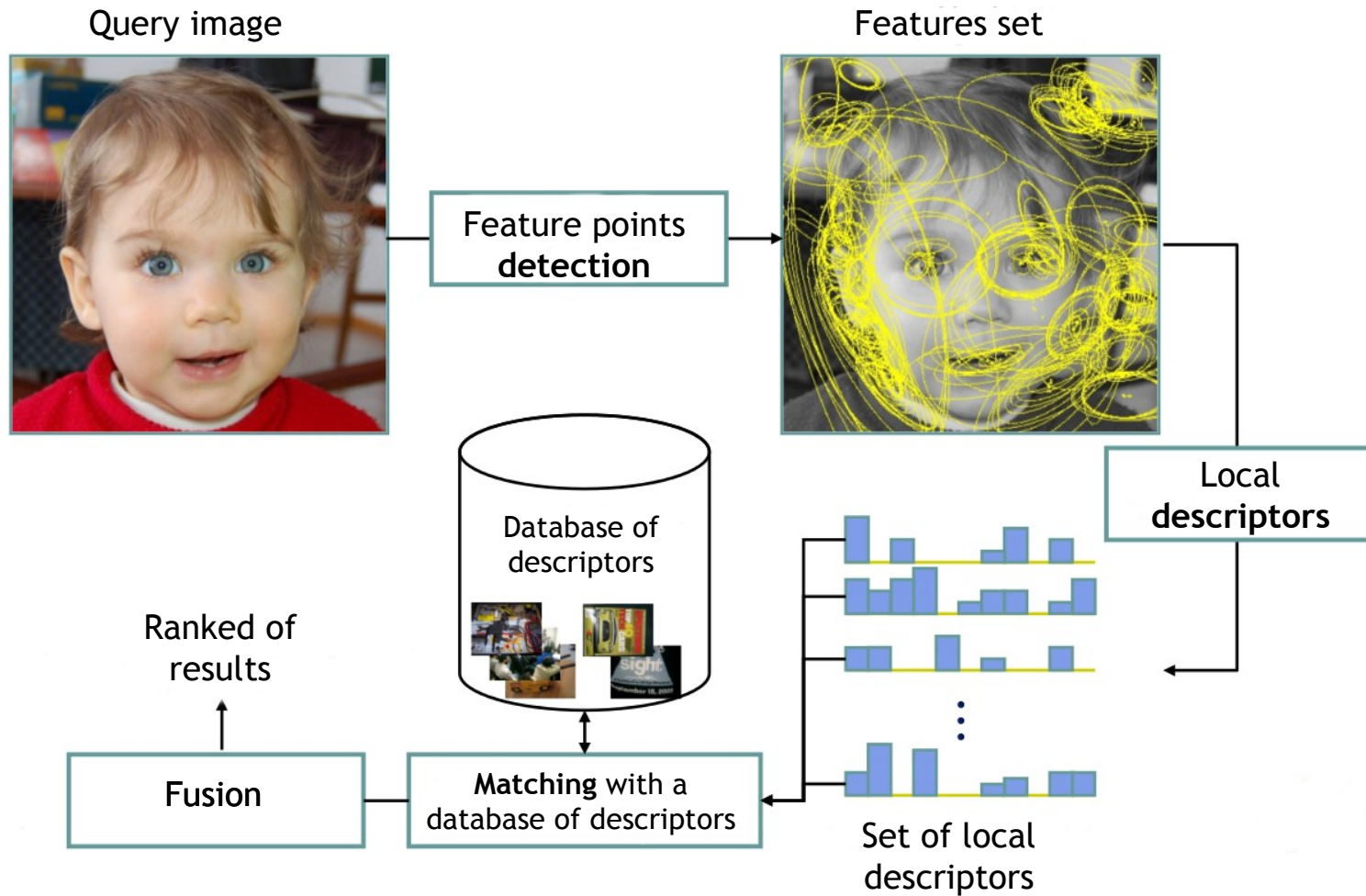


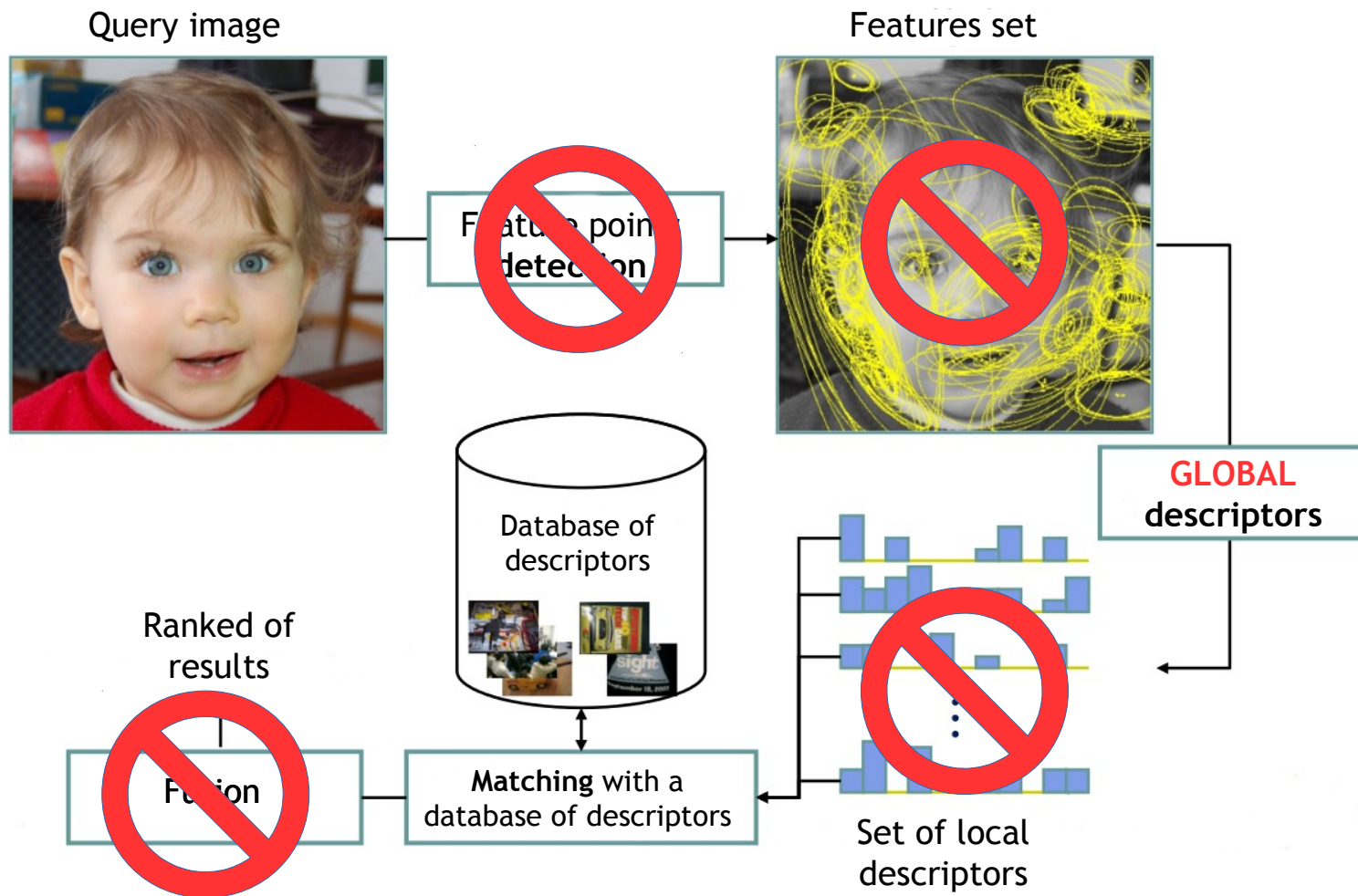
Image retrieval

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Local descriptors architecture



Global descriptors architecture



Global descriptors

- Color based
- Texture based
- Joint descriptors

Color Histogram

- Quantizing RGB color to 64 bins ...
 - Note that this “should” be based on a palette ...



In Lire: *SimpleColorHistogram*

Color Correlogram

- Histogram on
 - how often **specific colors** occur
 - in the **neighbourhood** of each other
- Histogram size is $(\# \text{ of colors})^2$
 - For each color an array of neighboring colors

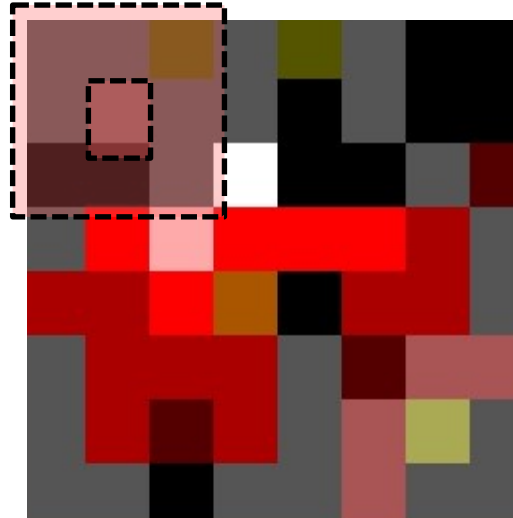
Color Correlogram

Number of colors

	Red	Green	Blue
Red	12	3	14
Green	3	16	8
Blue	14	8	23

For red pixels, we find 3 green pixels all over the image in a neighborhood p

Color Correlogram



Auto Color Correlogram

- Auto Color Correlogram
 - Just indexing how often $color(p)$ occurs in neighborhood of pixel p
 - Simplifies the histogram to size # of colors
 - Measure e.g. how red comes with red etc.

In Lire: *AutoColorCorrelogram*

	Red	Green	Blue
Red	12	3	14
Green	3	16	8
Blue	14	8	23

Other Color-based Global Descriptors

- Opponent Histogram (*OpponentHistogram*)
- Fuzzy Color Histogram (*FuzzyColorHistogram*)
- Fuzzy Opponent Histogram (*FuzzyOpponentHistogram*)

Global descriptors

- Color based
- Texture based
- Joint descriptors

Texture & Shape Features

- Indexing non color features in image
 - Outlines, edges of regions
 - Overall characteristics like coarseness and regularity



Edge detection (Canny detector)

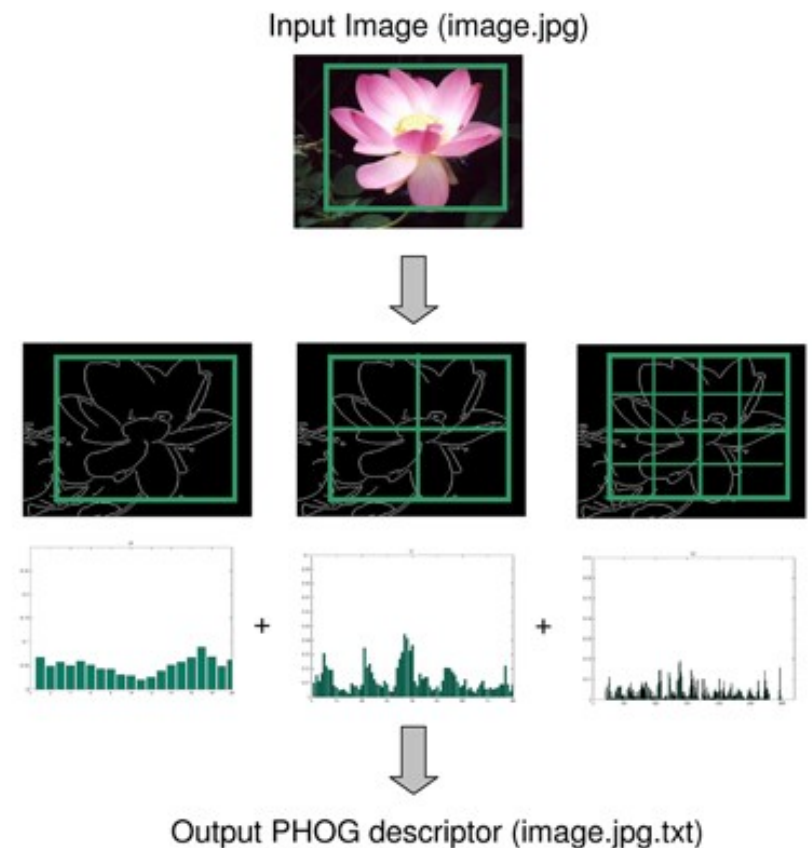


Horizontal and Vertical Gradients + Local maxima + Thresholding

→ Contours + Orientation

Texture-based features

- Edge Histogram (MPEG-7)
 - In Lire: *EdgeHistogram*
- Pyramidal Histogram of Oriented Gradients
 - In Lire: *PHOG*



Other Texture-based features

- Tamura features (*Tamura*)
- Rotation Invariant Local Binary Patterns (*RotationInvariantLocalBinaryPatterns*)

Global descriptors

- Color based
- Texture based
- Joint descriptors

Joint Histograms

- Color & texture properties per pixel
 - E.g. color (8 bins) + gradient (4 bins)
- E.g. directionality histogram per color bin
 - I.e. 4 times a color histogram

Joint Histogram

88 red pixels with a gradient direction of 0-45°

Color Histogram

	0°-45°	45°-90°	90°-135°	135°-180°	Σ
red	88	51	93	10	241
orange	29	29	53	34	144
yellow	57	58	22	88	224
green	6	13	58	8	85
blue	25	86	43	47	200
Σ	204	236	268	186	

Directionality Histogram

Joint Histograms

- Color and Edge Directivity Descriptor (*CEDD*)
- Fuzzy Color and Texture Histogram (*FCTH*)
- CEDD + FCTH (*JCD*)