

# Multidimensional Structural Descriptors for Medical Image Retrieval



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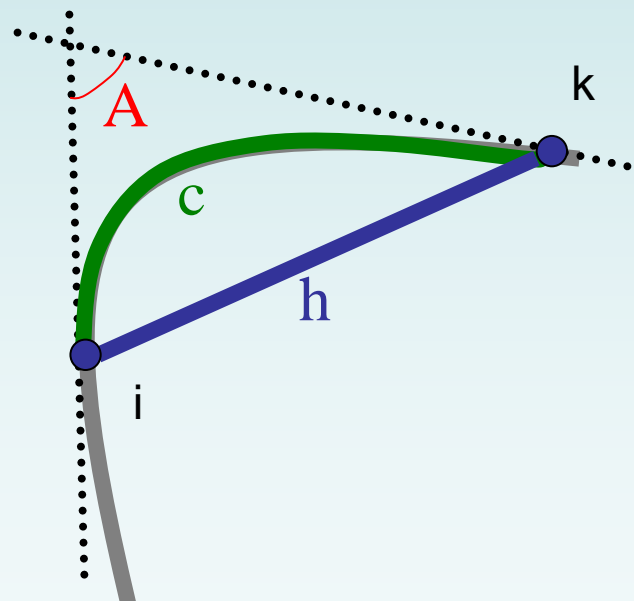
# Co-occurrence matrices concept

Ordinary histogram: structural information is fully abstracted away: two different images can have the same histograms.

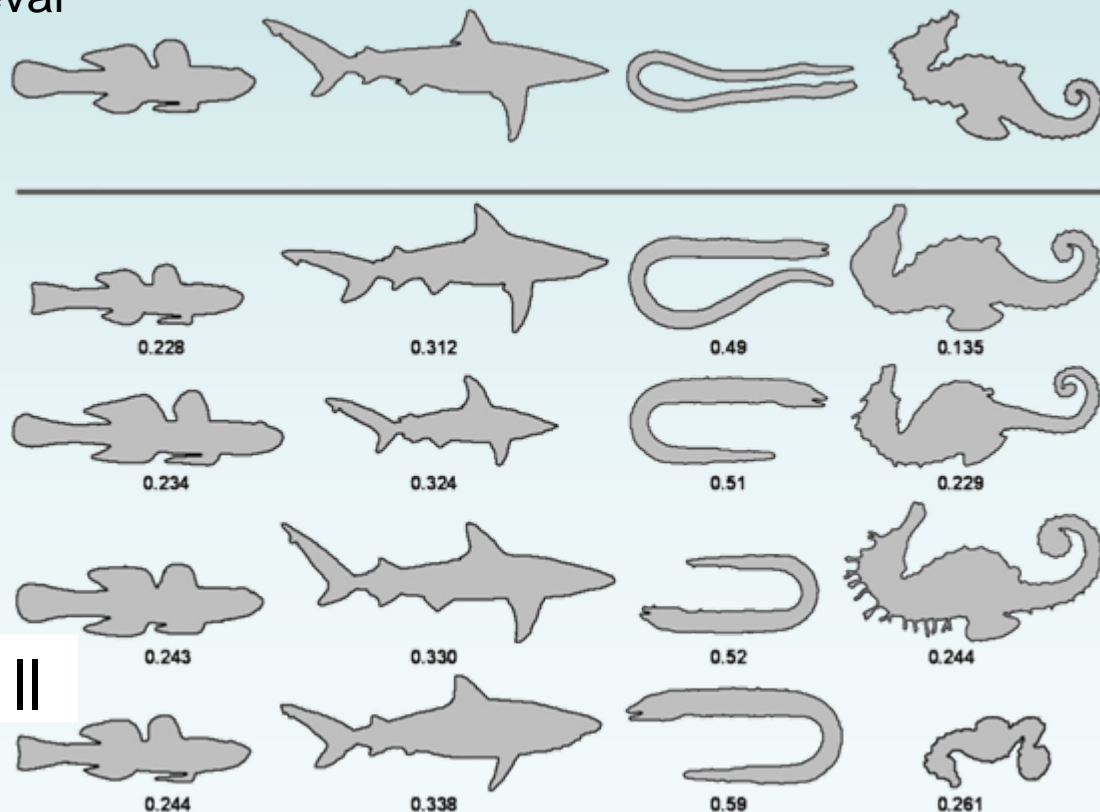
Classical co-occurrence matrix (Haralick): spatial information is added to the ordinary histogram.

The idea of “co-occurrence” can be extended

Example: Sea animals shapes retrieval

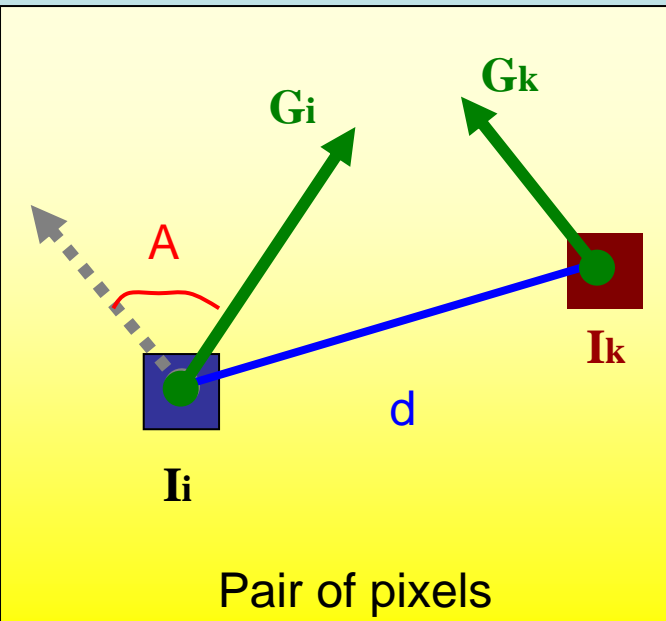


$$W_s = || w_s( c(i,k), h(i,k), A(i,k) ) ||$$



# Generalized co-occurrence matrices

We used the most general form of these descriptor for heterogeneous CLEF database



$$W = w(I(i), I(k), G(i), G(k), A(i, k), d(i, k))$$

where  $i = (x_i, y_i)$ ,  $k = (x_k, y_k)$  is an arbitrarily pair of pixels,

$d(i, k)$  distance between them,

$I(i), I(k)$  intensity of the pixels\*,

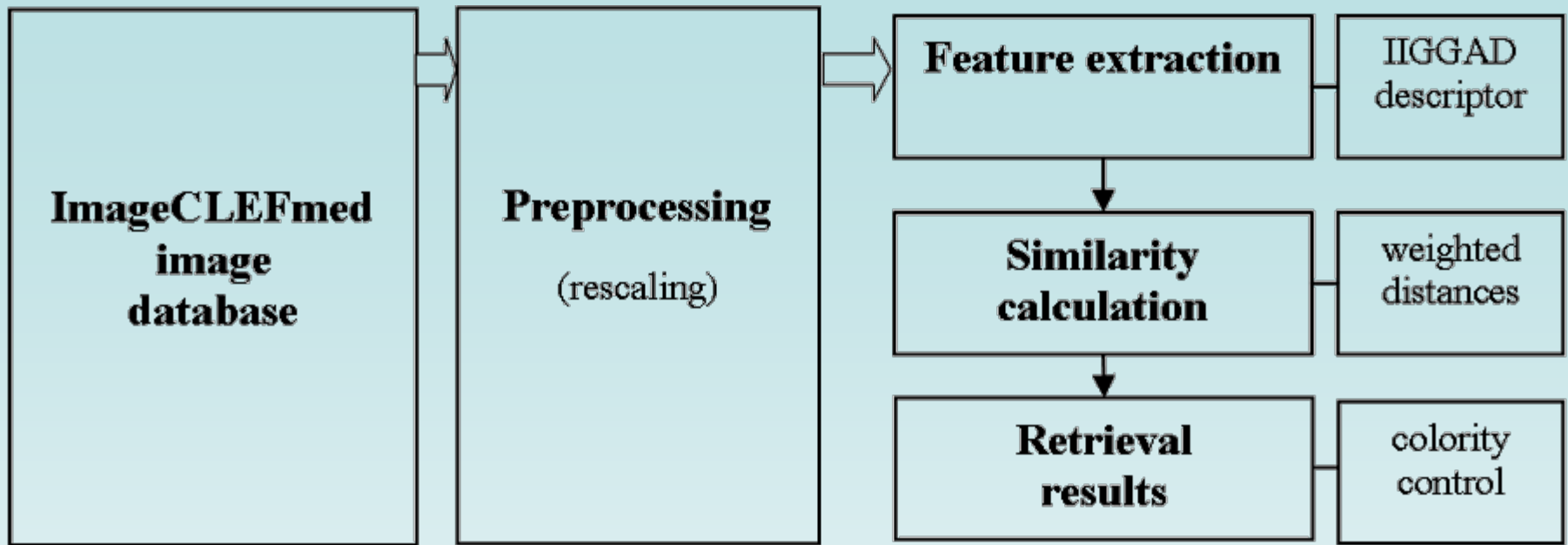
$G(i), G(k)$  absolute values of intensity gradients,

$A(i, k)$  angle between the directions of the gradients.

\*color can be converted to gray level

In some cases reduced forms of the above descriptors can be used ( eg., GGAD)

# Image retrieval schema



Preprocessing: image rescaling to 150x150 pixels

Descriptors: IIGGAD (54432 elements)

Similarity measure: minimal manhattan distance to the query group

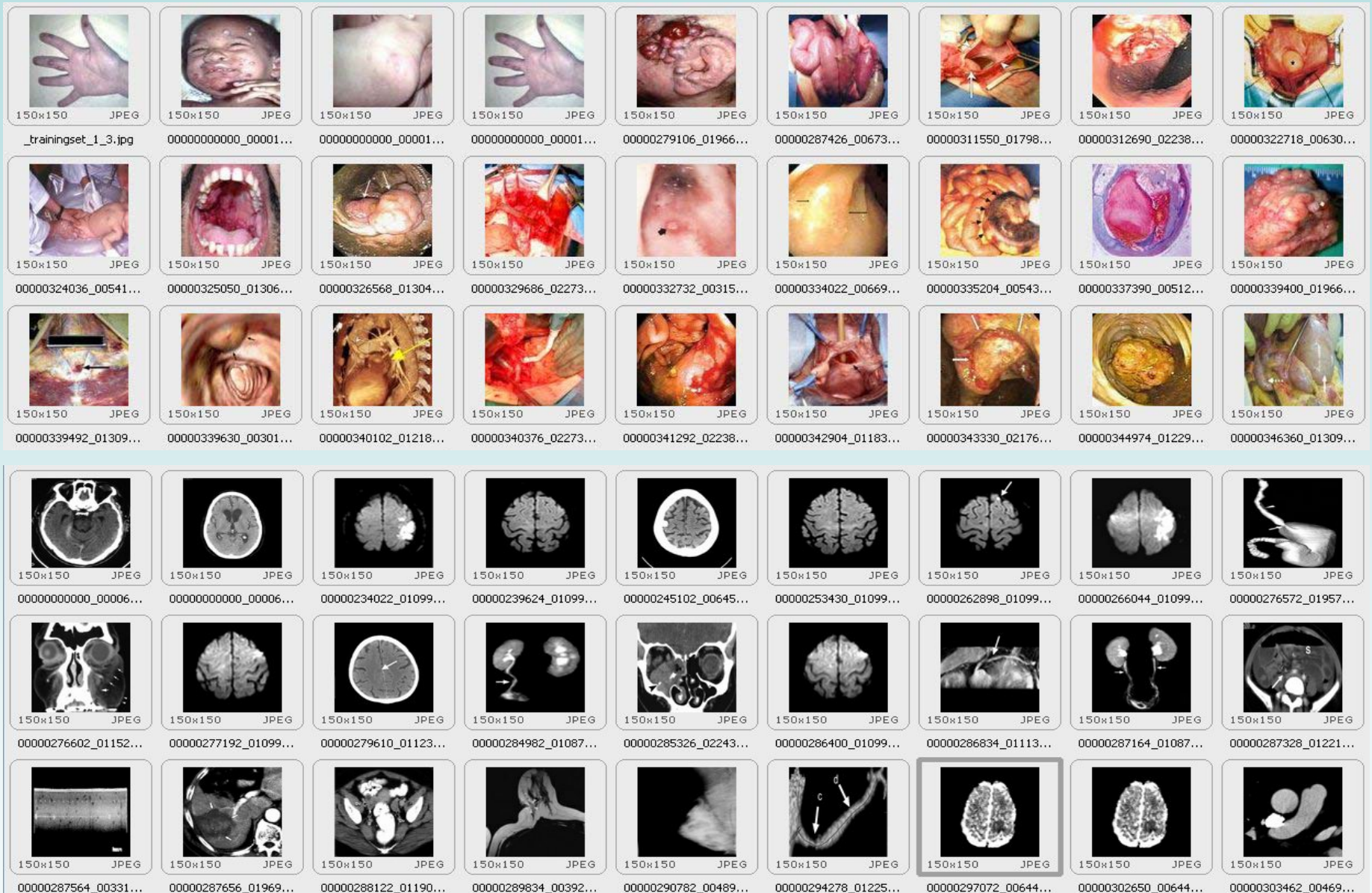
Query: group of 2-3 images

Image database : 18.6 Gb

Descr. database: 16 Gb (no optimization)

Retrieval time: 2 h

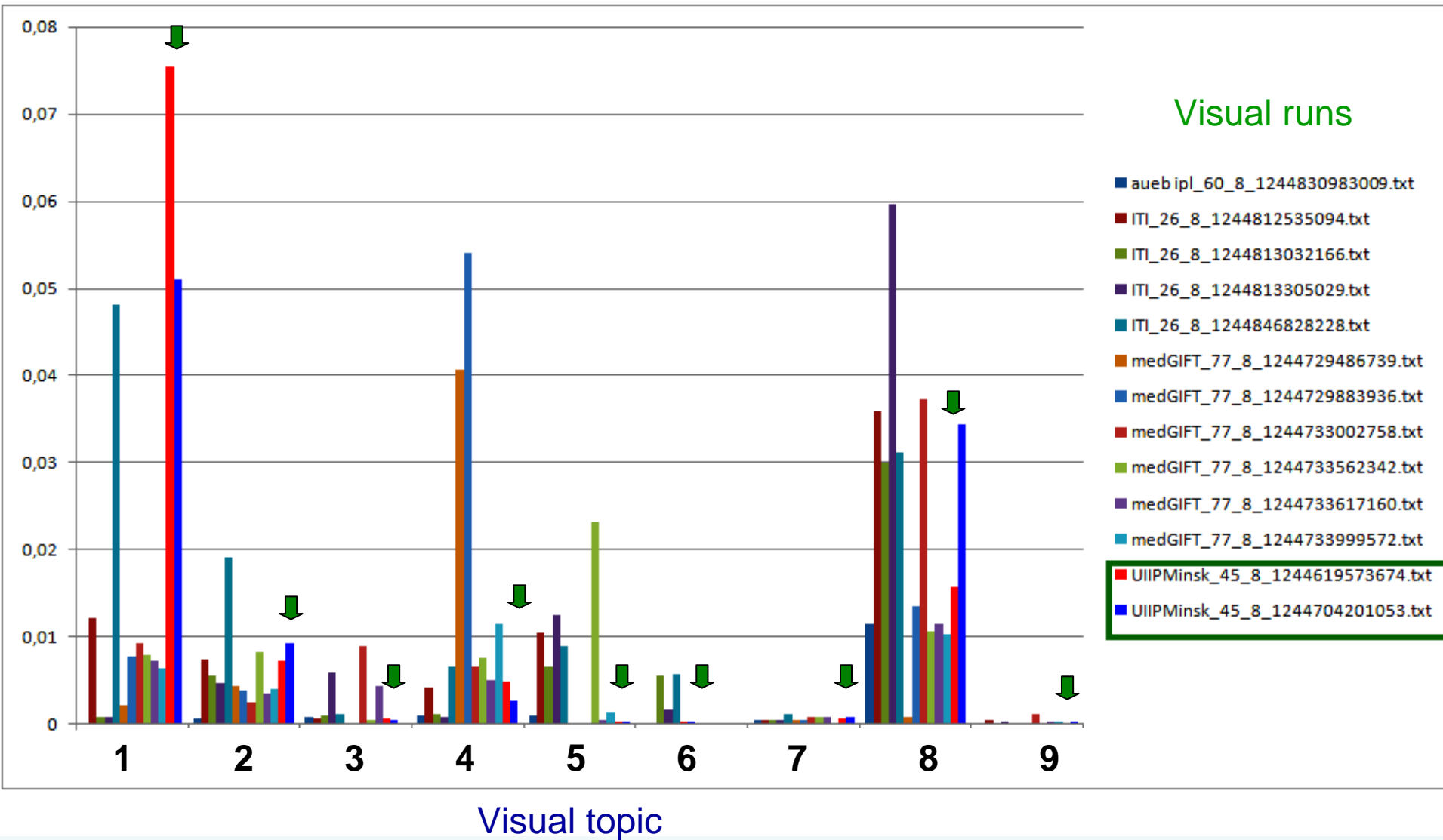
# Results



A snapshot of the top 27 retrieval results with the best and the worst mean average precision value (topic 1, "Photos of erythema", MAP = 0.0754; topic 6, "CT images of subdural hemorrhage", MAP = 0.0)

# Results

## MAP



MAP for the first 9 CLEF topics. Visual retrieval only.

# Results

- Image semantics is not described, just visual similarity.
- First 9 of 25 topics were submitted (visual topics only).
- Generalized co-occurrence matrices showed very promising results.

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