Sub-image Searching Through Intersection of Local Descriptors

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Problem
- Searching for database images that contain an object in the query image.

Examples
- Image retrieval by a partial image
- Identification of what is the query image

Applications
- Criminalistics
- Automatic annotation
- Object categorization

Properties
- Content-based retrieval
- Local information extraction

Solution
- Local image features
  - Scale Invariant Feature Transform (SIFT):
    - Descriptor – content of small neighborhood
    - Locator – coordinates of the neighborhood
    - Scale – importance of the descriptor
  - Describe objects by a set of features

Query Answer:

Intersection of local descriptors
- Image = set of features
- Find matching pairs (similar features)

Indexing:
- All features of images in M-tree
  - Along with image IDs

Searching:
- Get $n$ the most important features from the query
- For each run a range query in M-tree
  - A candidate list of images is obtained
- Rank candidates by
  - sum of $\alpha$-ranks divide by $n$
  - $\alpha \in \{x,y\}$ – spatial position of a feature
  - $\alpha$-rank = number of swapped features w.r.t. to the query

Demonstration

Data
- 15,337 company logos
- $\Rightarrow$ 2,359,839 SIFTs extracted

Infrastructure
- One server: 2 quad-core CPU 2GHz, 14GiB RAM, six-disk RAID5

Parameters:
- radius $\epsilon \in \{0,450\}$, default $\epsilon=250$
- $n \in \{1,24\}$, default $n=18$
- limit $\in \{0,\infty\}$, default limit=6