

Week7 Recitation

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CS190I Deep Learning

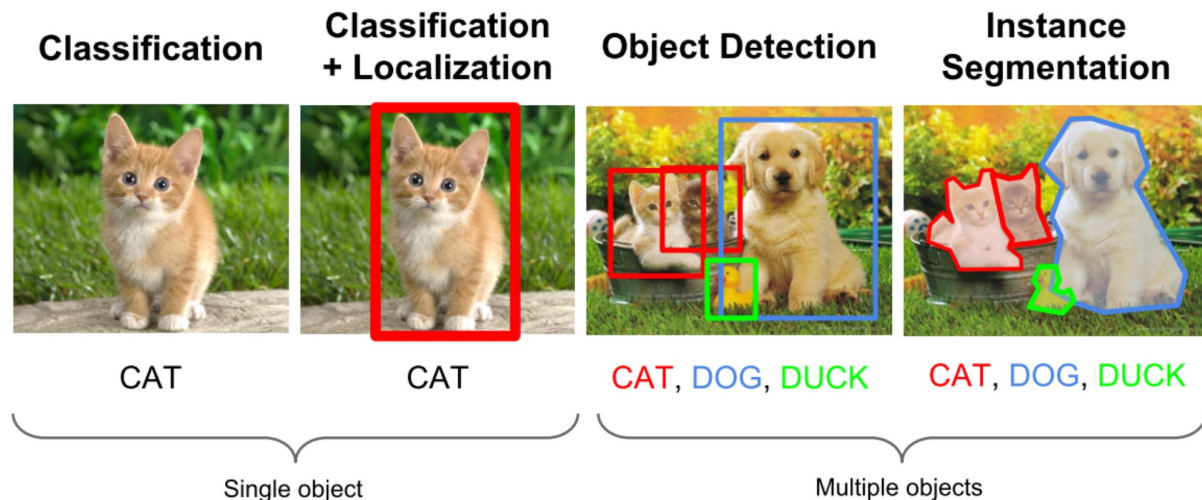


Outline

- **Basic Concepts in Object Detection**
- **One algorithm about object detection: R-CNN**

Concept

- The goal of object detection
 - To scan digital images to locate instances of every object, separate them and analyze the necessary features for real-time predictions
- Four main tasks in CV
 - Classification: classify the category of the object in a image
 - Location: locate the position of given object in an image
 - Detection: First locate and then classify
 - Segmentation: determine which object each pixel belongs to

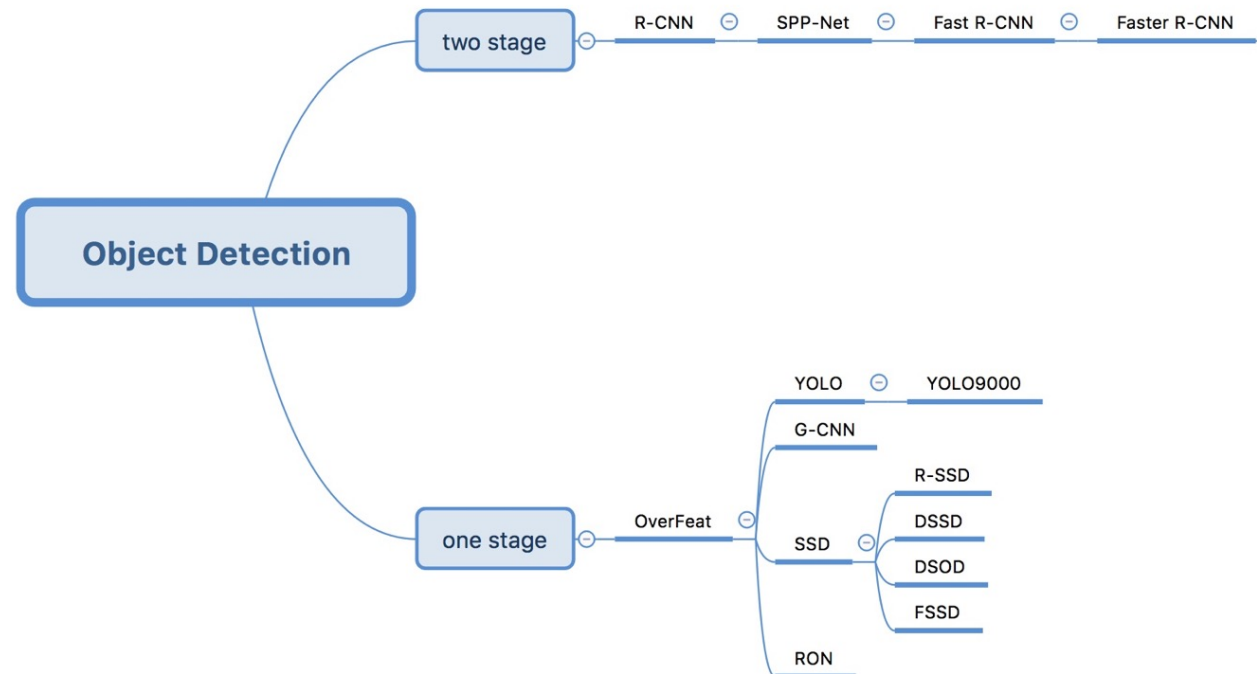


Challenge

- Classification
- Locate
 - Object may occur in any position in a image
 - Object may have different size
 - Object may have different shape

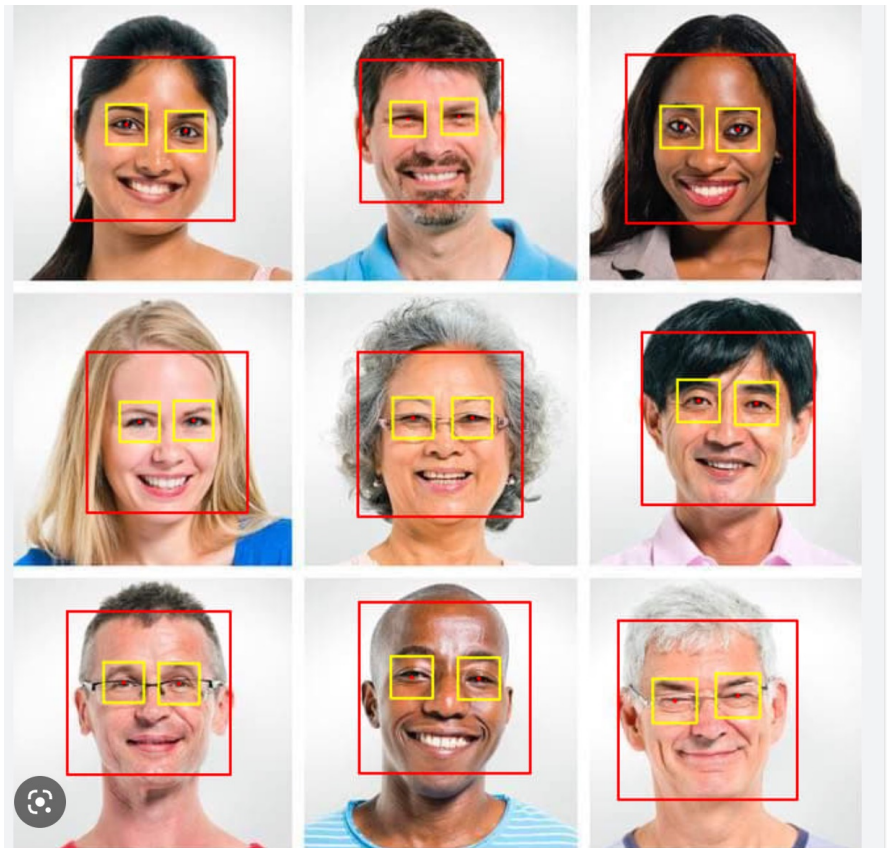
Algorithm

- Two-stage
 - First region proposal
 - Then CNN prediction
- One-stage
 - Directly capture features in an image to simultaneously predict position and label



Application

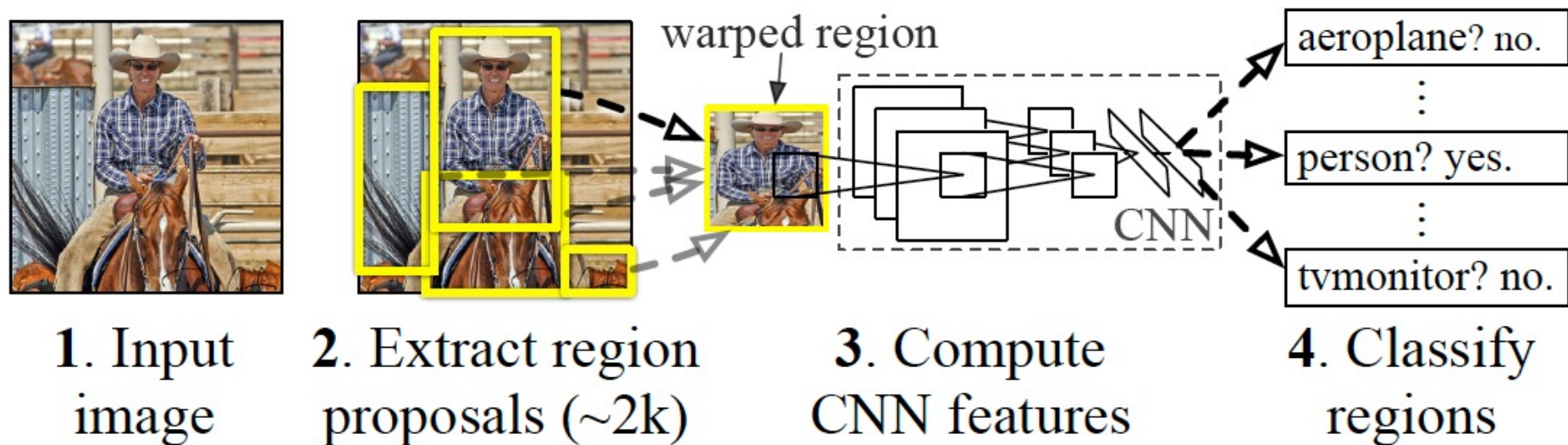
- Face detection, pedestrian detection, vehicle detection, road detection



Example: R-CNN

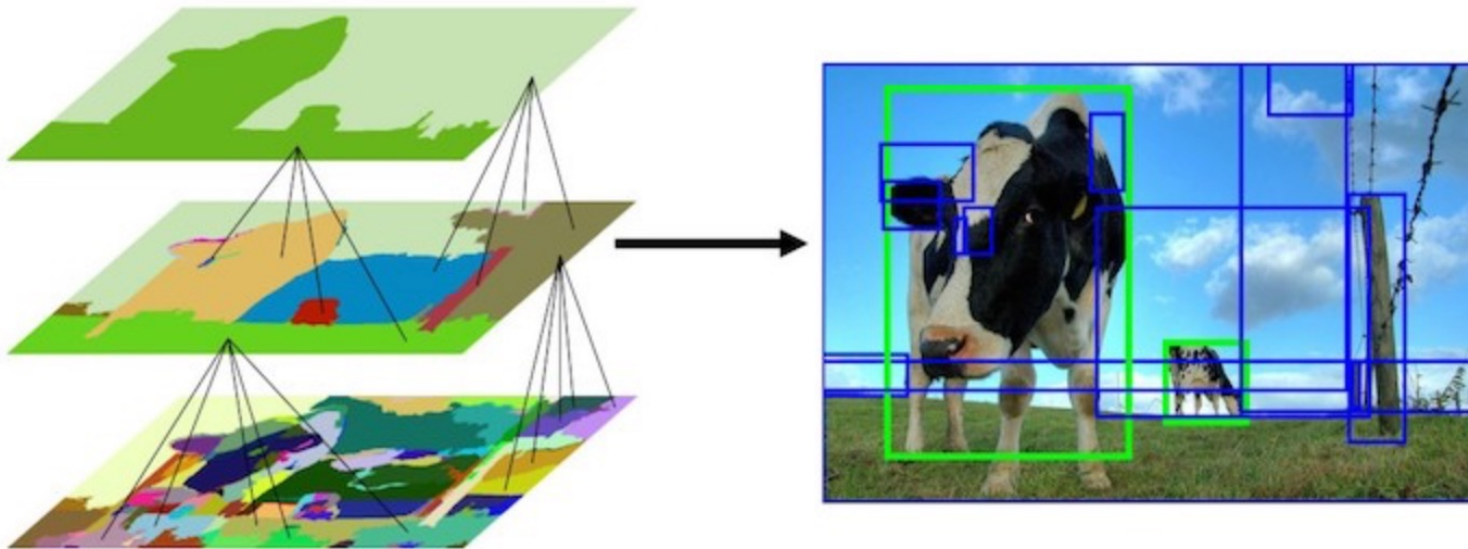
- The whole system includes three parts
 - The first part generates the category-independent region proposals
 - The second part is a large convolutional neural network
 - The third module includes a set of SVM which classify the label

R-CNN: *Regions with CNN features*



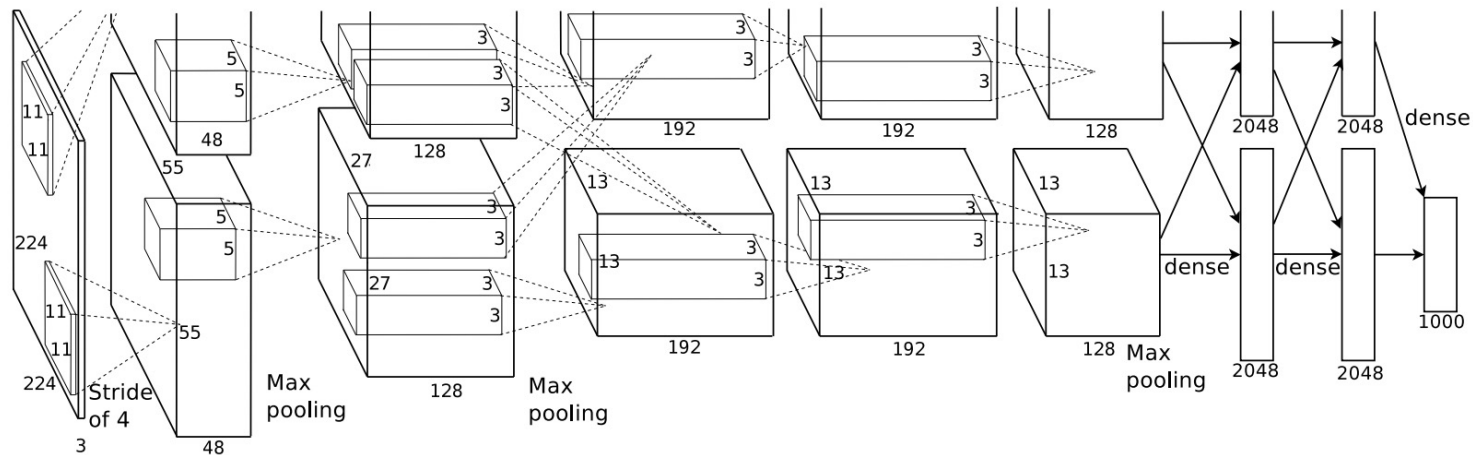
Example: R-CNN

- Region Proposal: Selective Search
 - First, segment an input image
 - Second, combine the two nearby regions which have high similarity
 - Third, Go to step 1

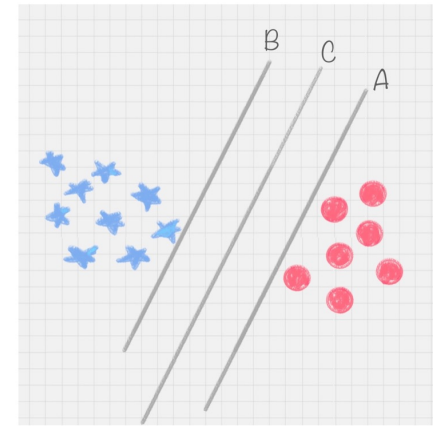


Example: R-CNN

- Feature extraction
 - Use a CNN from <https://proceedings.neurips.cc/paper/2012/file/c399862d3b9d6b76c8436e924a68c45b-Paper.pdf>
 - Five convolutional layers and two fully connected layers to extract features for each region

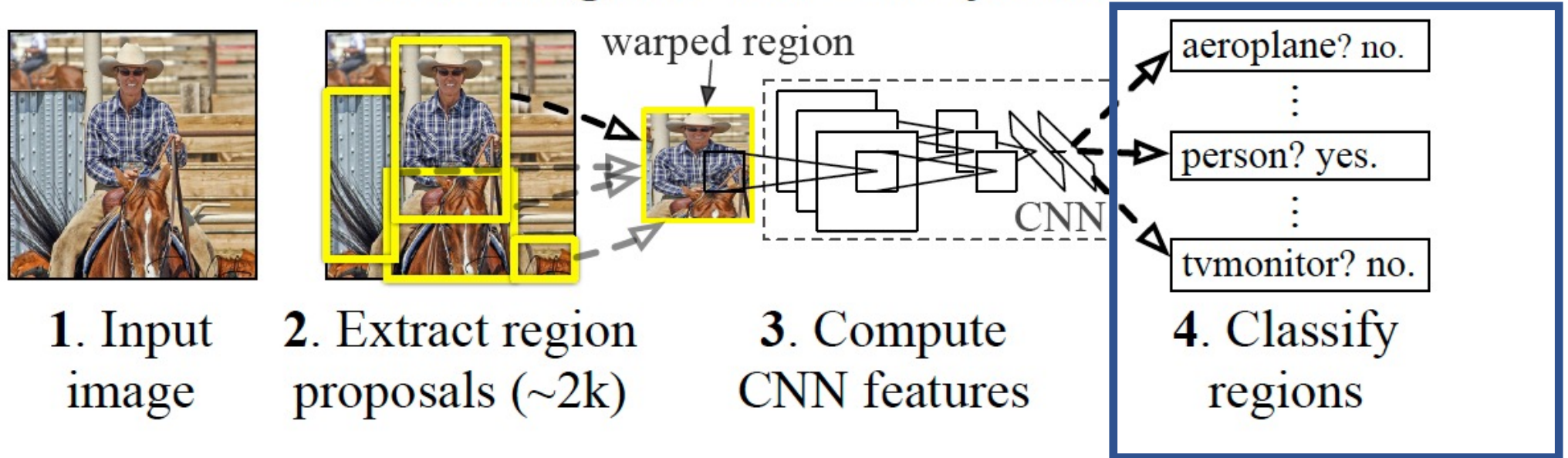


Example: R-CNN



- Region Classification
 - Use a set of SVMs: a binary-classifier (One V.S. Many)
 - SVM : maximize the minimum distance between support vector and hyper-plane

R-CNN: *Regions with CNN features*



Any Question?