# Histograms of Oriented Gradients NOTES

## Key Terms:

**Feature set** - an array, list, set, etc of local transformations to pixel values that are invariant of illumination and small geometric variations (Felzenszwab 2014)

**Gradient filters/Operators** - a pixel transformation using kernels

- Kernel - a matrix of numbers used in image convolutions
- Convolutions - a mathmatical operation: $O(i,j) = \sum_{k=1}^{m} \sum_{l=1}^{n} I(i+k-1, j+l-1) K(k,l)$ where two arrays of different sizes are "multiplied together"

ex:

$$I = \begin{bmatrix} I_{11} & I_{12} & I_{13} \\ I_{21} & I_{22} & I_{23} \\ I_{31} & I_{32} & I_{33} \end{bmatrix} \quad K = \begin{bmatrix} K_{11} & K_{12} \\ K_{21} & K_{22} \end{bmatrix}$$

$$O(2,2) = I_{22} * K_{11} + I_{23} K_{12} + I_{32} K_{21} + I_{33} K_{22}$$

- Edge detection - a kernel that aims at finding dramatic changes in image brightness or discontinuities

↳ ex: $\begin{bmatrix} 1 & 0 & -1 \\ 0 & 0 & 0 \\ -1 & 0 & 1 \end{bmatrix}$, $\begin{bmatrix} -1 & 0 & 1 \end{bmatrix}$, $\begin{bmatrix} -1 \\ 0 \\ 1 \end{bmatrix}$

- Gaussian smoothing - a kernel aimed at "blurring" an image and remove detail and noise

**Image Pyramids** - a multiscale representation of an image

- can be used to find objects at different scales, and combined with a sliding window it can be used to find objects in various locations ↳ a section or window is a part of the image that a object detector uses as input
- Usually this is done by down sampling/subsampling the image and applying gaussian smoothing filter to it

Sampling - the process of producing a finite set of points from a continuous wavelet that has been derived from an image