



Faculty of Science



A study of higher order image descriptors

Thesis defence

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Agenda

① Introduction to image descriptors

② Image correspondence

③ Pedestrian detection



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Introduction to image descriptors

- Representation of local image structure

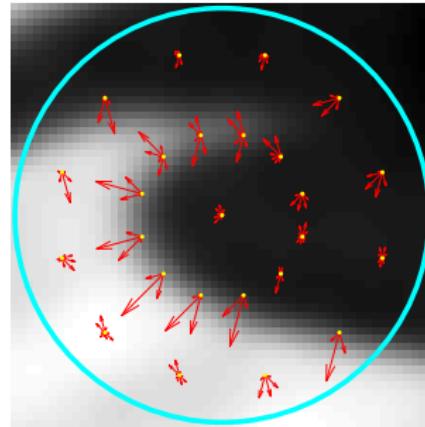


Image transformations



Scale-space



Applications



(a) Image correspondence



(b) Pedestrian detection



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Interest point detection



Matching strategy



Proposed descriptor

$$H_j(f_i) = \int F(\mathbf{x}) A_j(\mathbf{x}) P(\mathbf{x}) B(\mathbf{x}; f_i, f) d\mathbf{x}$$

where

i is the bin number

j is the cell number



Histogram domain

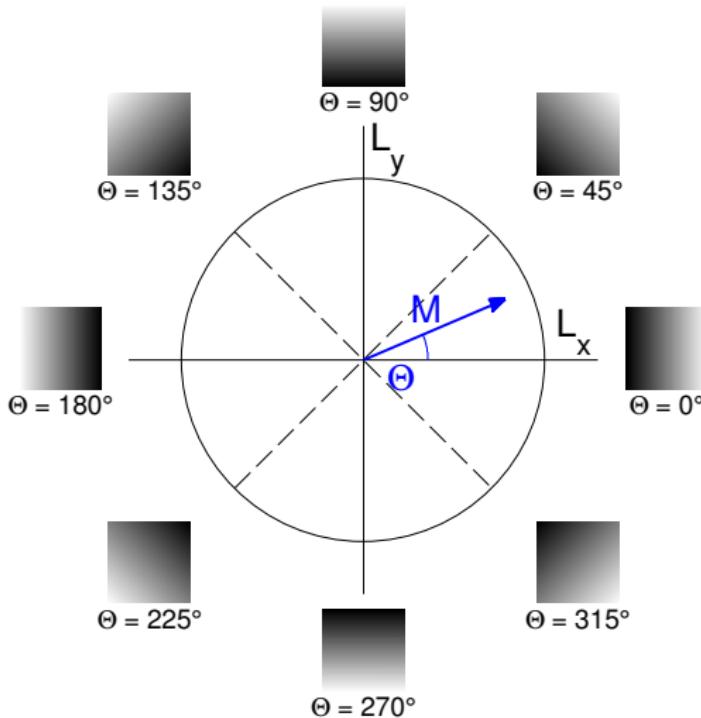
$$H_j(f_i) = \int F(\mathbf{x}) A_j(\mathbf{x}) P(\mathbf{x}) B(\mathbf{x}; f_i, f) d\mathbf{x}$$

Bin value function f

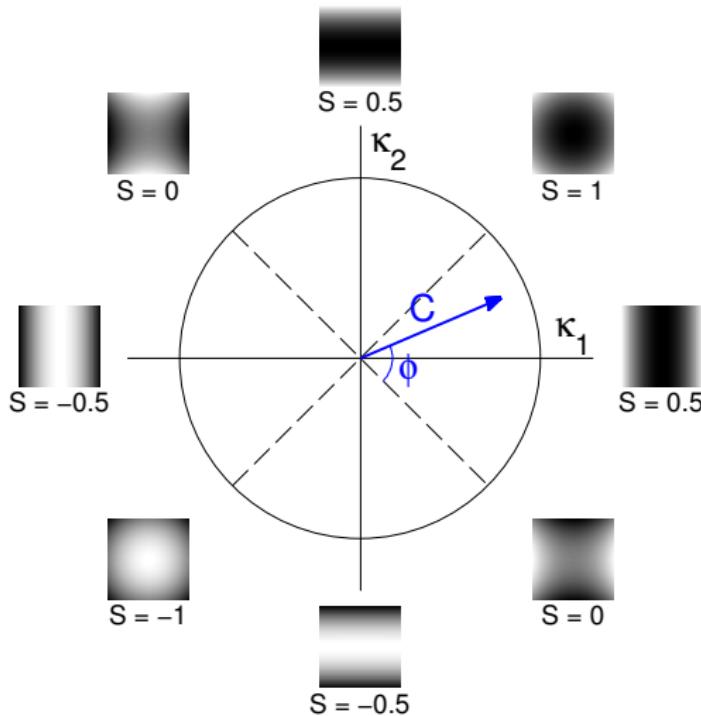
Magnitude function F



Gradient orientation



Shape index



Local magnitude normalization



Spatial weights

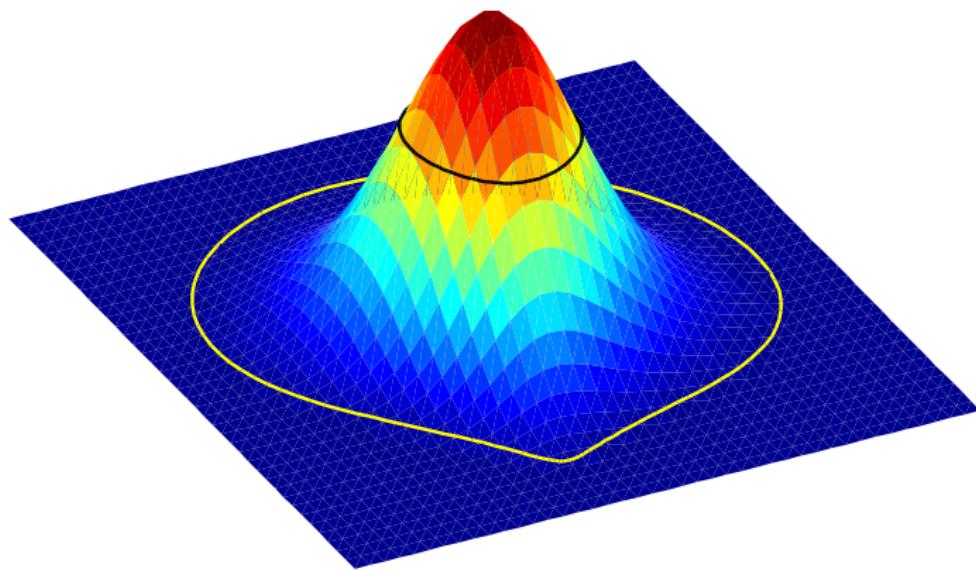
$$H_j(f_i) = \int F(\mathbf{x}) A_j(\mathbf{x}) P(\mathbf{x}) B(\mathbf{x}; f_i, f) d\mathbf{x}$$

Cell aperture function A

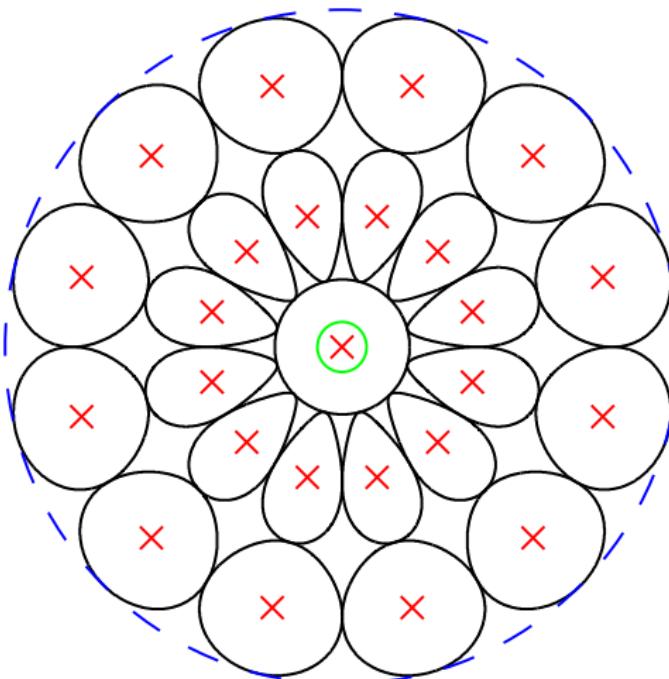
Center aperture function P



Cell aperture function



Grid of cells



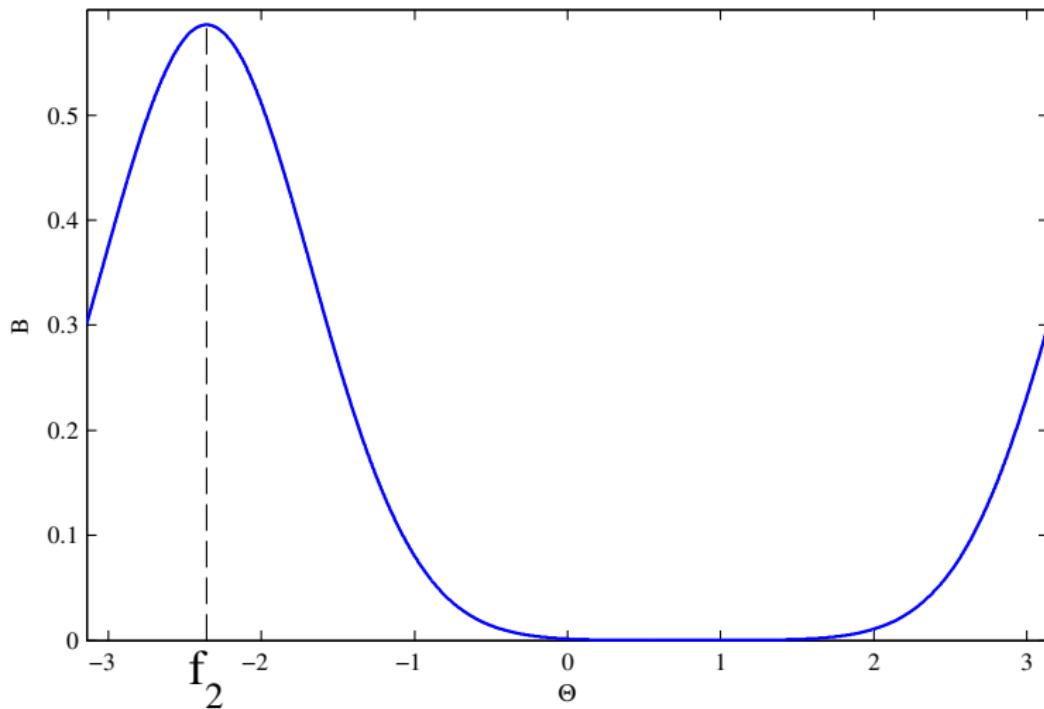
Bin weights

$$H_j(f_i) = \int F(\mathbf{x}) A_j(\mathbf{x}) P(\mathbf{x}) B(\mathbf{x}; f_i, f) d\mathbf{x}$$

Bin aperture function B

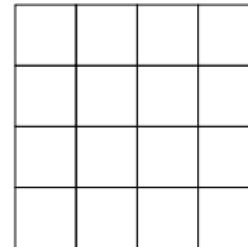


Bin weights



SIFT [2]

- 4×4 square grid
- Trilinear interpolation
- Clipping of magnitudes
- Include comparison results?



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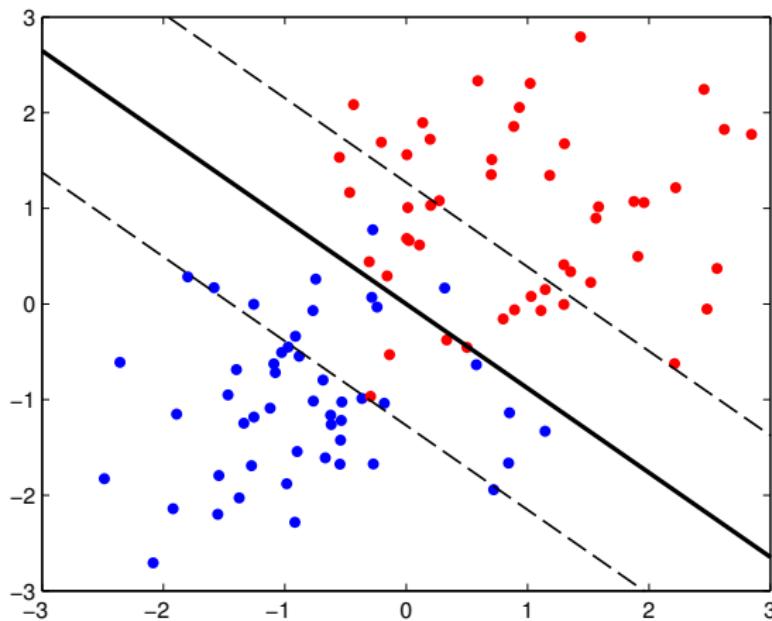


Sliding window



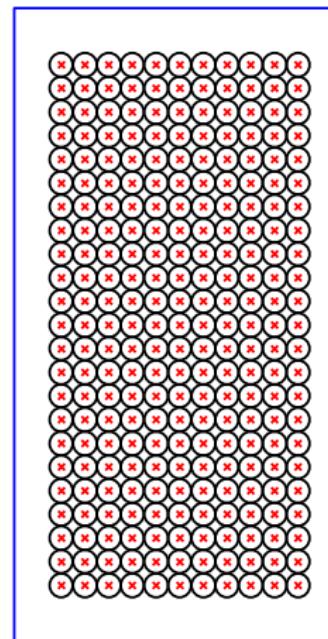
Support vector machines

- Binary classification of each window

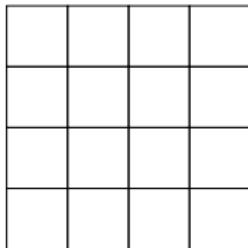


Proposed descriptor

- Uniform cell layout
- No center aperture function



HOG [1]



References

- [1] Navneet Dalal and Bill Triggs. "Histograms of oriented gradients for human detection". In: *Computer Vision and Pattern Recognition, 2005. CVPR 2005. IEEE Computer Society Conference on.* Vol. 1. IEEE. 2005, pp. 886–893.
- [2] David G Lowe. "Distinctive image features from scale-invariant keypoints". In: *International journal of computer vision* 60.2 (2004), pp. 91–110.

