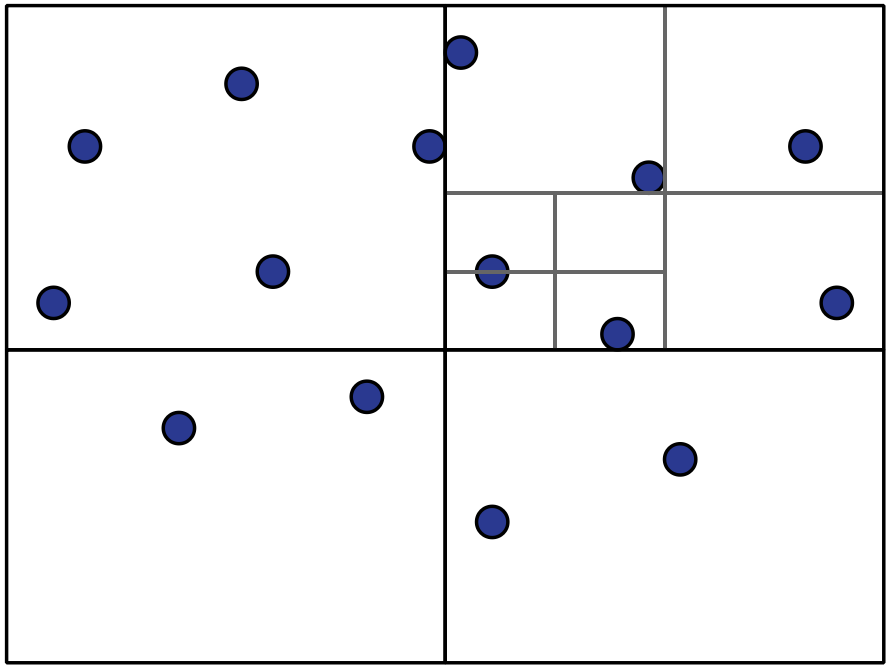
Indexing Visual Information

- 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

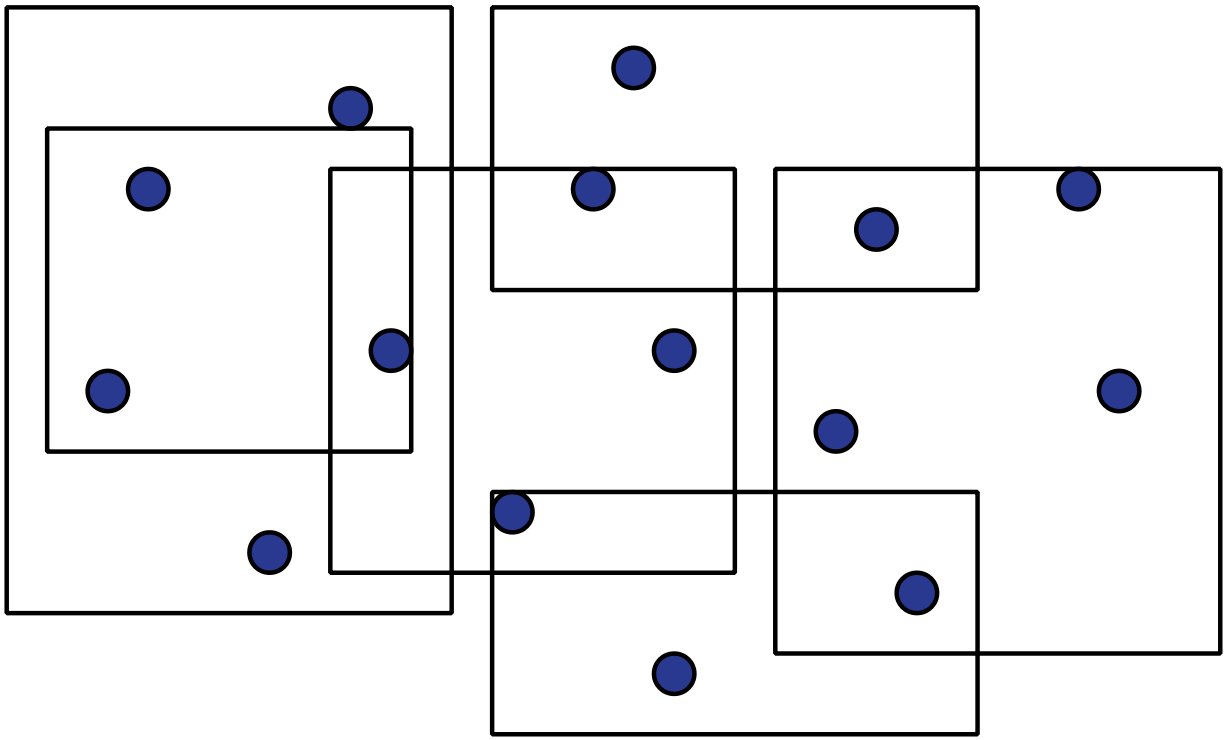
- Vectors describe “points in a space”
  - Space is n-dimensional
  - n might be rather big
- Metric describes distance between points
  - E.g. L1 or L2 ...
- Query is also a vector := point
  - Searching for points (vectors) near to query
- Idea for index:
  - Index neighbourhood ...

Spatial Indexes



Using equally sized rectangles (Optimal for L1 …)

Spatial Indexes

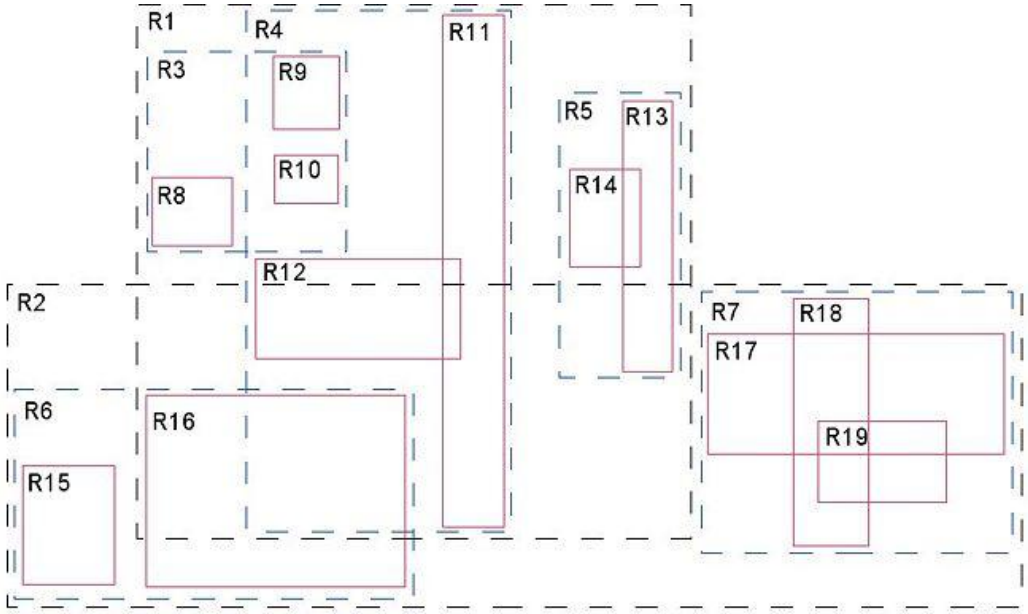


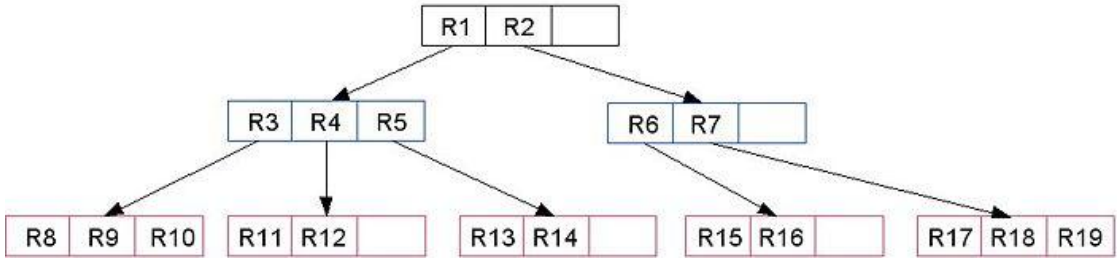
Using overlapping rectangles …

Spatial Indexes

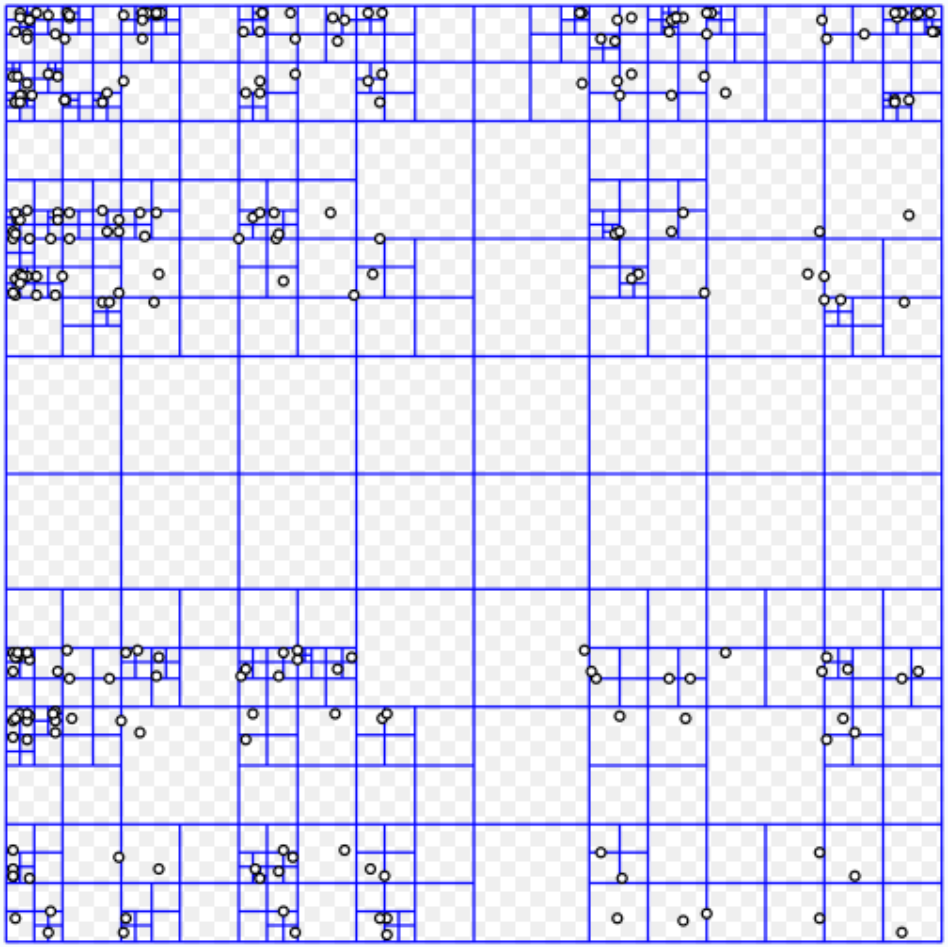
- Common data structures
  - R Tree
    - R*, R+, ...
    - Overlapping rectangles
    - Search is a rectangle
  - Quadtree (Octtree)
    - Equally sized regions, subdivided
    - 4 quadrants or 8 octants
    - Search selects quadrants

R-Tree


R1
R4
R11
R3
R9
R5
R13
R10
R14
R8
R12
R2
R7
R18
R17
R6
R16
R19
R15


R1
R2
R3
R4
R5
R6
R7
R8
R9
R10
R11
R12
R13
R14
R15
R16
R17
R18
R19

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

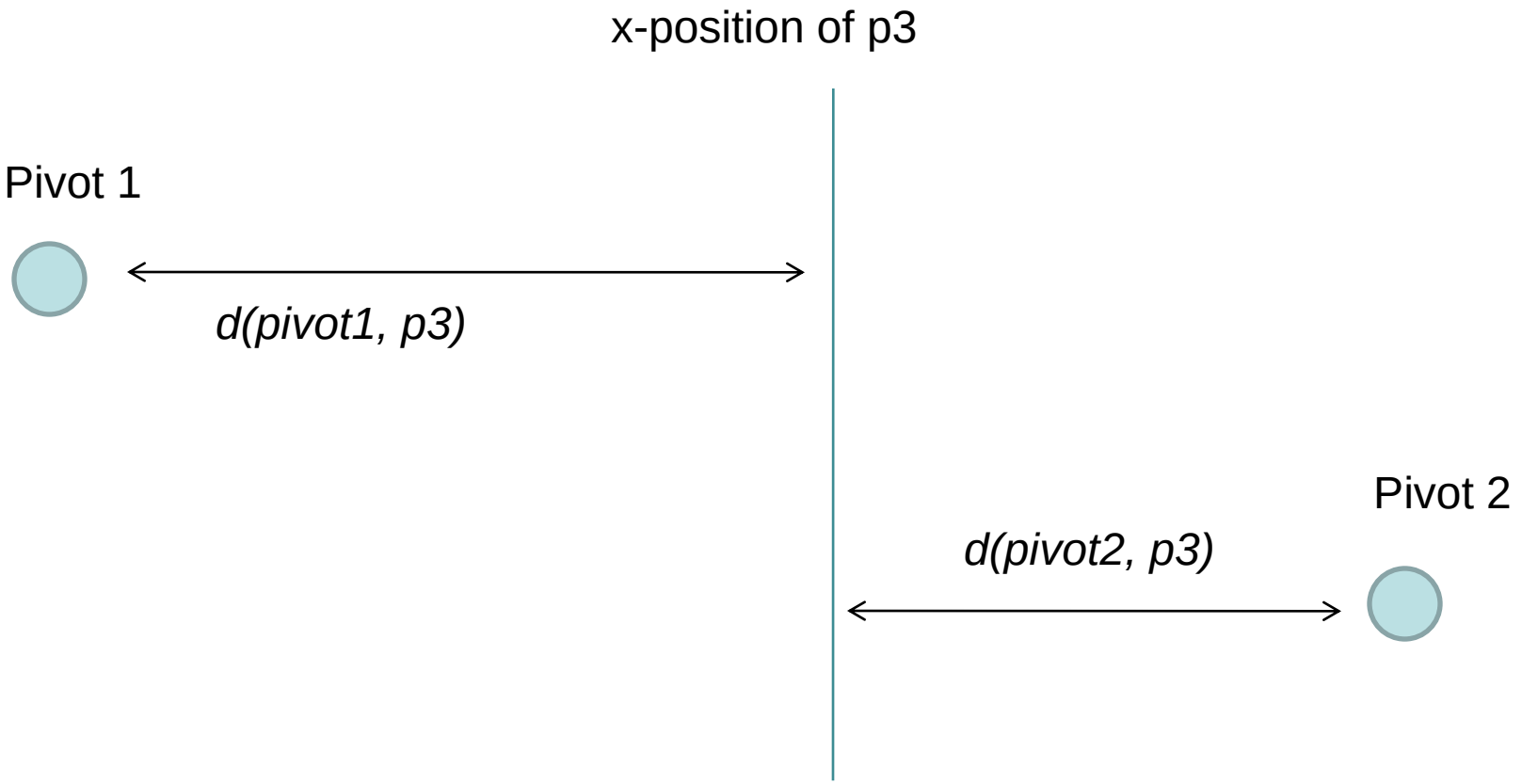
Multidimensional Scaling (MDS)

- Interpolation: FastMap
  - Linear in terms of objects
  - Used e.g. in IBM QBIC
- Iterative: Force Directed Placement
  - Iterative optimization of initial placement
  - Cubic runtime

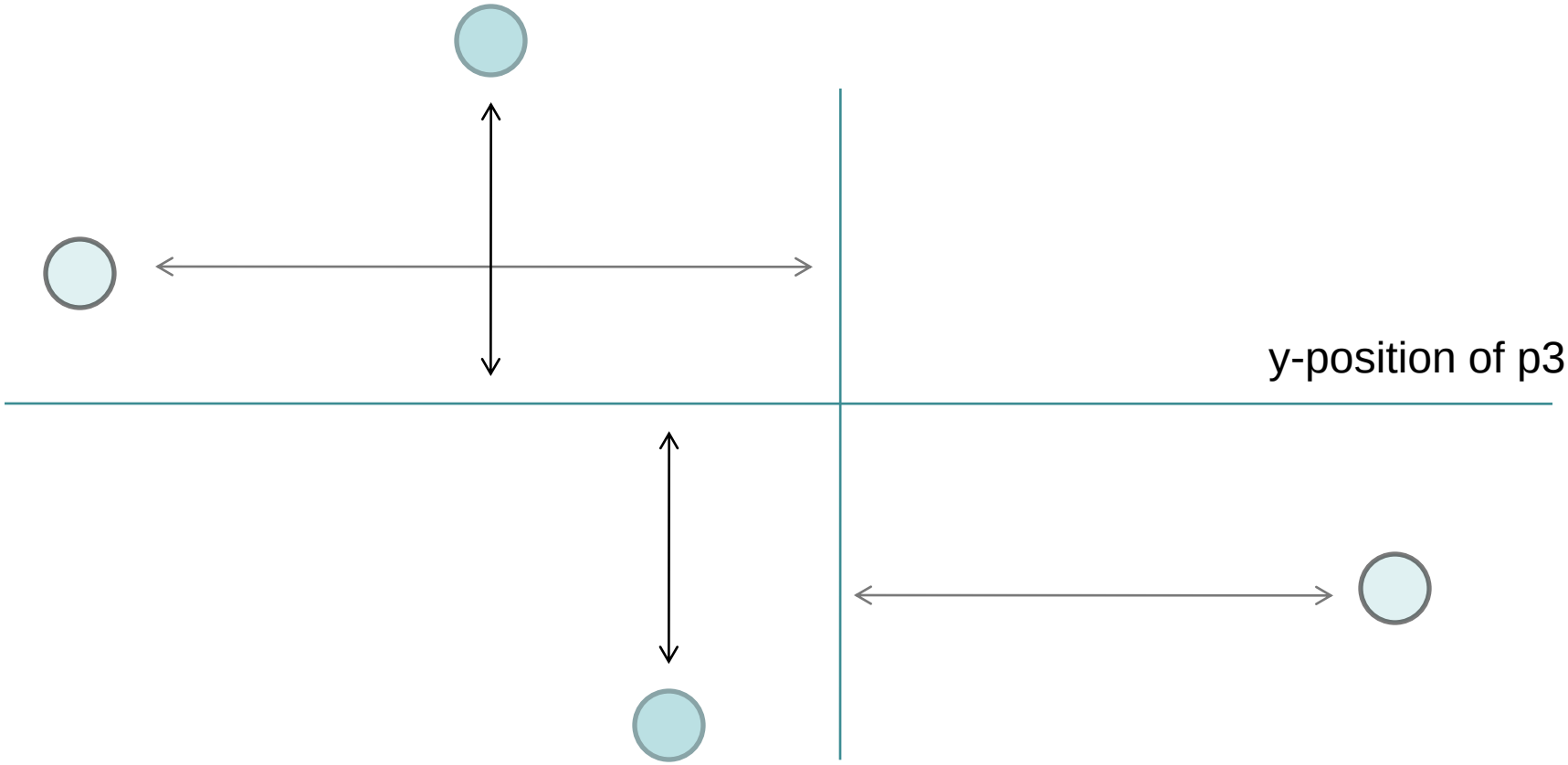
FastMap

- 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



FastMap



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

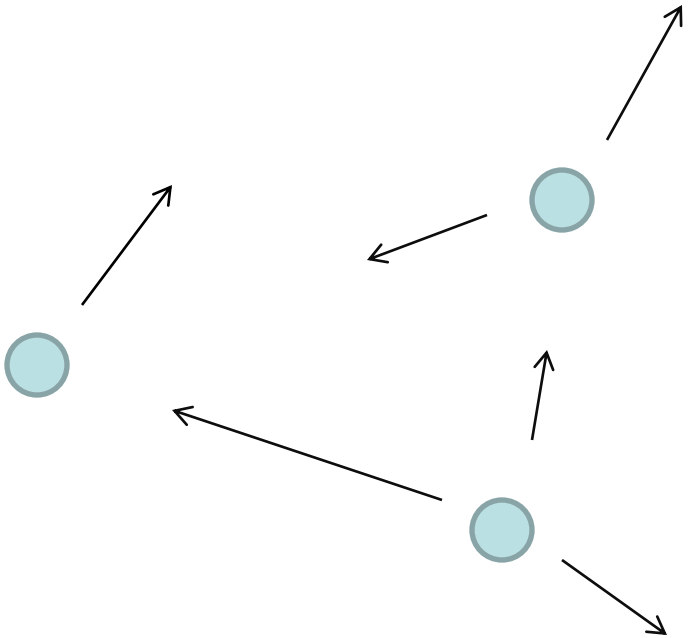
- All objects are assigned coordinates
- For each object *o*
  - Movement vector $v = 0$
  - For each object *p*
    - Calculate repulsion & attraction forces between *o* & *p*
    - Compute movement vector $v(o, p)$ depending on the forces
    - $v = v + v(o, p)$

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