

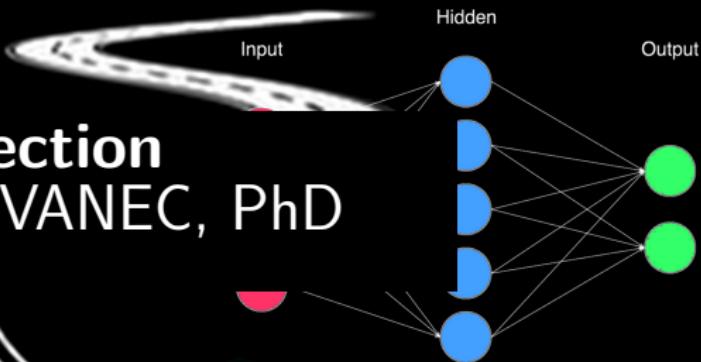
$$Q(s_t, a_t) \leftarrow Q(s_t, a_t) + \alpha [r_{t+1} + \lambda \max_a Q(s_{t+1}, a) - Q(s_t, a_t)]$$

(The New Action Value = The Old Value) + The Learning Rate \times (The New Information — the Old Information)

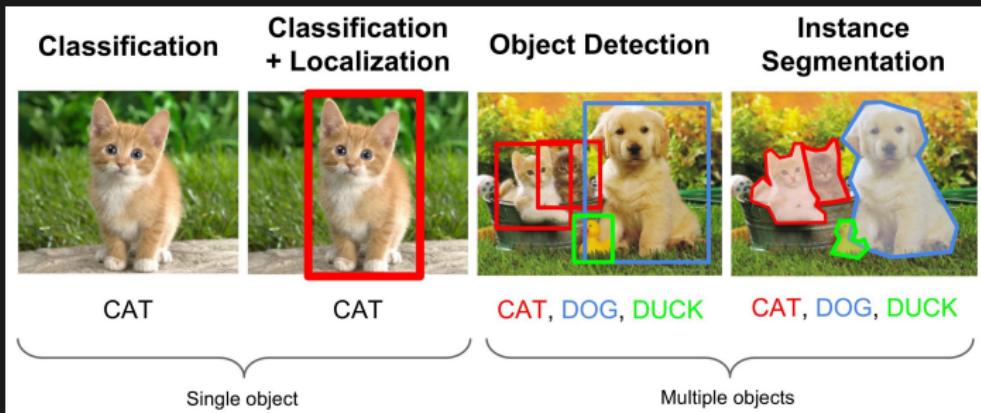


Image detection

Michal CHOVANEC, PhD



Classification, Detection, Segmentation



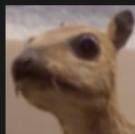
Historical methods

- noise filtering
- edge detection
- thresholding
- histogram of oriented gradients, HOG, SVM

Noise filtering



$$\begin{vmatrix} 0 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 0 \end{vmatrix}$$



$$\begin{vmatrix} 1 & 1 & 1 \\ 1 & 1 & 1 \\ 1 & 1 & 1 \end{vmatrix}$$



$$\begin{vmatrix} 0 & -1 & 0 \\ -1 & 5 & -1 \\ 0 & -1 & 0 \end{vmatrix}$$

source [https://en.wikipedia.org/wiki/Kernel_\(image_processing\)](https://en.wikipedia.org/wiki/Kernel_(image_processing))

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empty

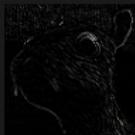
Edge detection



$$\begin{vmatrix} 0 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 0 \end{vmatrix}$$



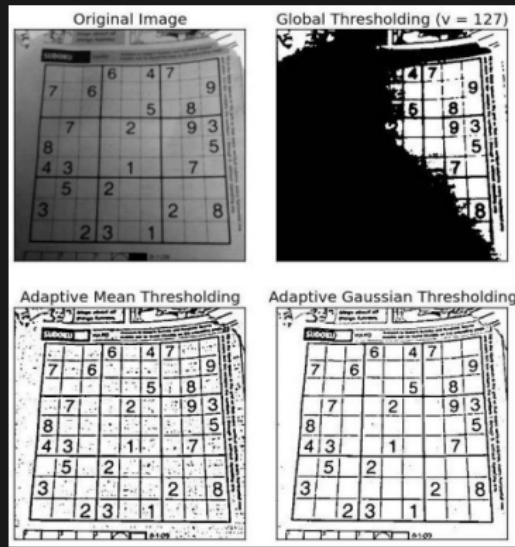
$$\begin{vmatrix} -1 & -1 & -1 \\ -1 & 8 & -1 \\ -1 & -1 & -1 \end{vmatrix}$$



$$\begin{vmatrix} 0 & 1 & 0 \\ 1 & -4 & 1 \\ 0 & 1 & 0 \end{vmatrix}$$

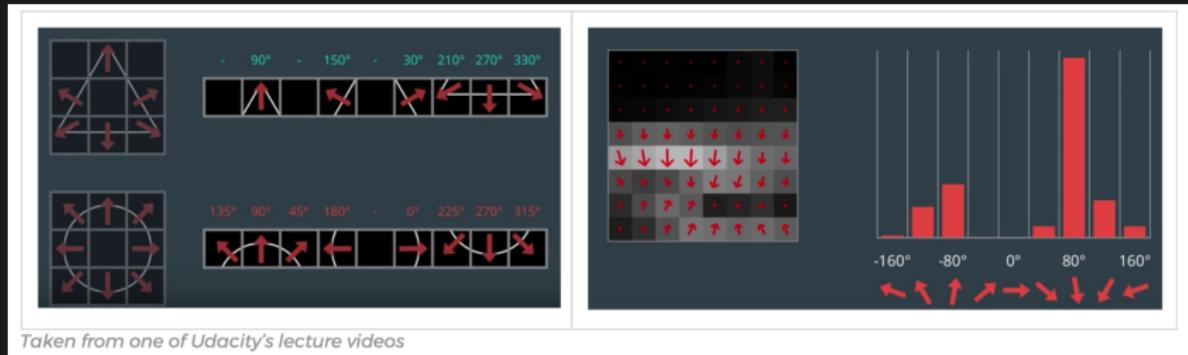
source [https://en.wikipedia.org/wiki/Kernel_\(image_processing\)](https://en.wikipedia.org/wiki/Kernel_(image_processing))

Thresholding

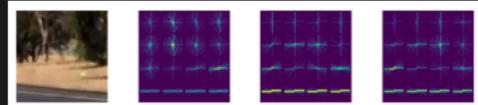
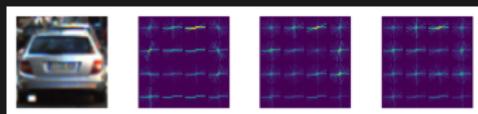


source https://docs.opencv.org/3.4.3/d7/d4d/tutorial_py_thresholding.html

Histogram of oriented gradients



Taken from one of Udacity's lecture videos

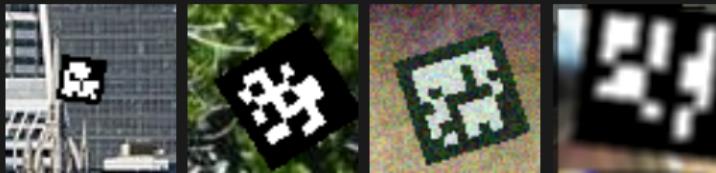


source <https://medium.com/@mithi/vehicles-tracking-with-hog-and-linear-svm-c9f27eaf521a>

Deep neural networks

① good dataset

- at least 10x images than network parameters
- random noised, shifted, rotated, luminance, resized
- **errors in dataset !**



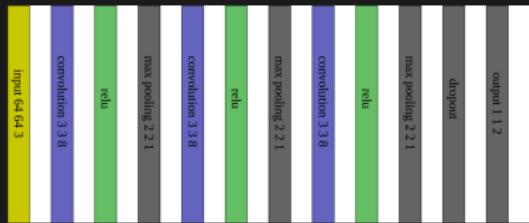
② good CNN architecture

- convolution + pooling layers, full connected
- VGG net, YOLO

CNN architecture

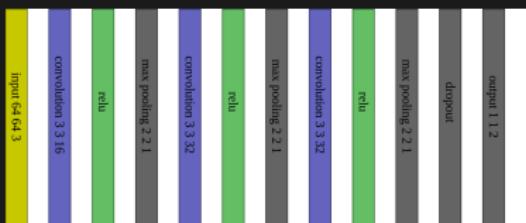
path net 0

- C8-P2-C8-P2-C8-P2-FC2
- accuracy 95.856%
- 1.840132 MFlops
- 65FPS, 640x480, GTX940

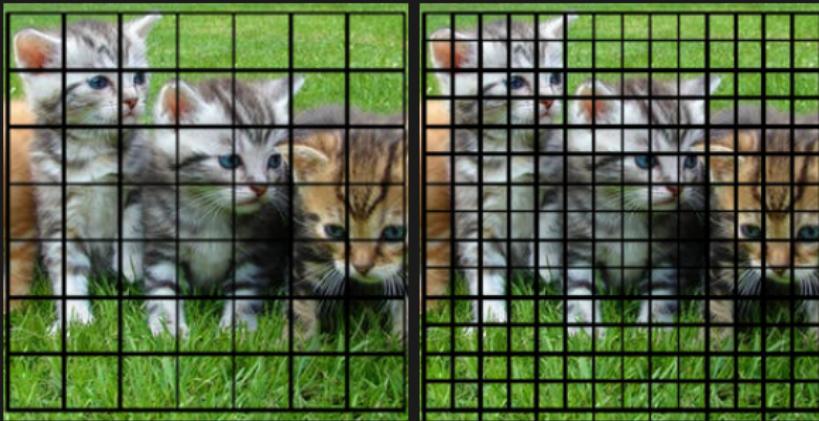


path net 3

- C16-P2-C32-P2-C32-P2-FC2
- accuracy 97.01%
- 9.392132 MFlops
- 18FPS, 640x480, GTX940



Deep neural network, detector mode



Testing



Q&A



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www.youtube.com/channel/UCzVvP2ou8v3afNiVrPAHQGg
github <https://github.com/michalnand>