A study of higher order image descriptors

Thesis defence

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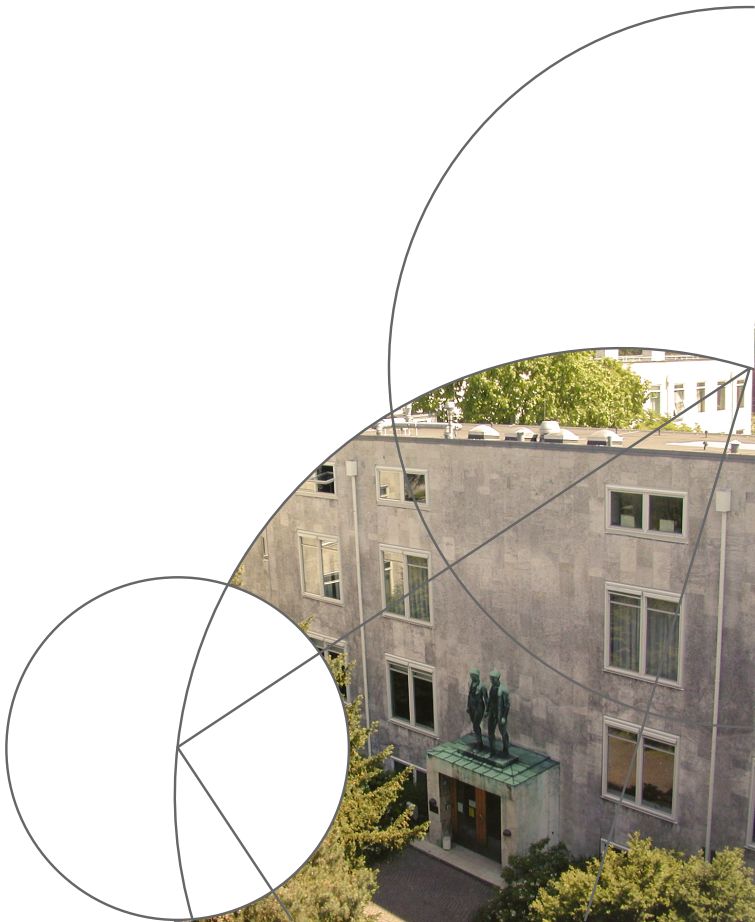

Agenda

1. Introduction to image descriptors
2. Image correspondence
3. Pedestrian detection

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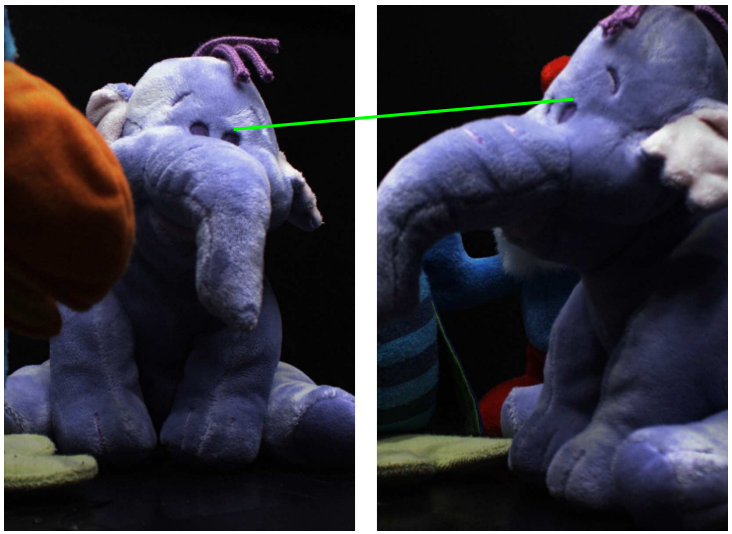
Introduction to image descriptors

Create shoe image with descriptor

Image transformations

Scale-space

Applications



(a) Image correspondence

(b) Pedestrian detection

Agenda

1. Introduction to image descriptors
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Interest point detection

Matching strategy

Proposed descriptor

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

where

i is the bin number

j is the cell number

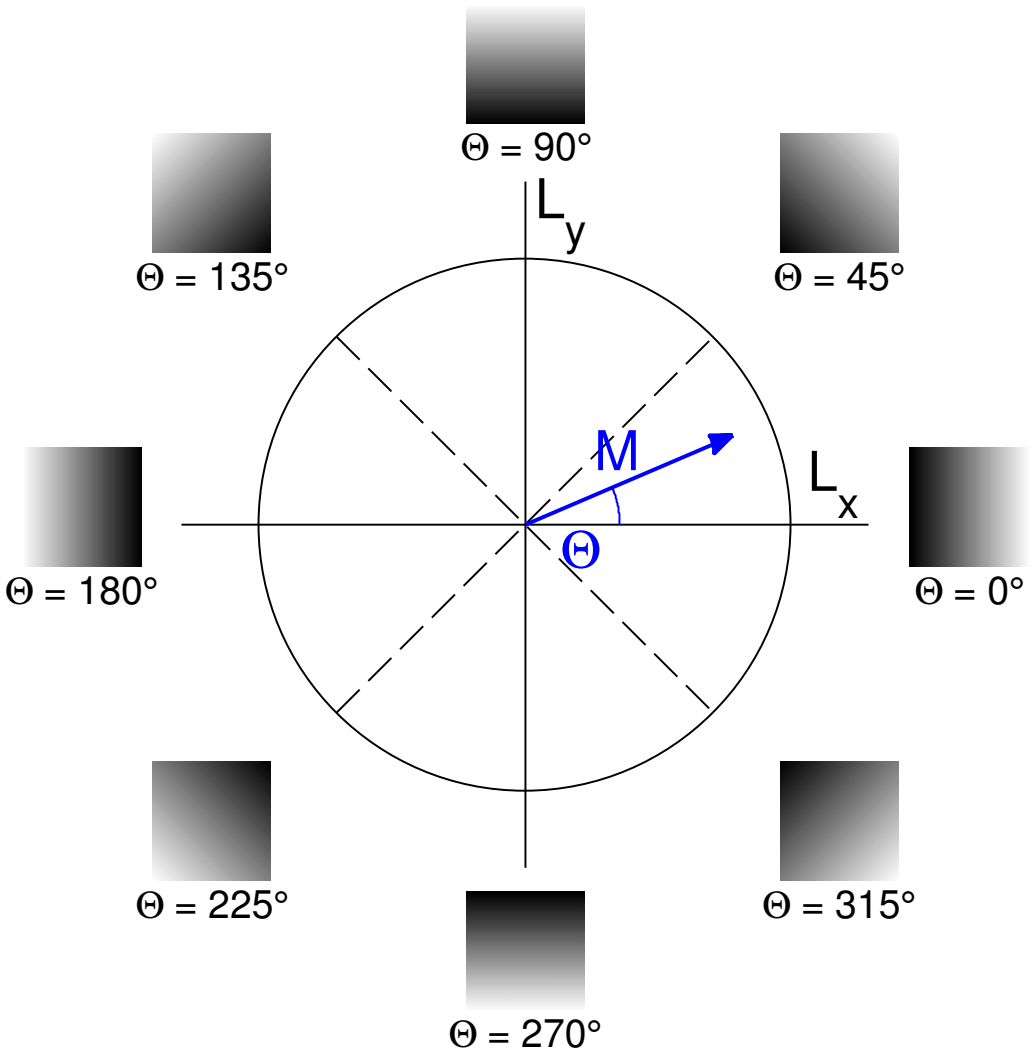
Histogram domain

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

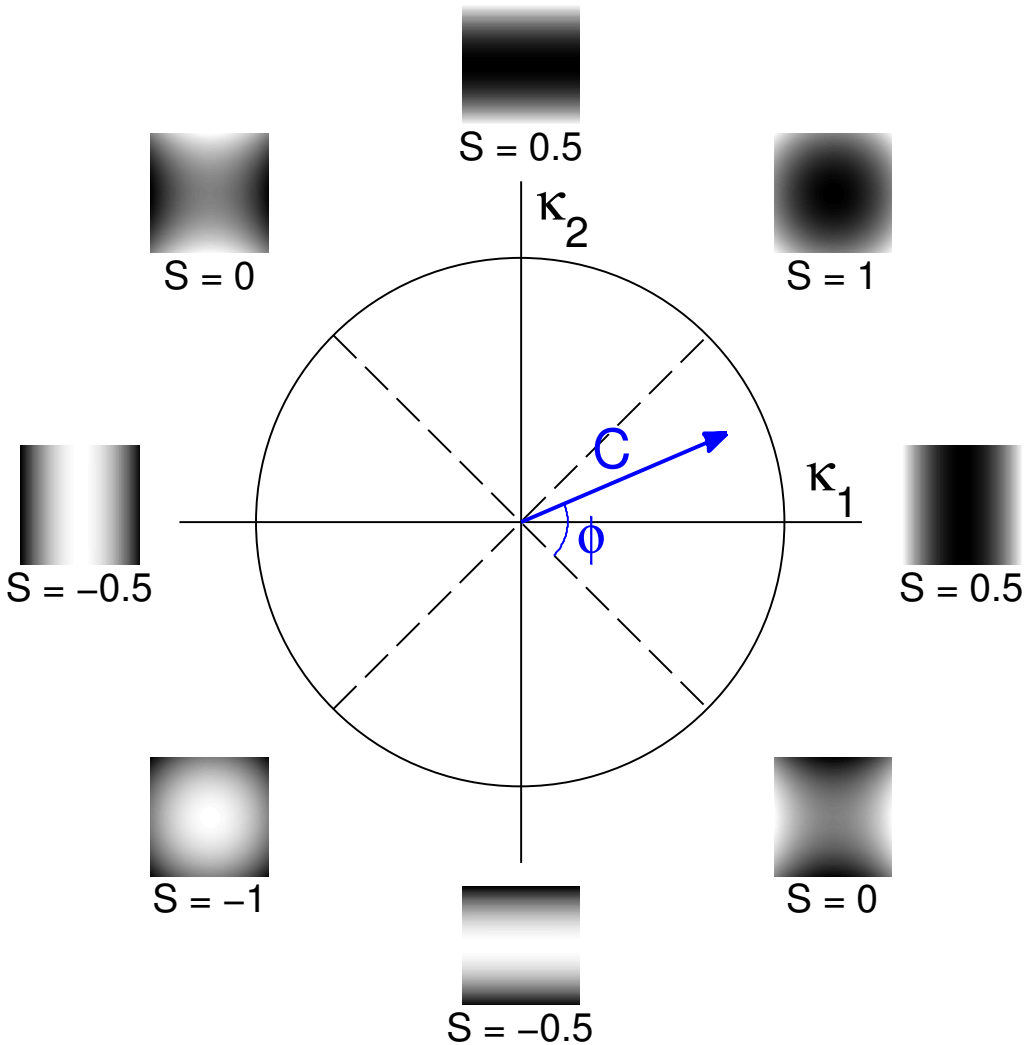
Bin value function f

Magnitude function F

Gradient orientation



Shape index



Local magnitude normalization

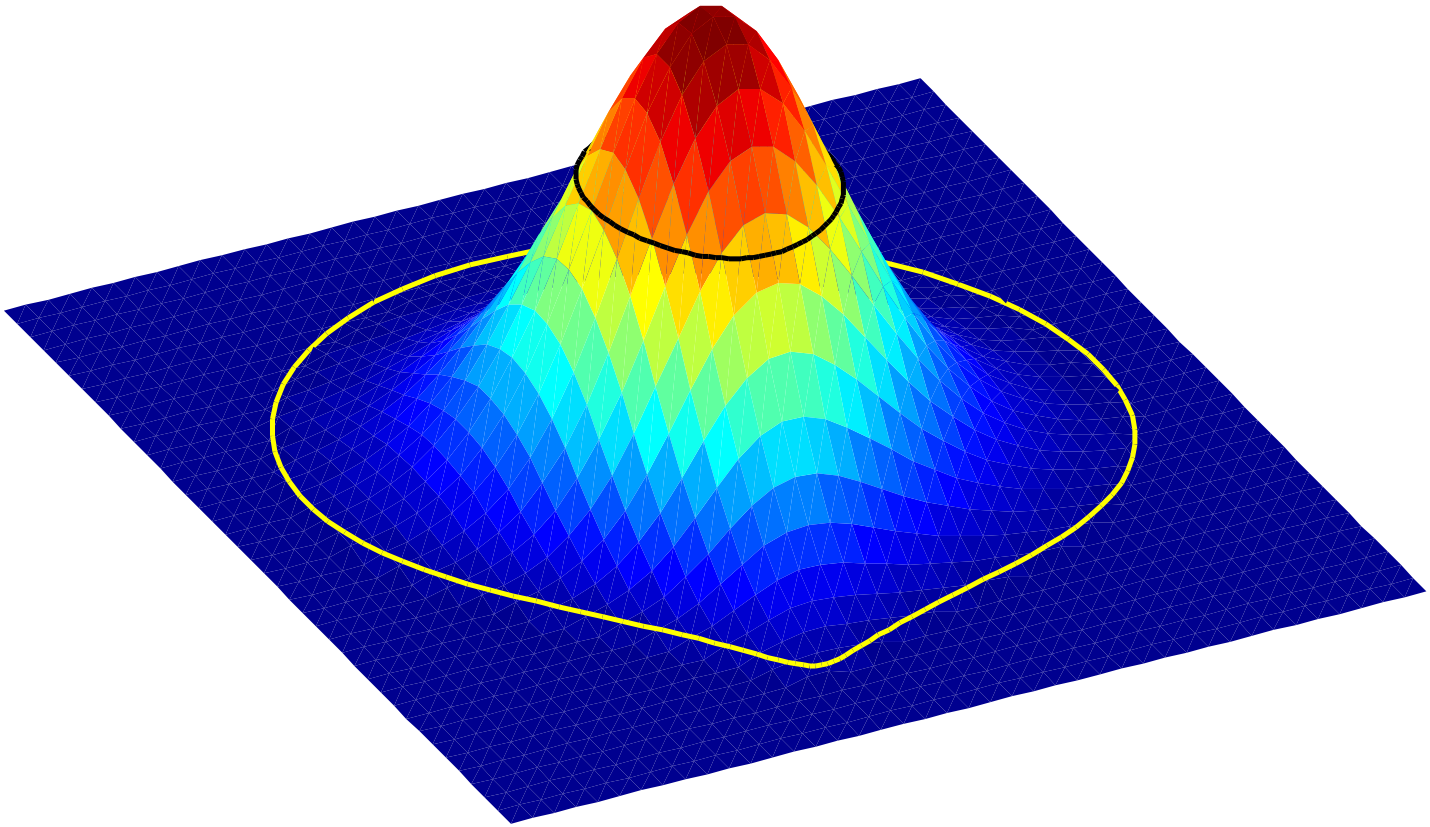
Spatial weights

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

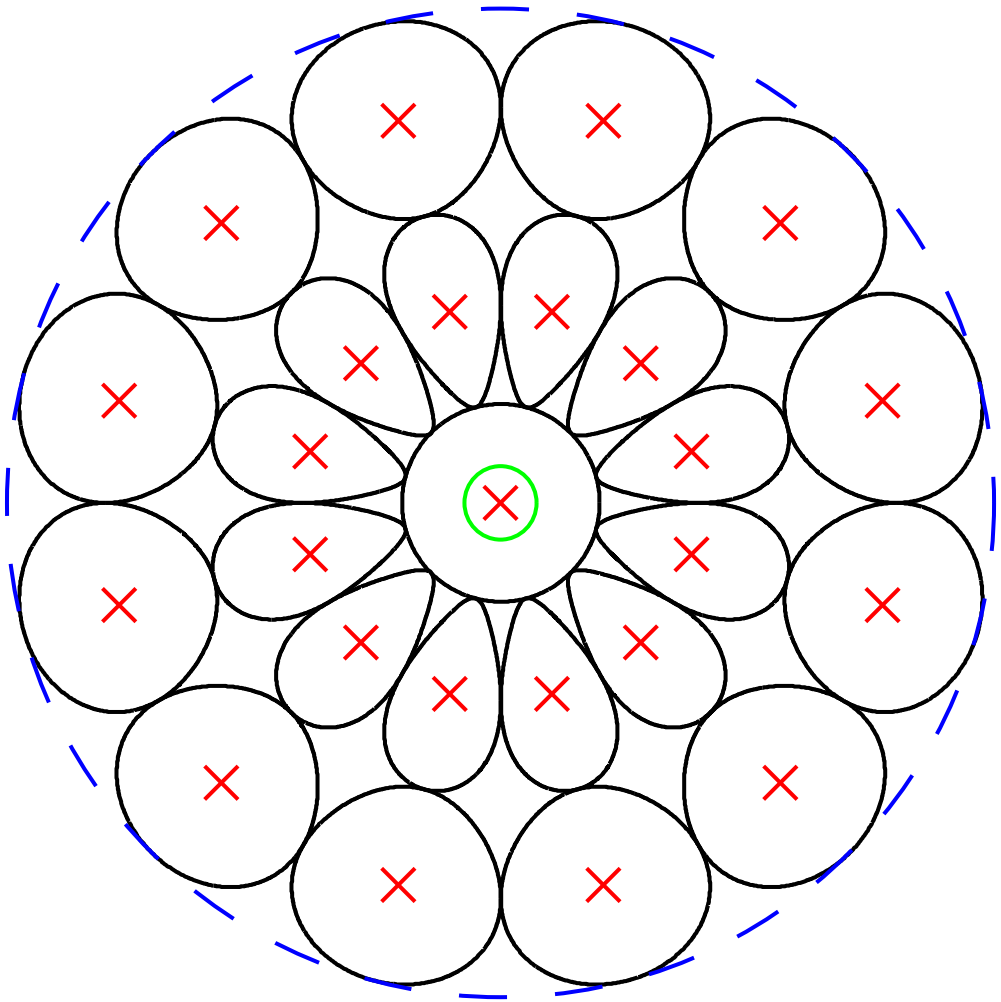
Cell aperture function A

Center aperture function P

Cell aperture function



Grid of cells

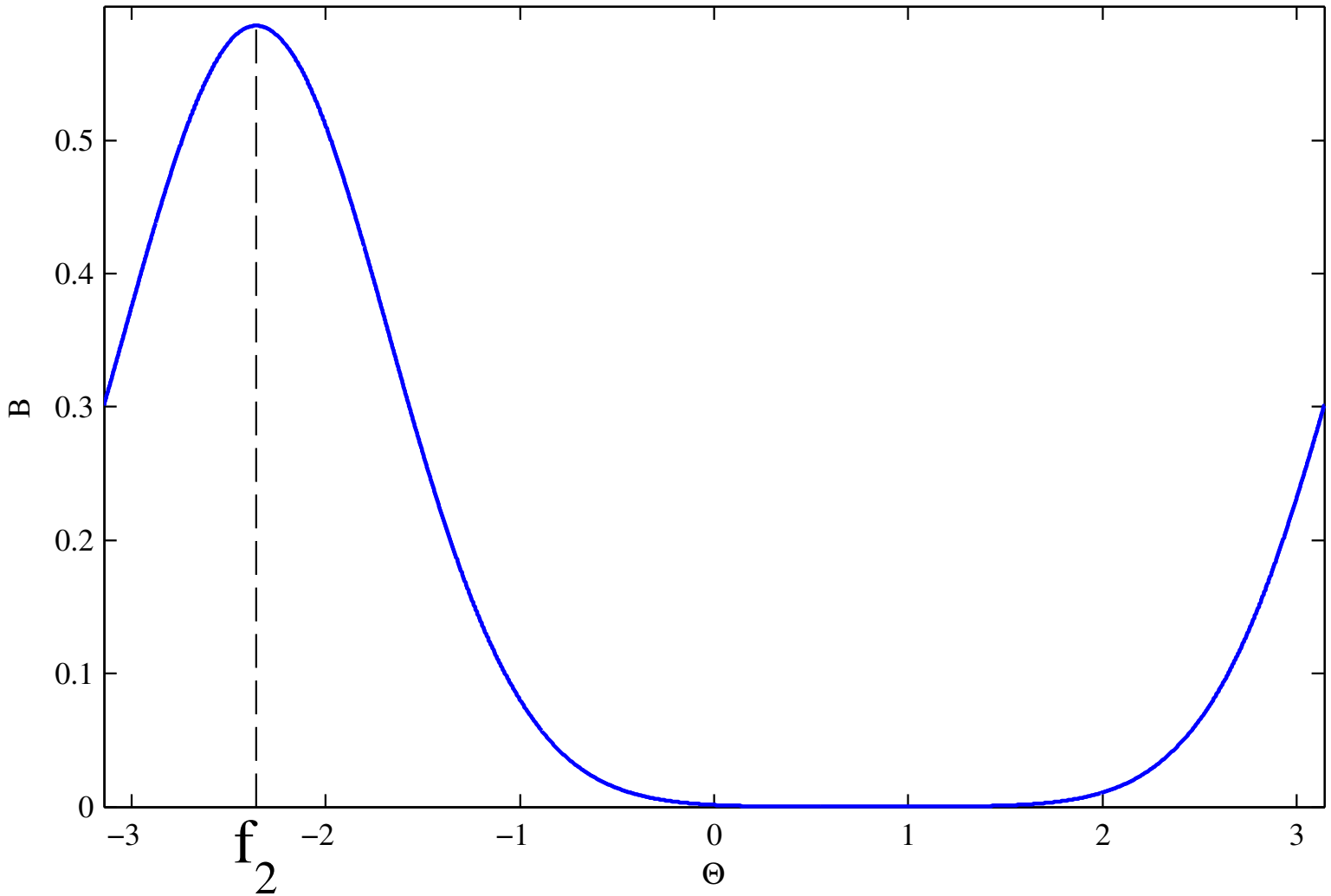


Bin weights

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

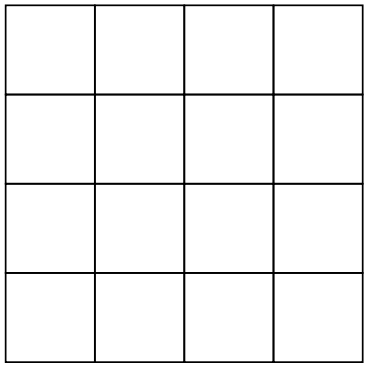
Bin aperture function B

Bin weights



SIFT [2]

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



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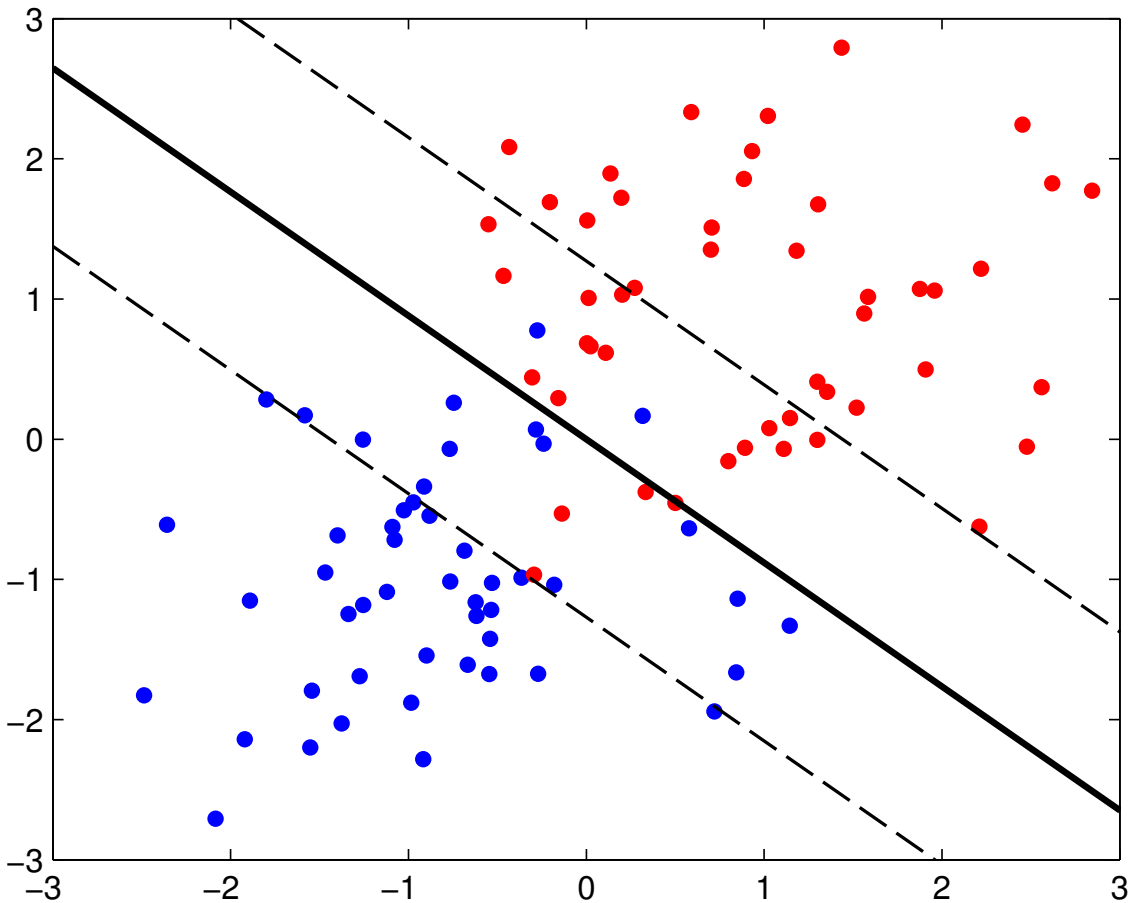
Sliding window

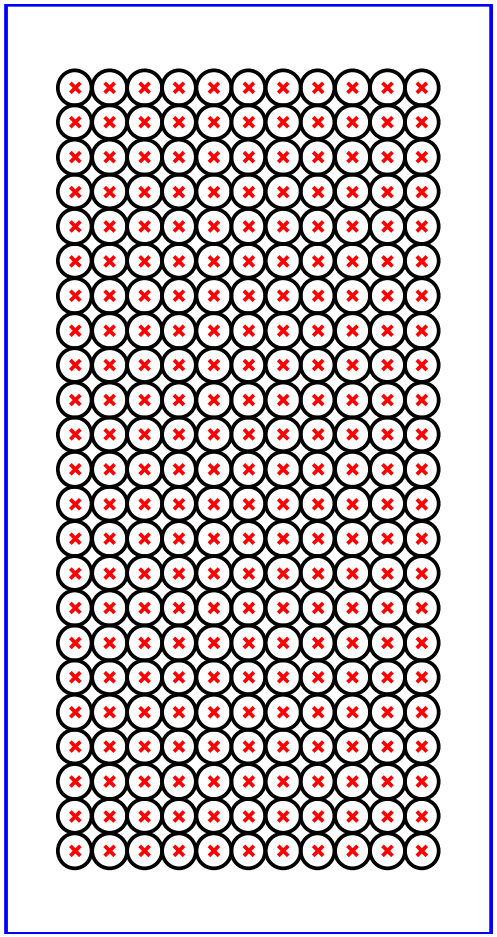
Support vector machines

- Binary classification of each window

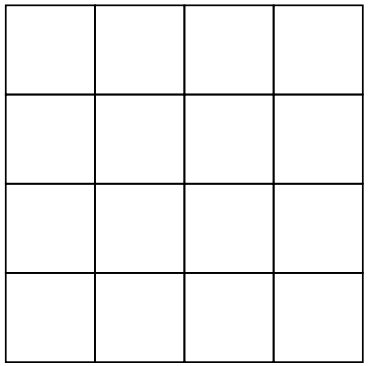


Proposed descriptor

- 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.