

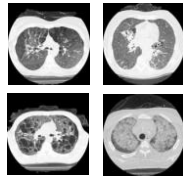
Bag-of-Features and Color Histogram Based Composite Descriptor for Accurate Large-scale Image Retrieval

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Research Contents

Content-based Image Retrieval (CBIR)

- Searching for relevant images by contents not by annotations
- Key issues
 - Accuracy of results
 - Memory usage
 - Query time
- Wide applications
 - Web search engines
 - Satellite image search
 - Art collection Management
 - Biodiversity
 - Medical diagnosis



Medical diagnosis



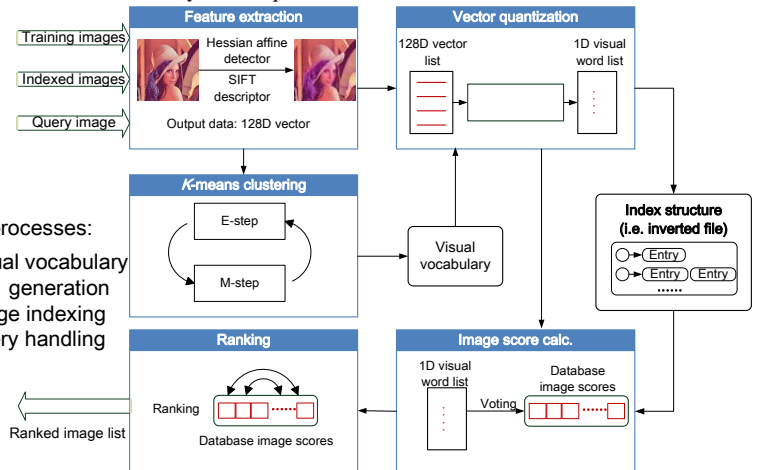
Art collection Management



Biodiversity

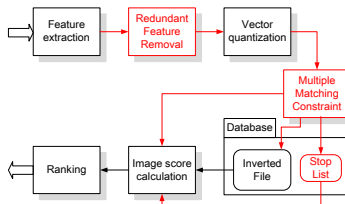
Bag-of-Features (BOF) Histogram based Image Retrieval

- High accuracy: using local descriptor (e.g. SIFT)
- Low memory: due to quantization



- Three processes:
- Visual vocabulary generation
 - Image indexing
 - Query handling

Proposed Feature Selection Strategies



Redundant Feature Removal

$$comerness = \det(\mu(x, \sigma_x, \sigma_y)) - \alpha \times trace^2(\mu(x, \sigma_x, \sigma_y))$$

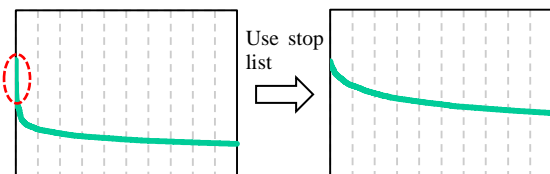
Keep the top R_{max} descriptors according to the descent order of *comerness* and remove the rest ones

Multiple Match Constraint

MMC directly constrains the number of descriptors with the same centroid:

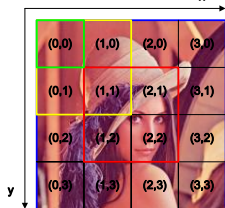
$$\text{count}(q) \leq C_{max}$$

Stop List Filtering

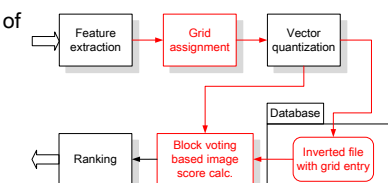


Proposed Configurable Block Voting Mechanism

4*4 grids support 4 kinds of blocking modes



b: block in the query image
b': block in a database image



$$s^* = \text{weight_sum}(H)$$

$$s_b^* = \max_{1 \leq b' \leq 9} (s_{b,b'})$$

$$H = \begin{bmatrix} s_1^* & s_2^* & s_3^* \\ s_4^* & s_5^* & s_6^* \\ s_7^* & s_8^* & s_9^* \end{bmatrix}$$

Proposed Composite Descriptor

$$k\text{-dimensional BOF histogram} \oplus m\text{-dimensional Color histogram}$$

Quantized RGB Color Histogram (QCH)

Fuzzy Color and Texture Histogram (FCTH)

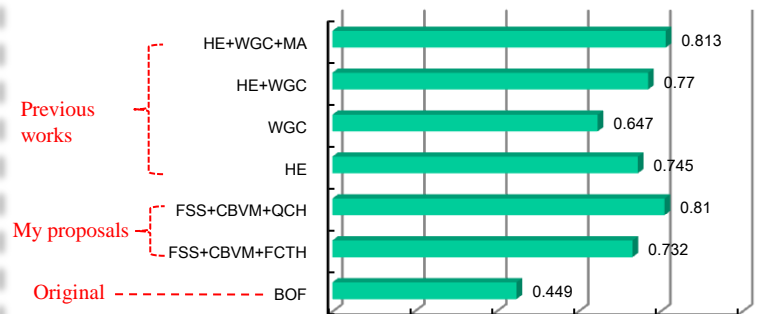
Emphasis on high accuracy

Emphasis on low space expense

Memory usage:
QCH --- 192 bytes per image
FCTH --- 72 bytes per image

$$\text{Merged Image Score: } score = score_{bof} + \alpha * score_{ch}$$

Experimental Results



One example query image

Methods	Correct Result 1	Rank	Correct Result 2	Rank
BOF		287		185
FSS+CBVM+FCTH		51		2
FSS+CBVM+QCH		1		2

