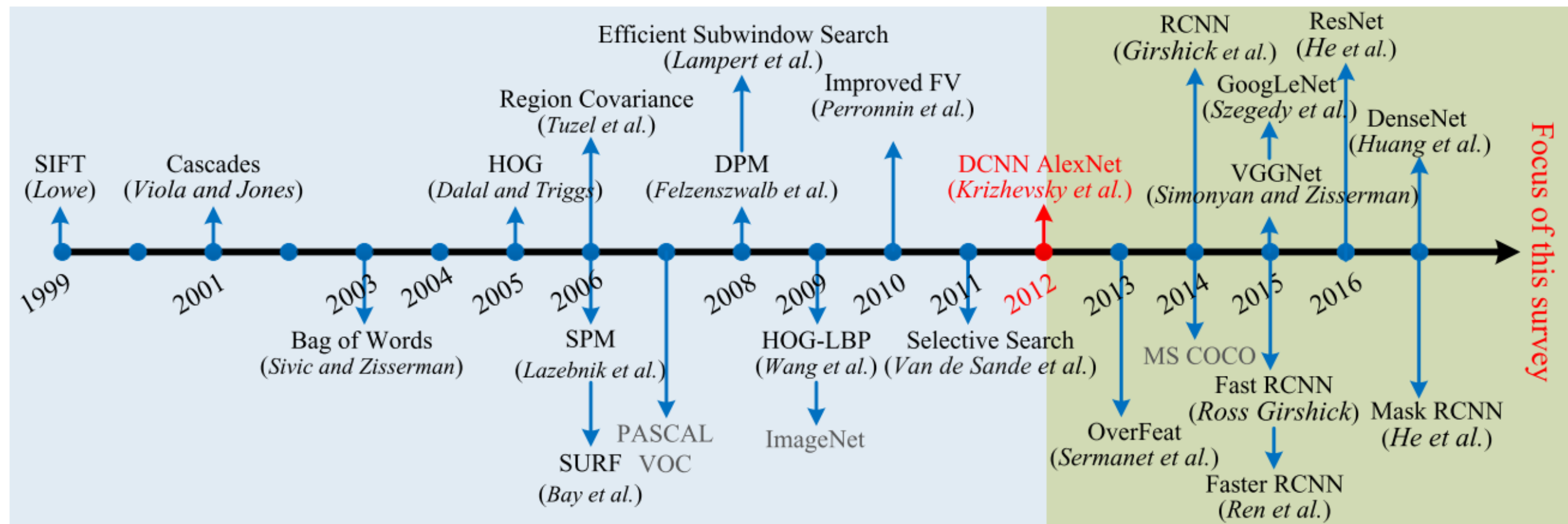


컴퓨터는 어떻게 객체를 탐지할까?

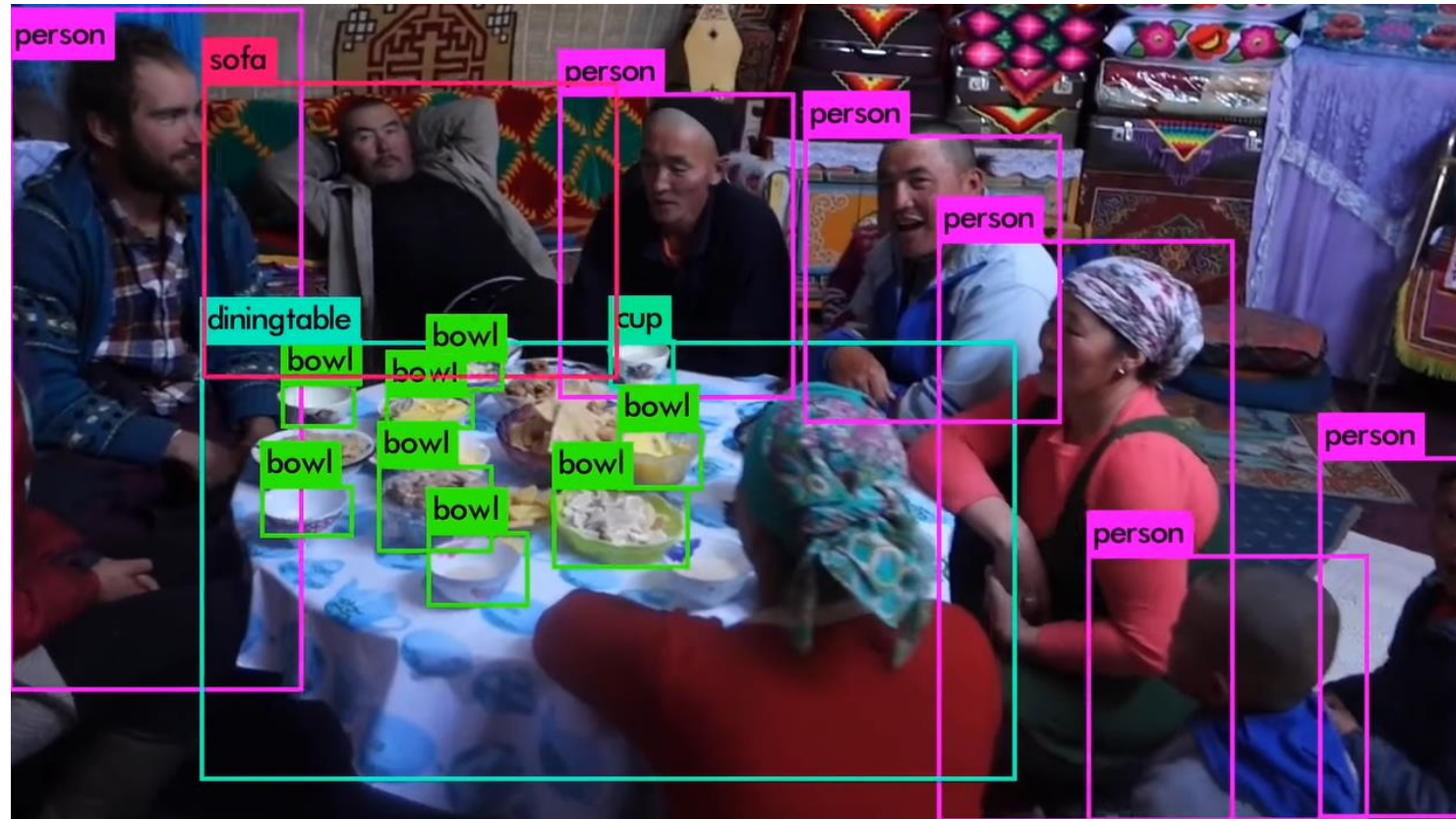
2022.05.11.

ZeroPage oms

Object detection? (1)



Object detection? (2)

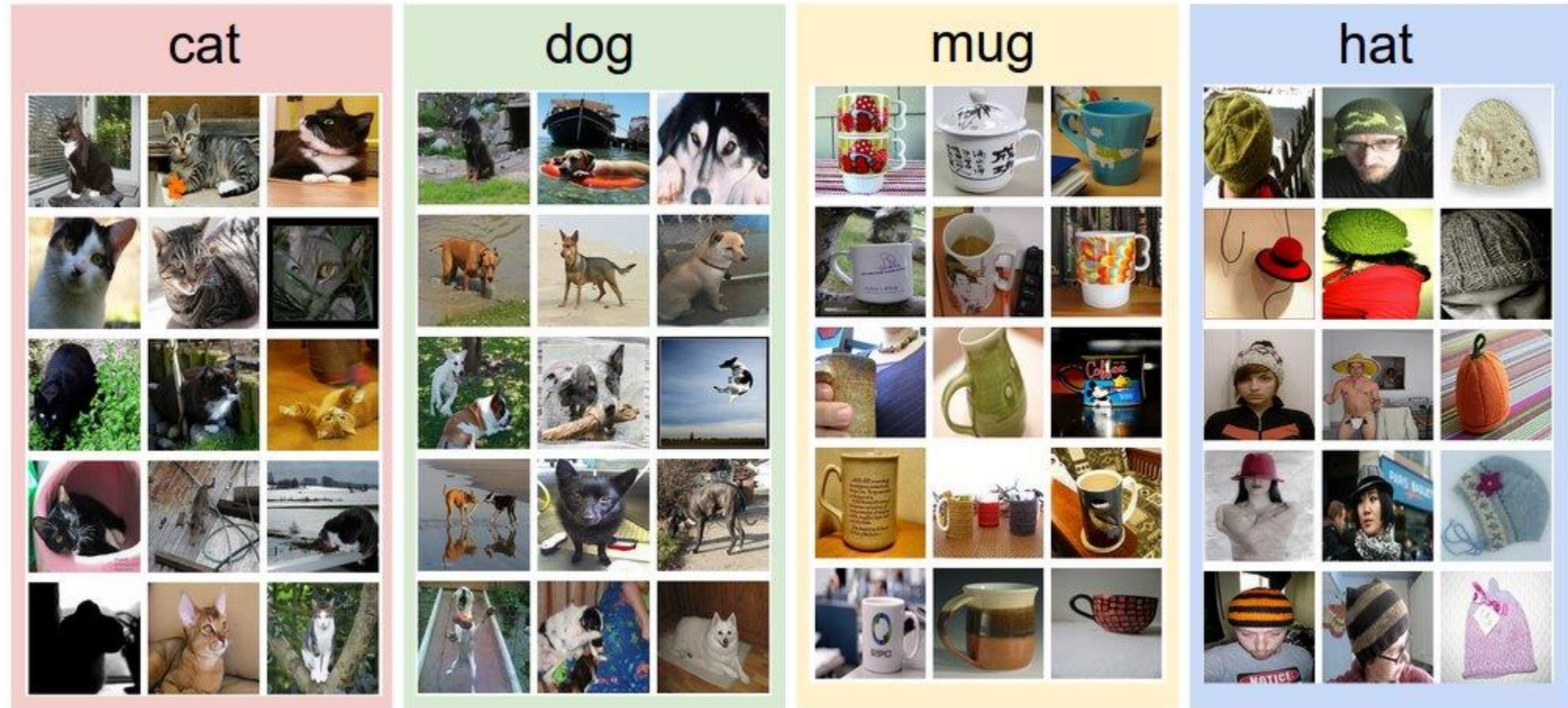


<https://youtu.be/MPU2HistivI?t=92>

Computer vision?

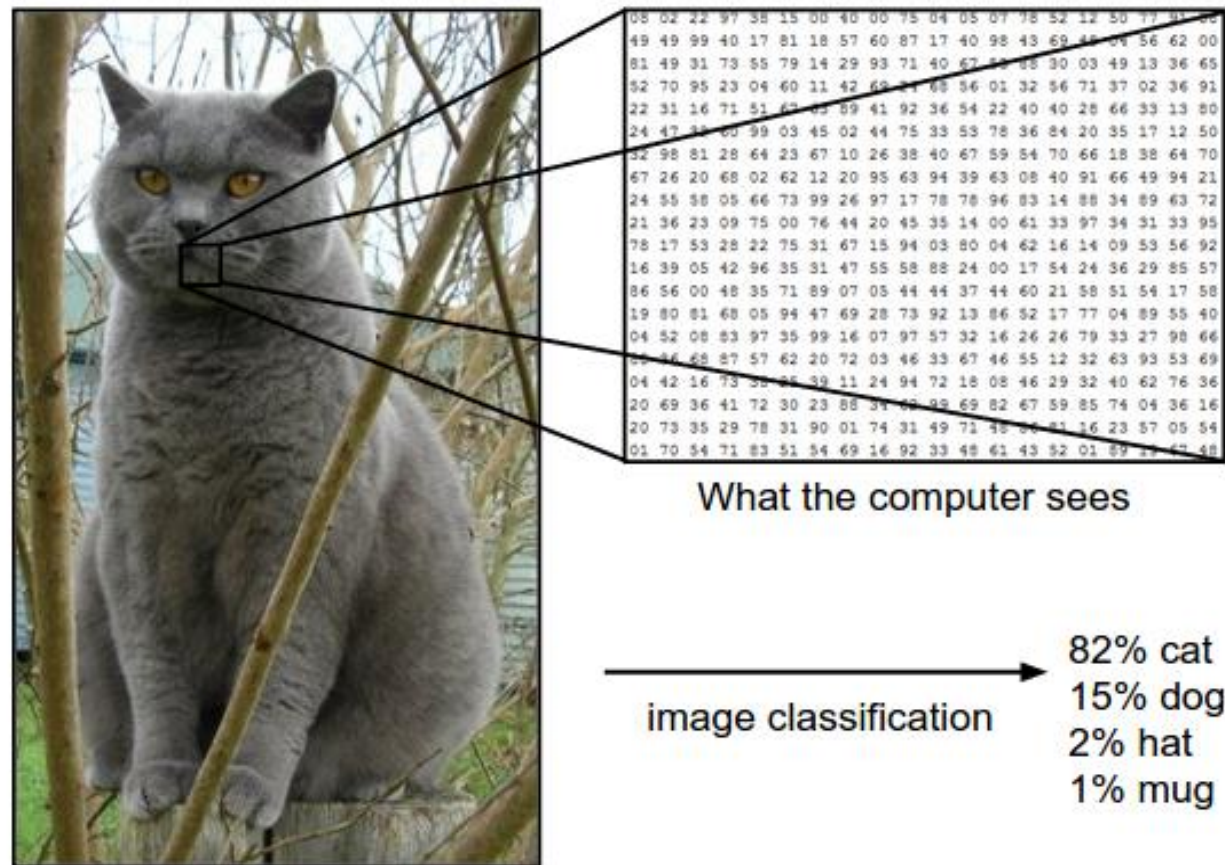


Classification(1)



Classification(2)

- 248 x 400 x 3
- that ranges from 0 (black) to 255 (white).
- to turn this into a single label, such as *"cat"*.



Classification(3)

Viewpoint variation



Scale variation



Deformation



Occlusion



Illumination conditions



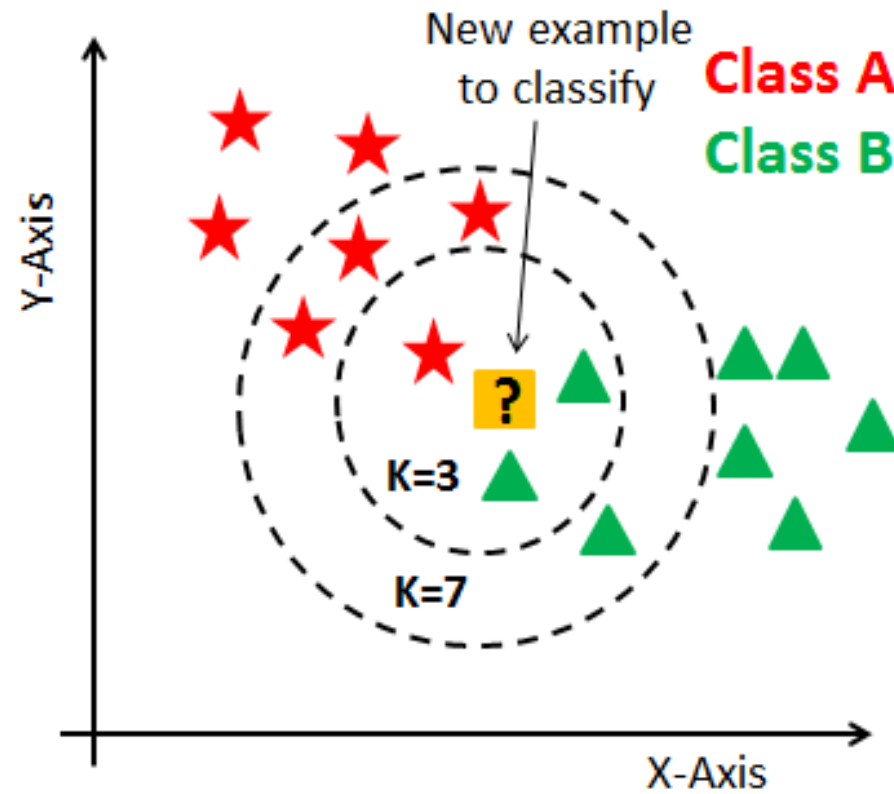
Background clutter



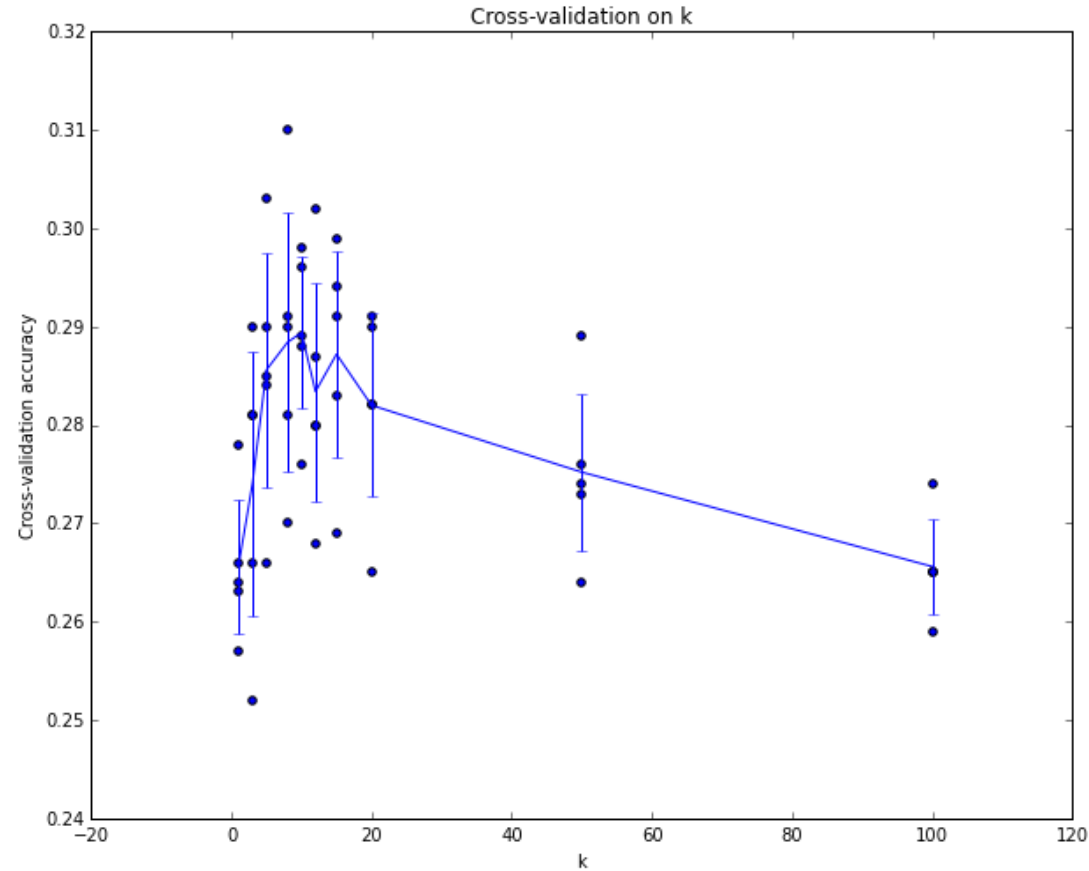
Intra-class variation



Data-driven approach – kNN (1)

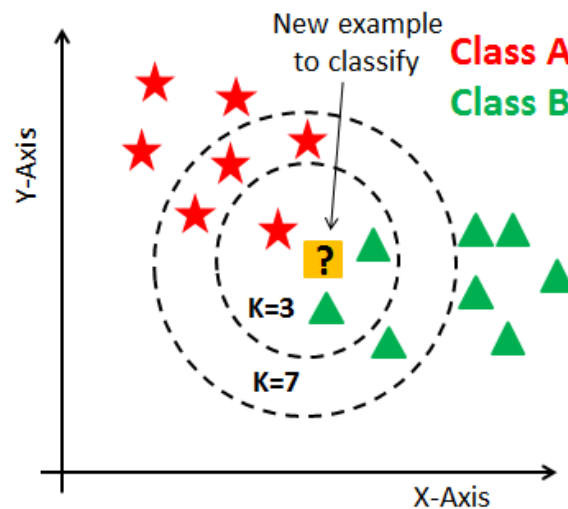
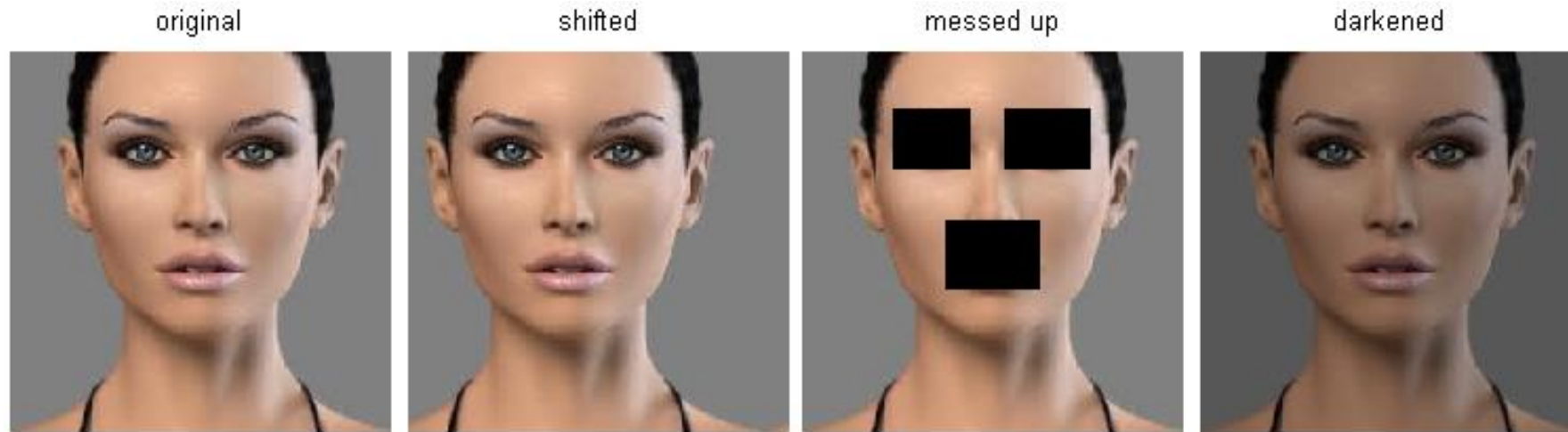


Data-driven approach – kNN (2)



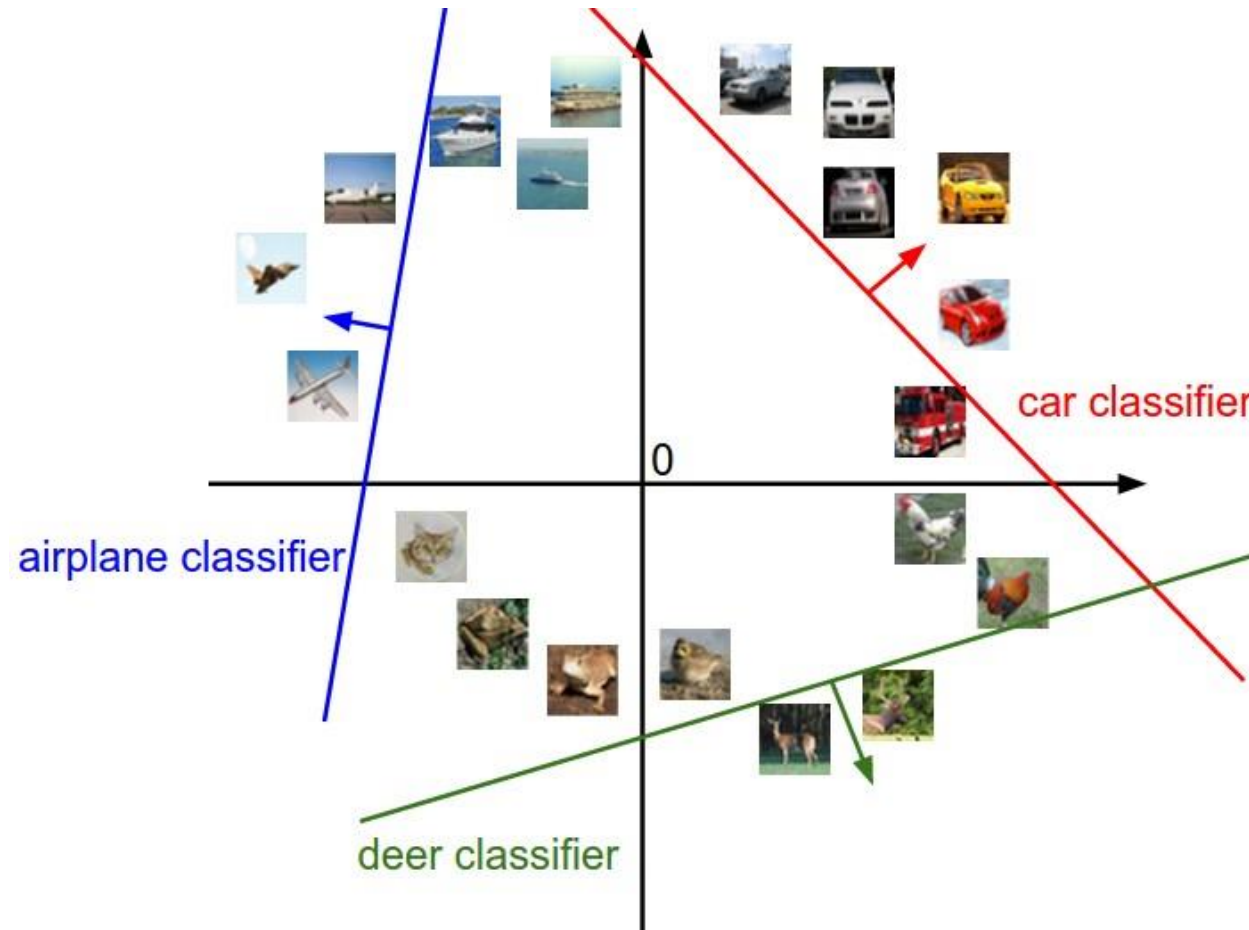
[CS231n Convolutional Neural Networks for Visual Recognition](#)

Data-driven approach – kNN (3)



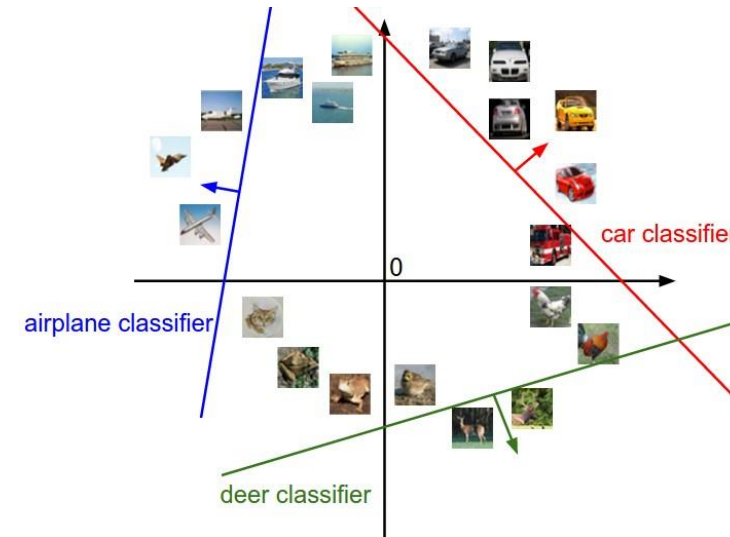
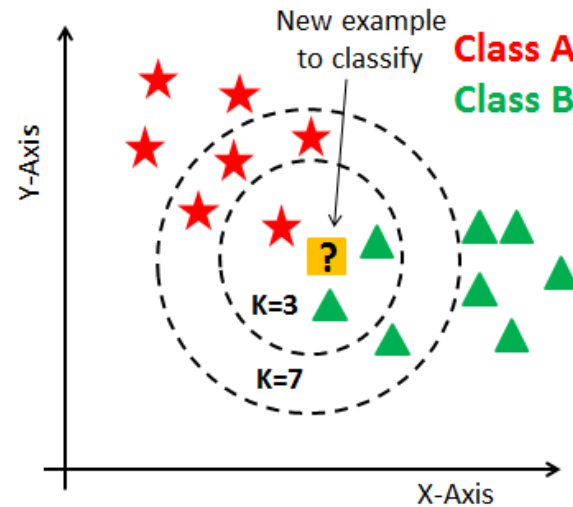
Inefficient

Data-driven approach - svm



Classification(4)

1. Classifier – kNN, svm ...



2. Feature extraction

Feature extraction



[Canny Edge Detection Step by Step in Python — Computer Vision | by Sofiane Sahir | Towards Data Science](#)

alexnet



[This image is CC0 public domain](#)

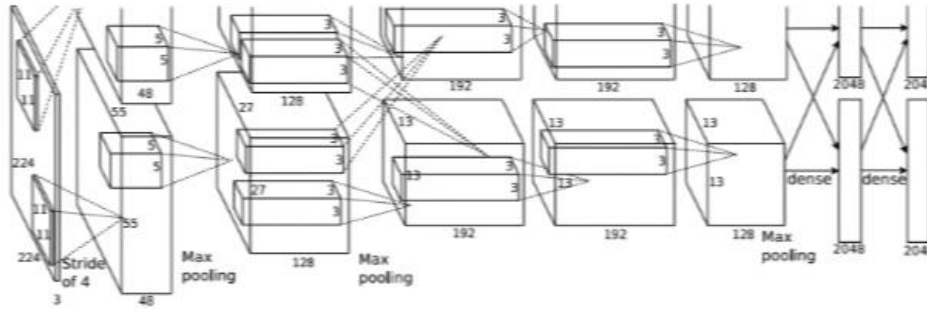


Figure copyright Alex Krizhevsky, Ilya Sutskever, and Geoffrey Hinton, 2012. Reproduced with permission.

Vector:
4096

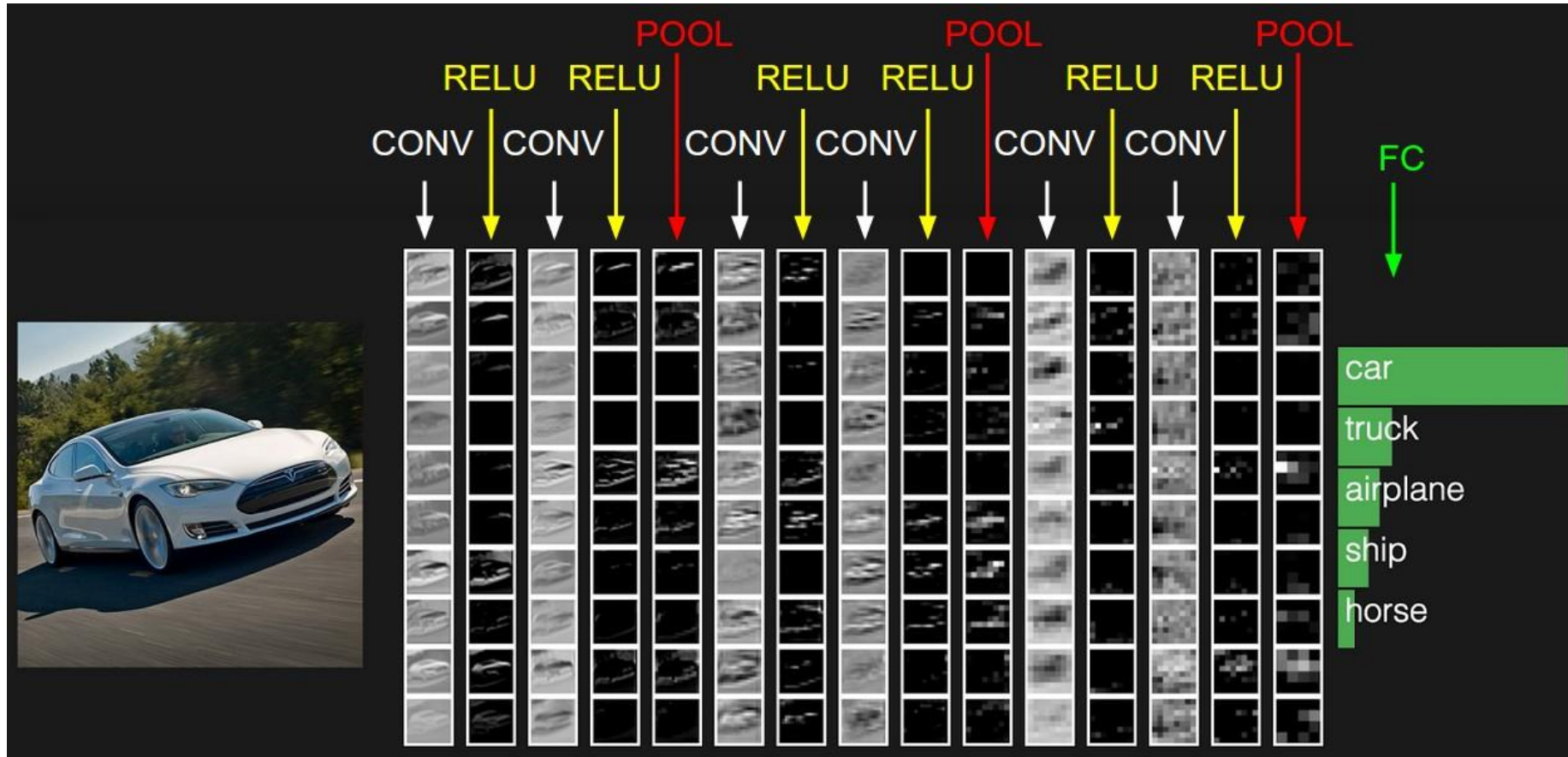
Fully-Connected:
4096 to 1000

Class Scores

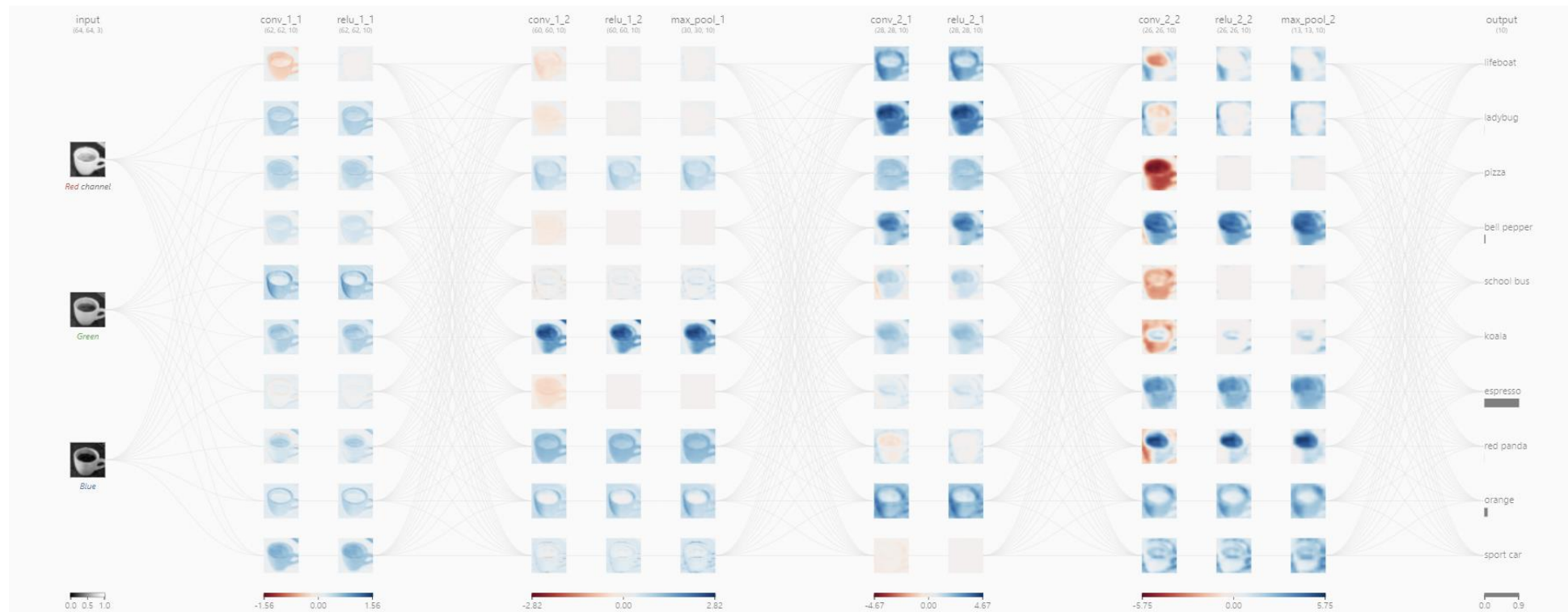
Cat: 0.9
Dog: 0.05
Car: 0.01

...

cnn



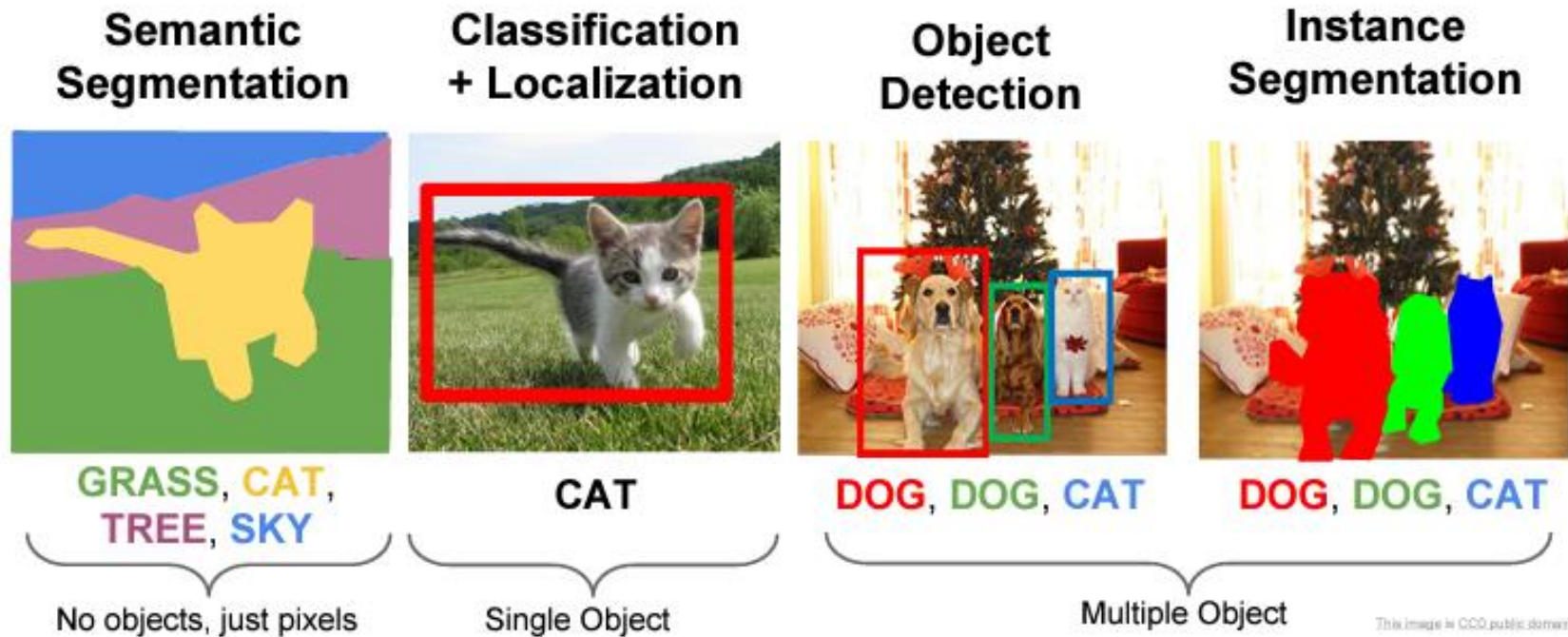
cnn



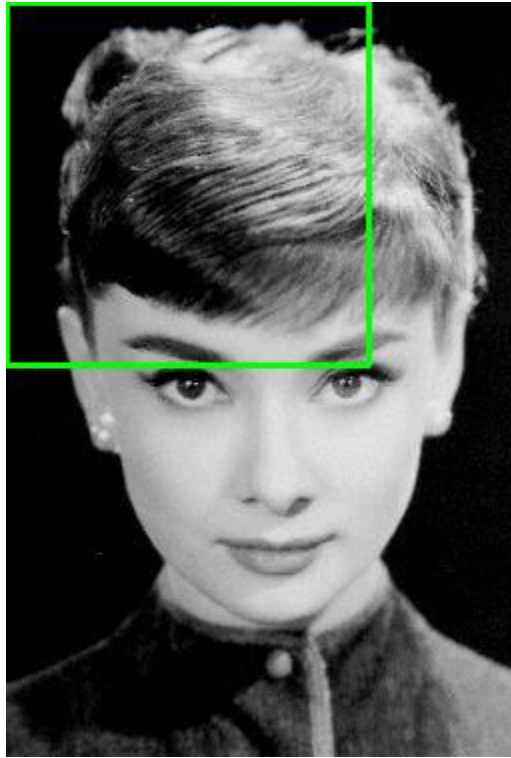
[CNN Explainer \(poloclub.github.io\)](https://poloclub.github.io/CNN-Explainer/)

To what extent do the CNN classification results on ImageNet generalize to **object detection** results on the PASCAL VOC Challenge?

Object detection



Localization (1) – sliding window



[Sliding Windows for Object Detection with Python and OpenCV - PyImageSearch](#)

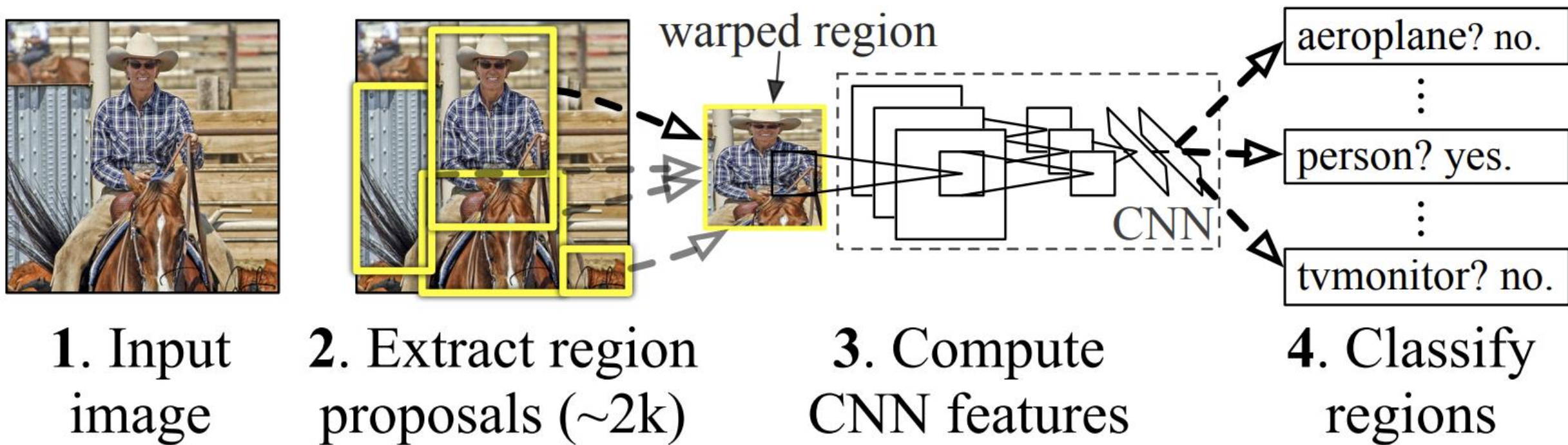
Localization (2) – selective search



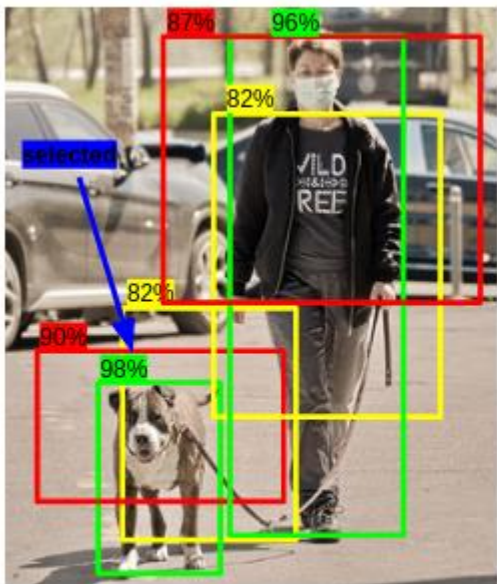
[Selective Search Explained | Papers With Code](#)

R-cnn (1)

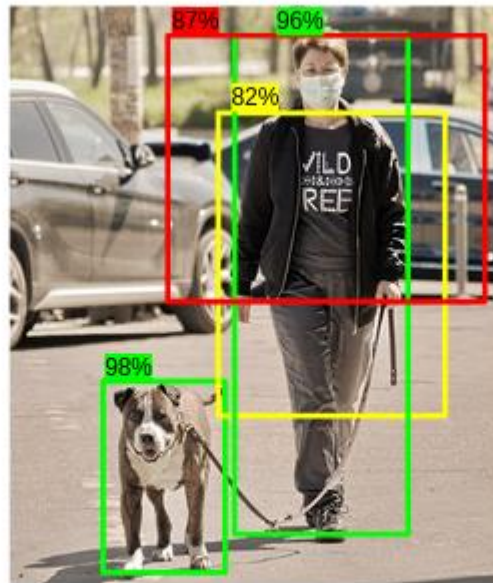
R-CNN: *Regions with CNN features*



Non maximum suppression (nms)



Step 1: Selecting Bounding box with highest score



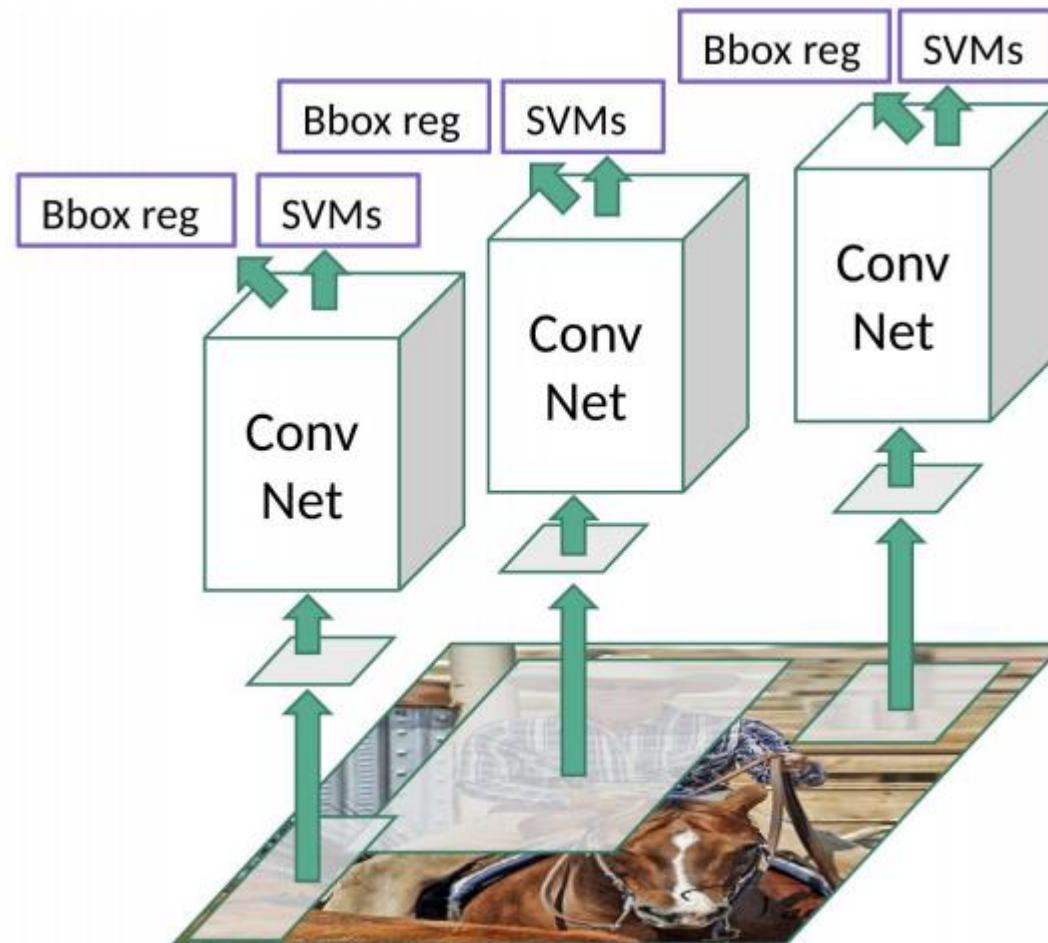
Step 3: Delete Bounding box with high overlap



Step 5: Final Output

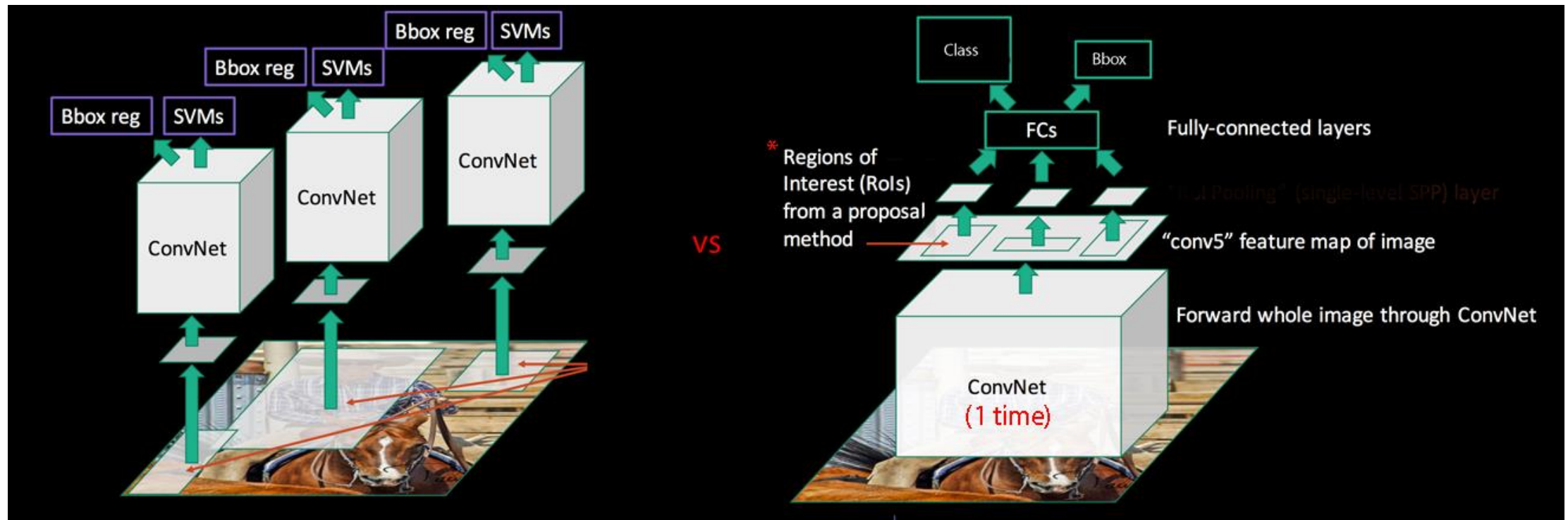
[Selecting the Right Bounding Box Using Non-Max Suppression \(with implementation\) \(analyticsvidhya.com\)](https://analyticsvidhya.com)

R-cnn (2)



sppnet

Spatial Pyramid Pooling



["Fast R-CNN and Faster R-CNN" \(jhui.github.io\)](https://github.com/jhui/Fast-RCNN)

감사합니다!