



GluonCV: Object Detection

Tong He

Applied Scientist, Amazon Web Services.

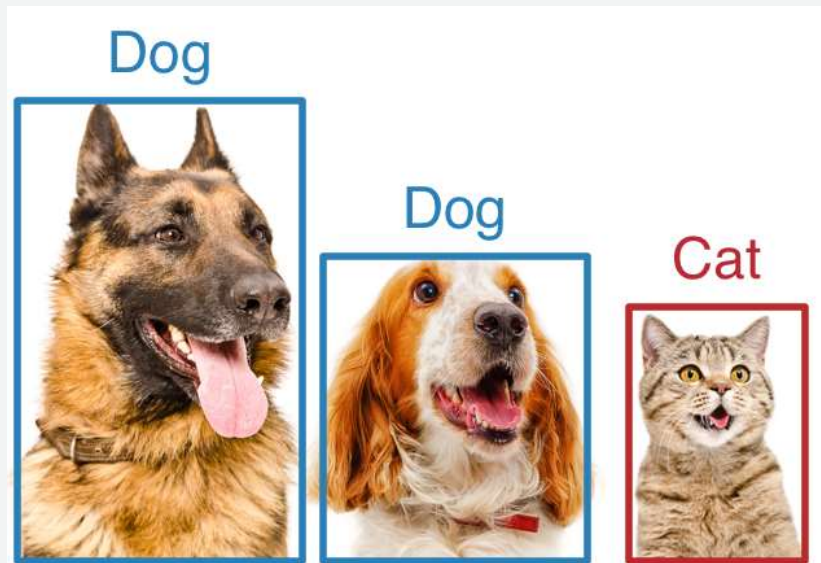
2018.12.17



Introduction

What is detection?

Classify and Localize the object



Why Object Detection?

Multiple Objects



Object Detection with Deep Learning

Object Detection with Deep Learning

Compared with Image Classification

Classification:

Input: image

Output: class label

Evaluation: accuracy

Detection:

Input: image

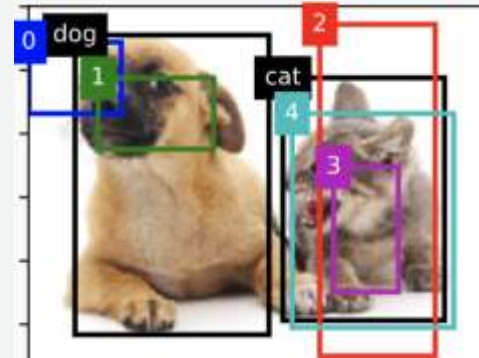
Output: boxes with labels

Evaluation: IoU

Object Detection with Deep Learning

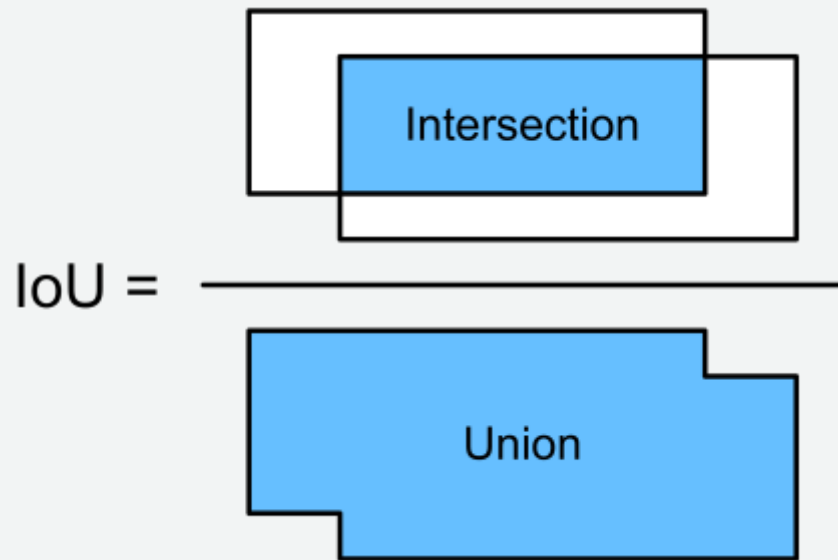
Bounding Box

- Generated by model
- Represented by (h, w, x, y)



Object Detection with Deep Learning

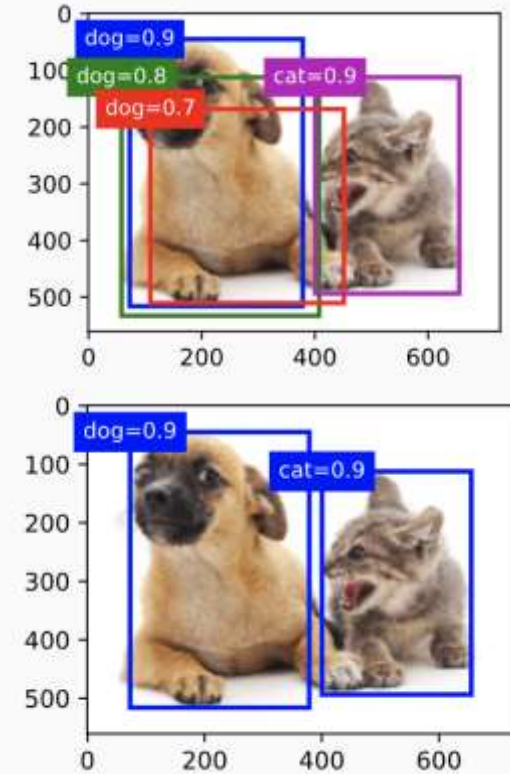
IoU: Intersection over Union



Object Detection with Deep Learning

NMS: Non-Maximum Suppression

- Choose the highest score
- Remove $\text{IoU} > \text{threshold}$
- Repeat



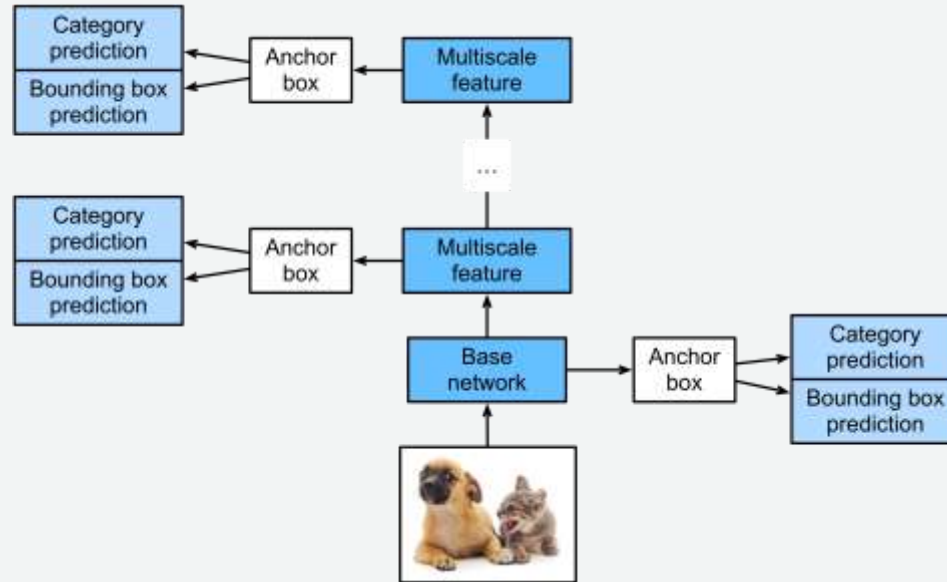
Object Detection with Deep Learning

Three popular models

- SSD
- Faster R-CNN
- YOLO

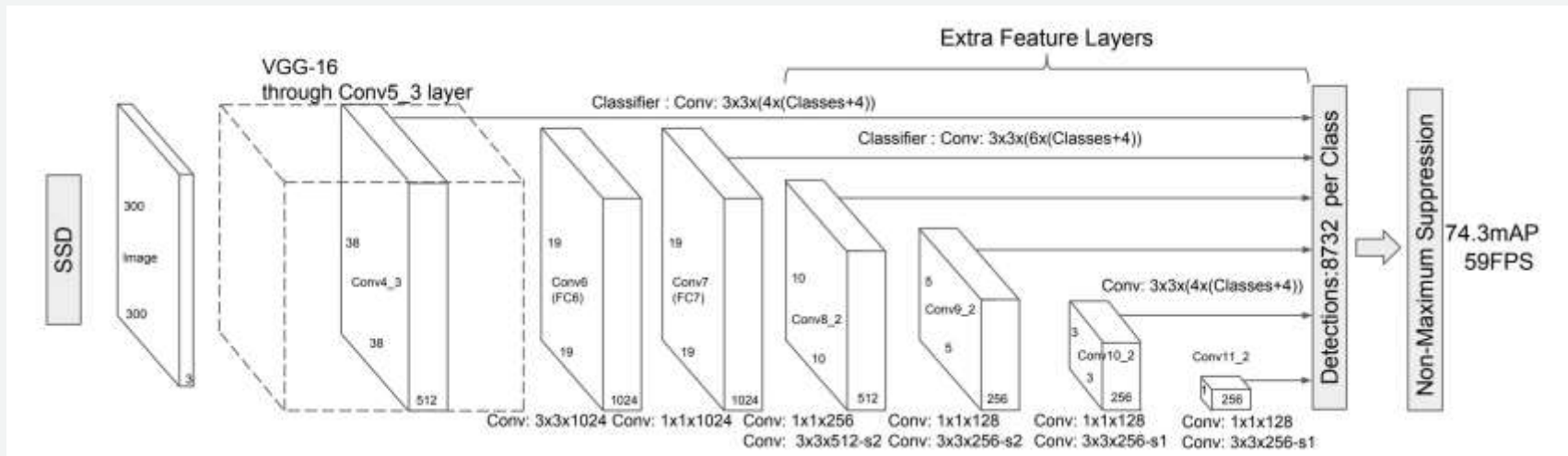
Object Detection with Deep Learning

SSD: Single Shot multibox Detection



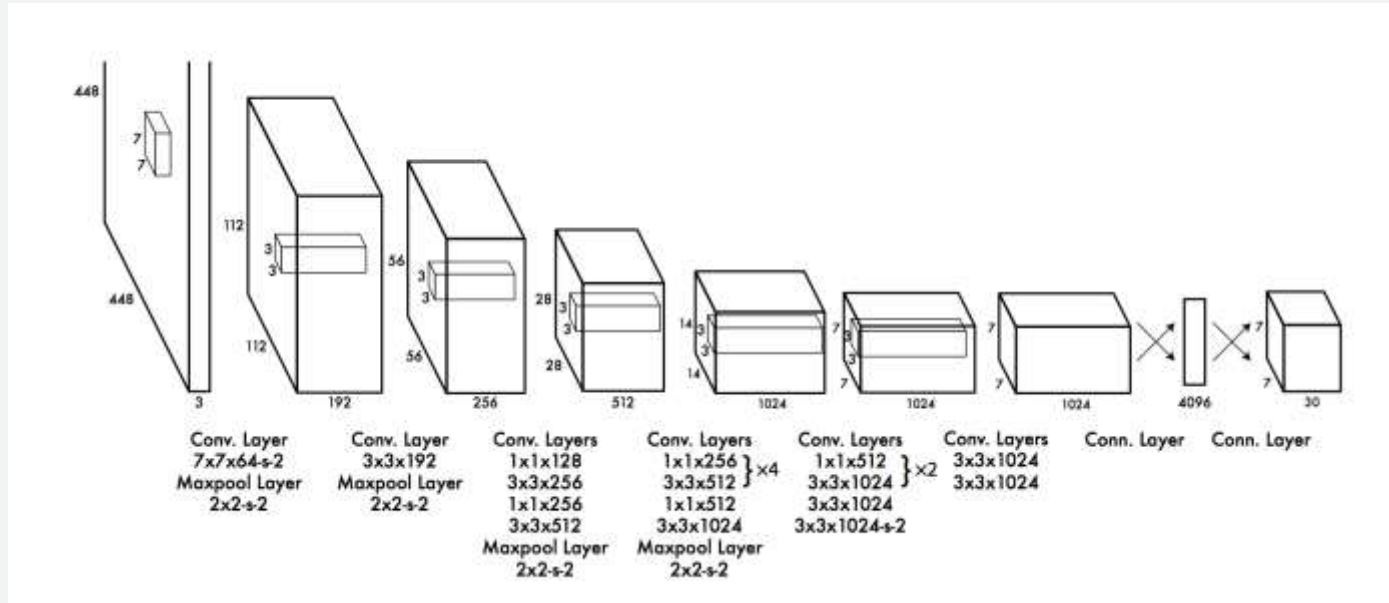
Object Detection with Deep Learning

SSD: Single Shot multibox Detection



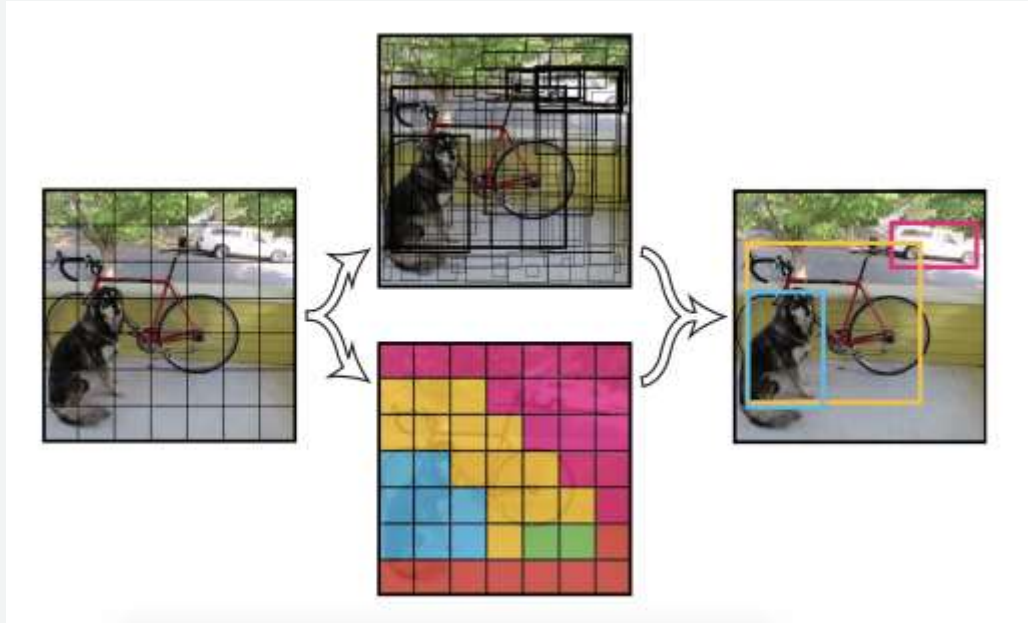
Object Detection with Deep Learning

YOLO: You Only Look Once



Object Detection with Deep Learning

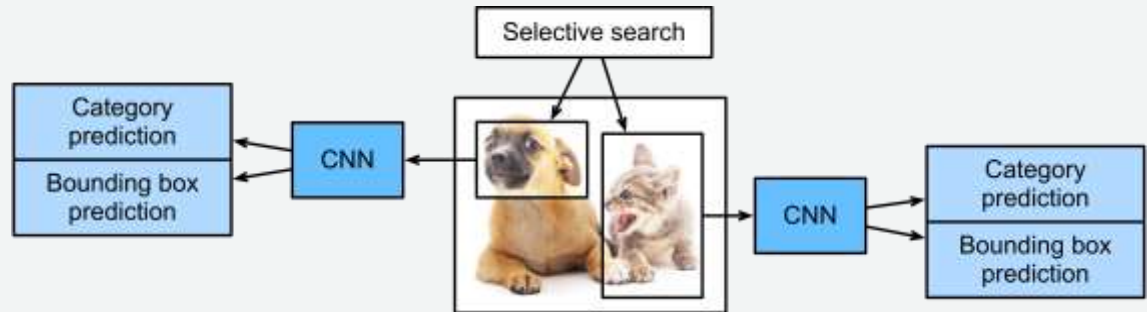
YOLO: You Only Look Once



Object Detection with Deep Learning

R-CNN

- Selective search is slow
- Class prediction by SVM



Object Detection with Deep Learning

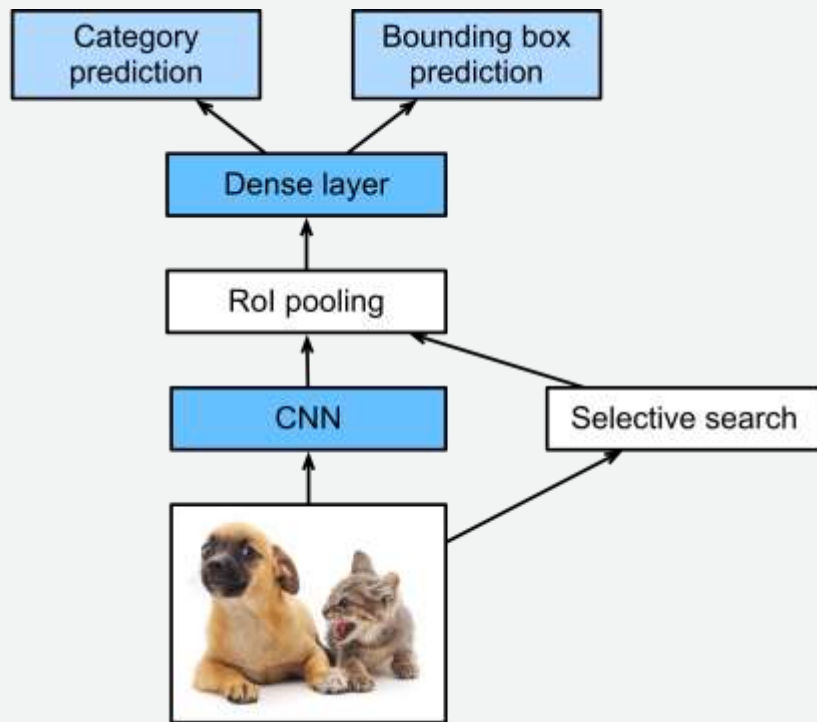
Fast R-CNN

- RoI Pooling
- Prediction in dense layer

| | | | |
|----|----|----|----|
| 0 | 1 | 2 | 3 |
| 4 | 5 | 6 | 7 |
| 8 | 9 | 10 | 11 |
| 12 | 13 | 14 | 15 |

2 x 2 RoI
Pooling

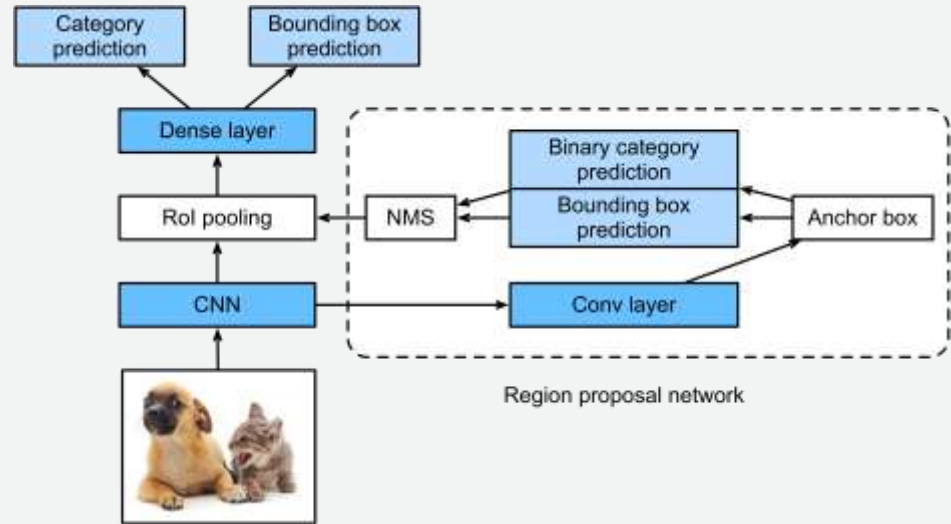
| | |
|---|----|
| 5 | 6 |
| 9 | 10 |



Object Detection with Deep Learning

Faster R-CNN

- Replace selective search by region proposal network



Object Detection with Deep Learning

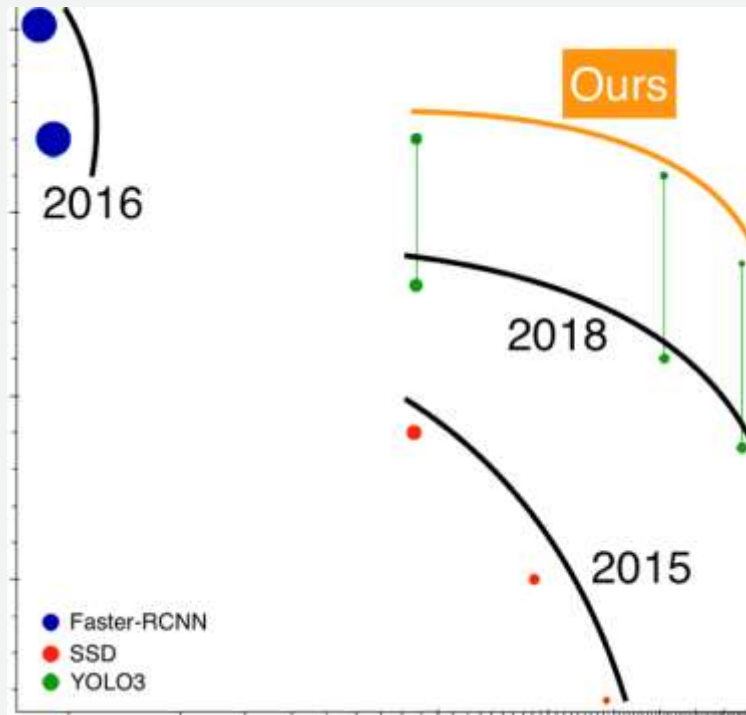
Summary

- SSD
 - Fast, easy to implement, less accurate
- Faster R-CNN
 - Slow, very accurate
- YOLO
 - Fast, accurate

Object Detection with GluonCV

Object Detection with GluonCV

Model Zoo



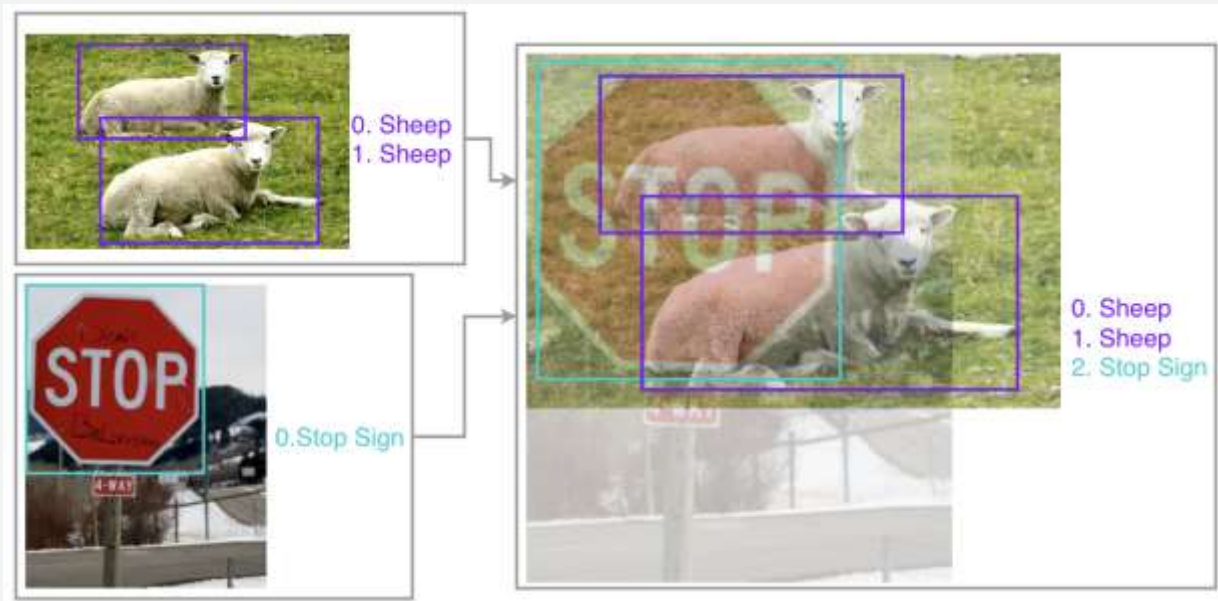
Object Detection with GluonCV

Advanced Training

- Learning rate schedule
- Mix-up
- Label smoothing

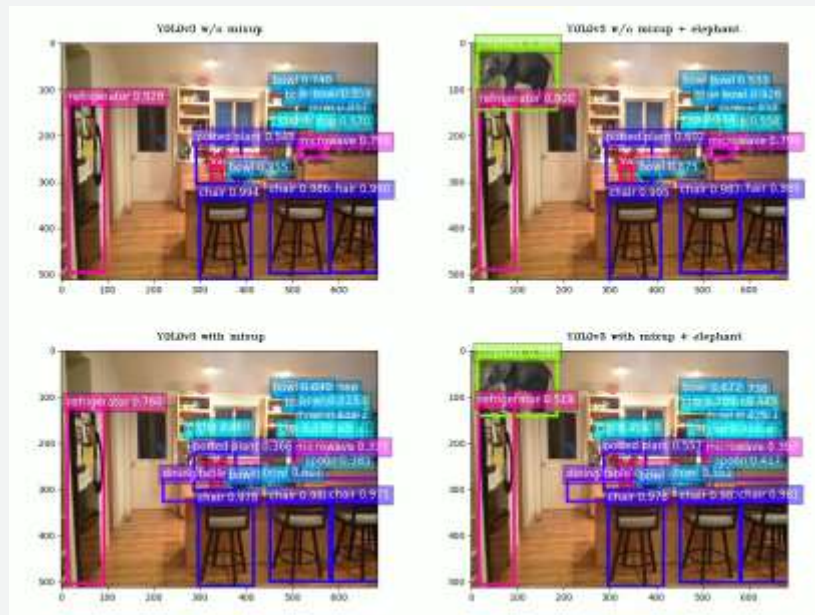
Object Detection with GluonCV

Mix-Up



Object Detection with GluonCV

Elephant-in-the-Room



Object Detection with GluonCV

Resources:

- Model Zoo: https://gluon-cv.mxnet.io/model_zoo/detection.html
- Tutorials: https://gluon-cv.mxnet.io/build/examples_detection/index.html
- Deep Learning Book: <http://en.diveintodeeplearning.org/>

Object Detection with GluonCV

Hands On!