YOU LOOK ONLY ONCE (YOLO)

A Hands-on Introduction to the State of the Art Real Time Object Detection Deep Learning Model

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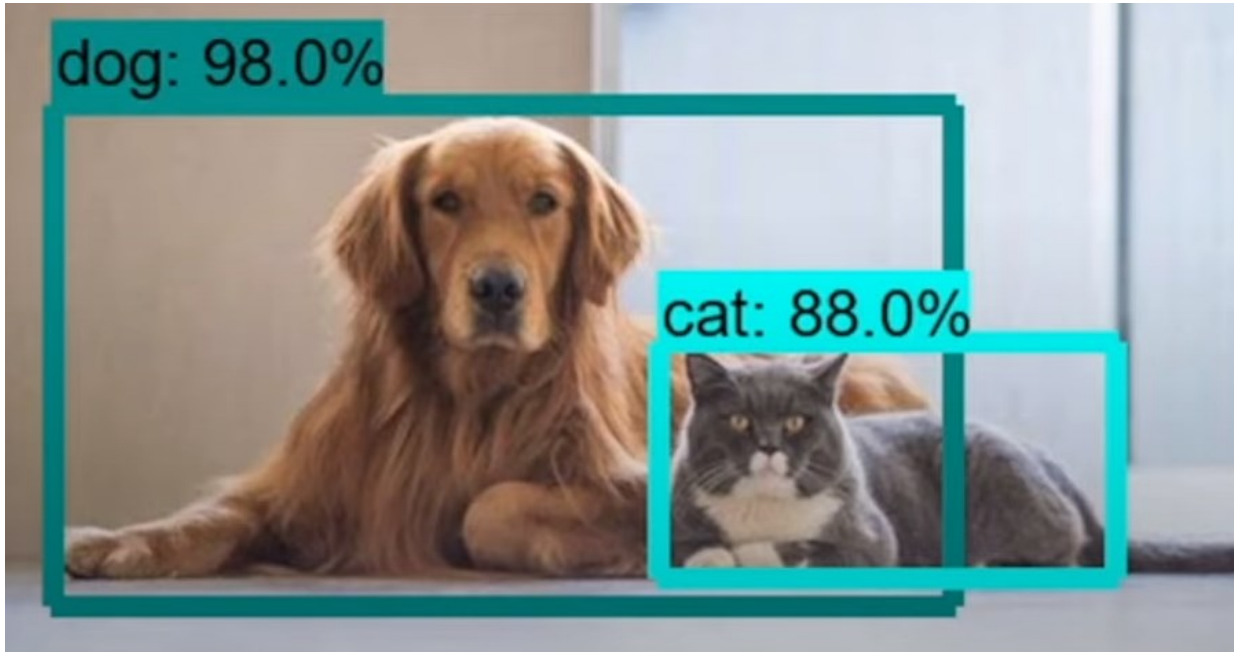
Part 1

INTRODUCTION

Defining Object Detection (1)

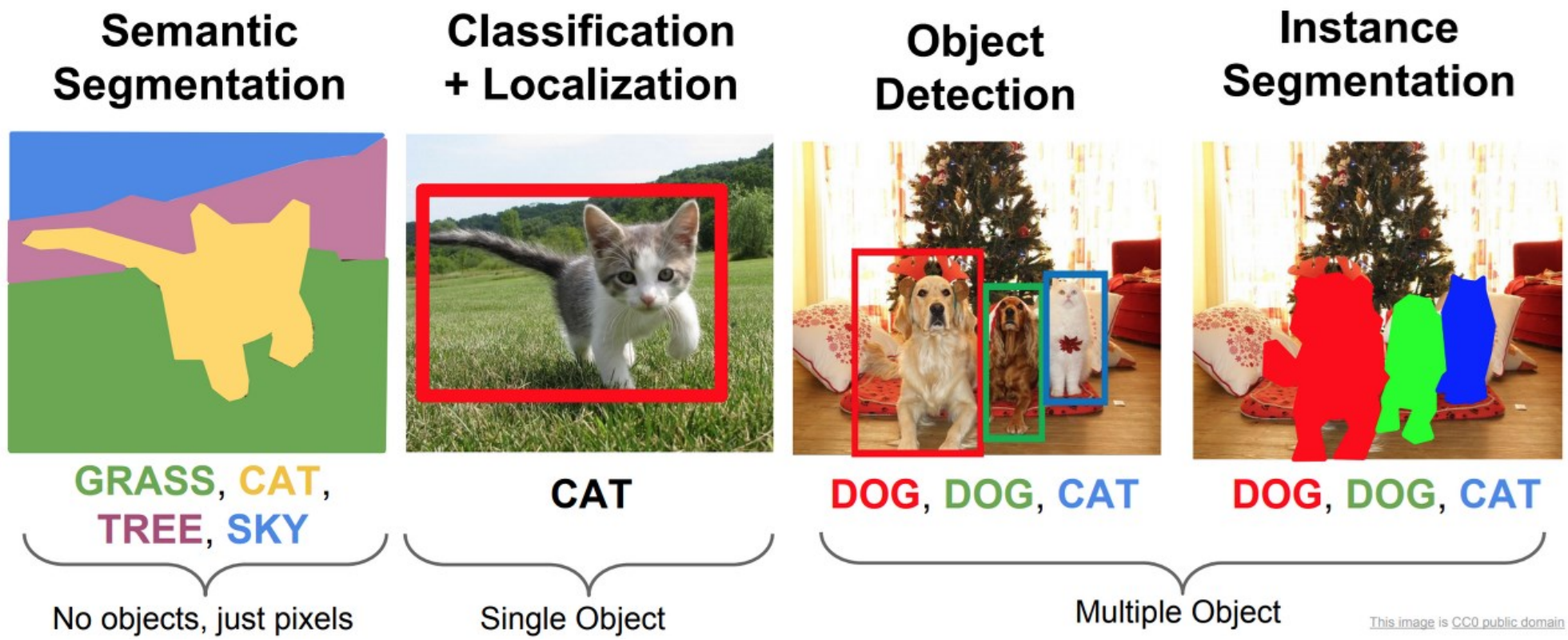


Object Detection:

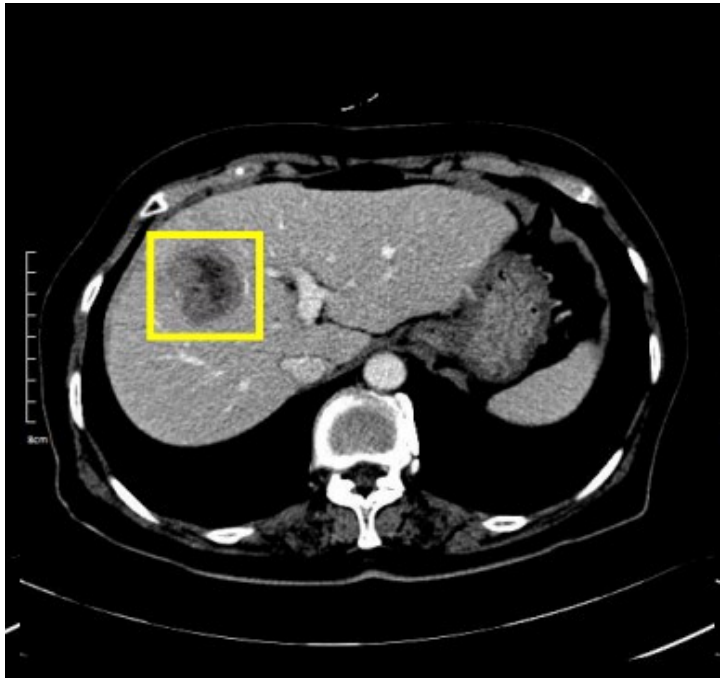
1. **What kind of object is it?**
2. **Where is that object located?**

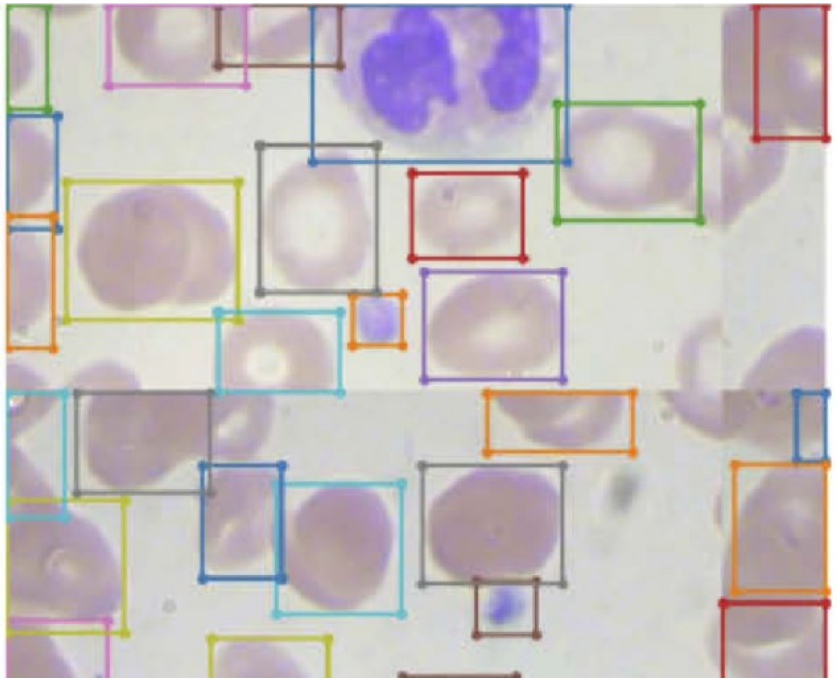
Defining Object Detection (2)

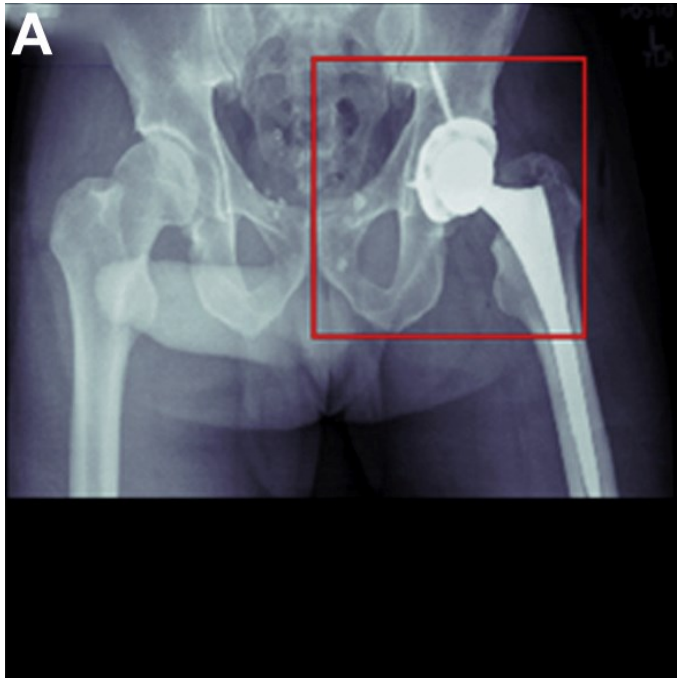
Defining Object Detection (3)



Medical Applications of Object Detection







Sources:

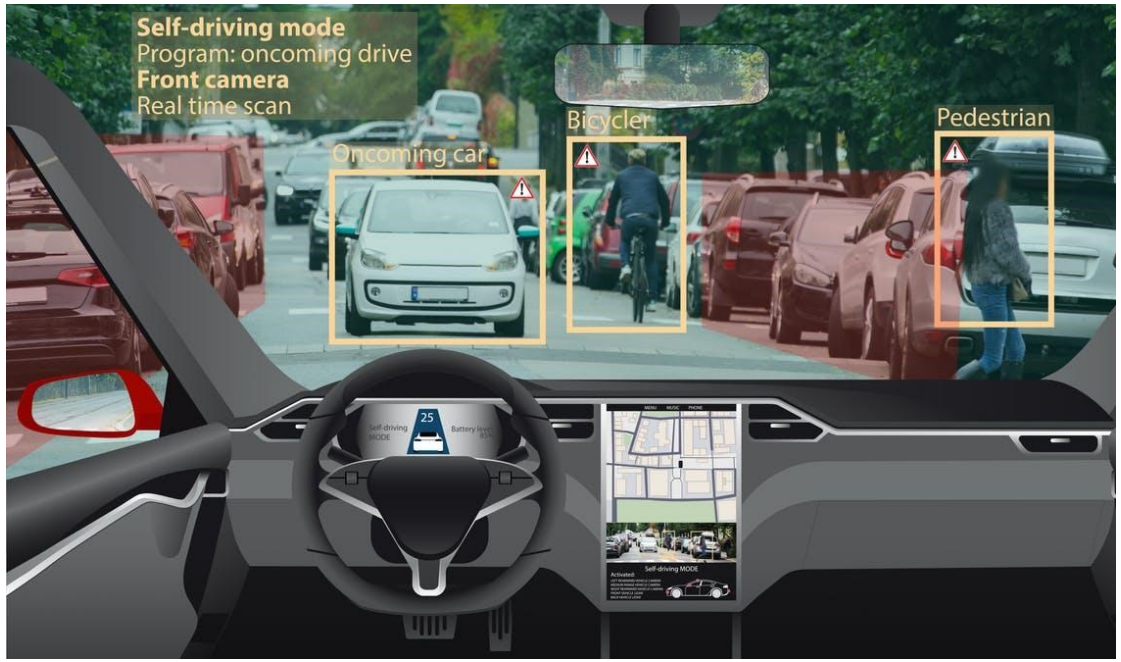
- Liver Lesion Detection from Weakly-labeled Multi-phase CT Volumes with a Grouped Single Shot MultiBox Detector
- Improved detection performance in blood cell count by an attention-guided deep learning method
- Deep Learning Artificial Intelligence Model for Assessment of Hip Dislocation Risk Following Primary Total Hip Arthroplasty From Postoperative Radiographs

Real Time Object Detection (1)

Real-time object detection is the task of doing object detection in real-time with fast inference while maintaining a base level of accuracy.

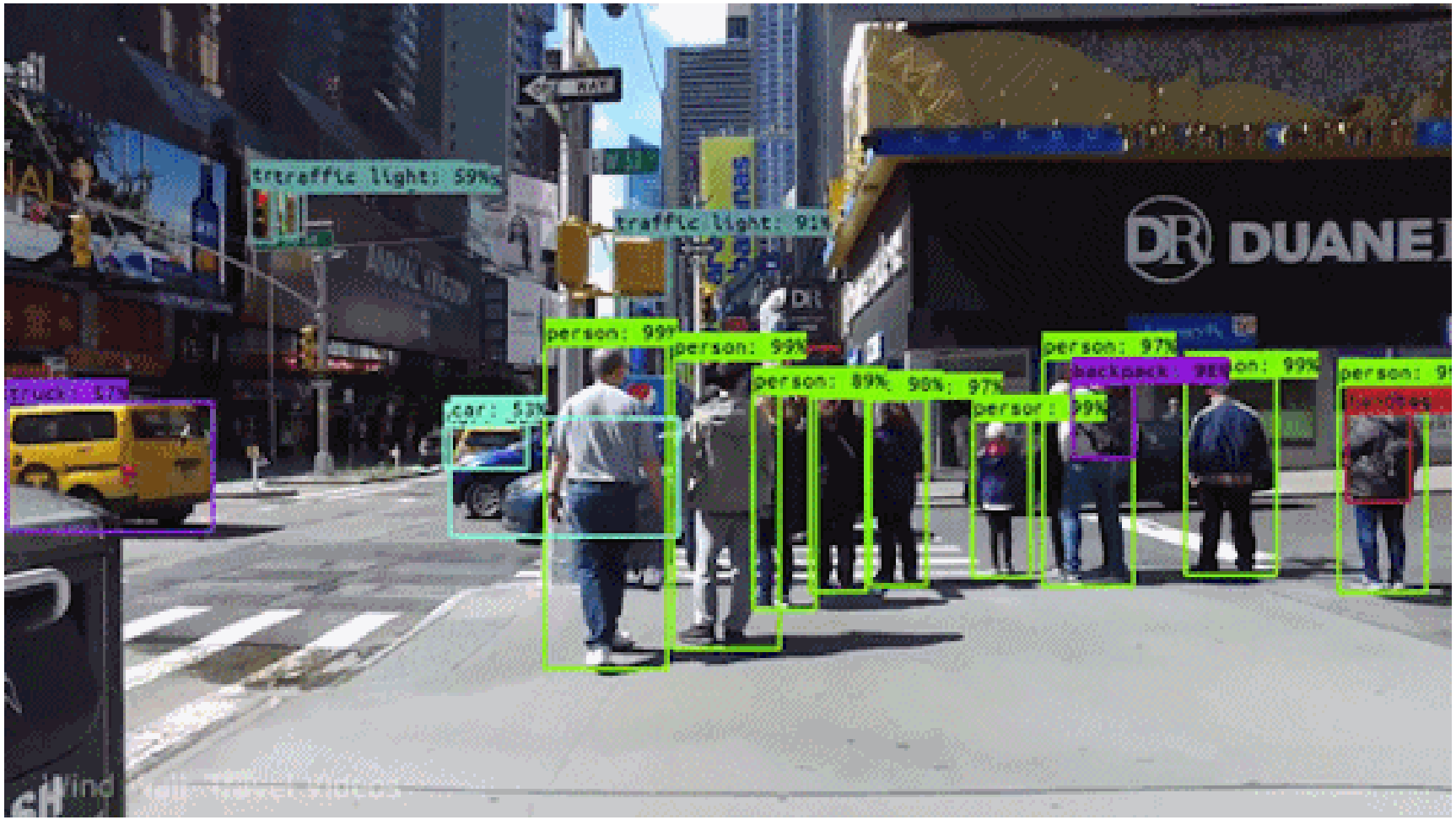
The model should be able to detect objects and make inferences within microseconds!

Examples of Real-time Object Detection Models
Faster-RCNN (as opposed to RCNN and Fast-RCNN)
EfficientDet
MM-Detection
Single Shot Detection (SSD)
You Look Only Once (YOLO)

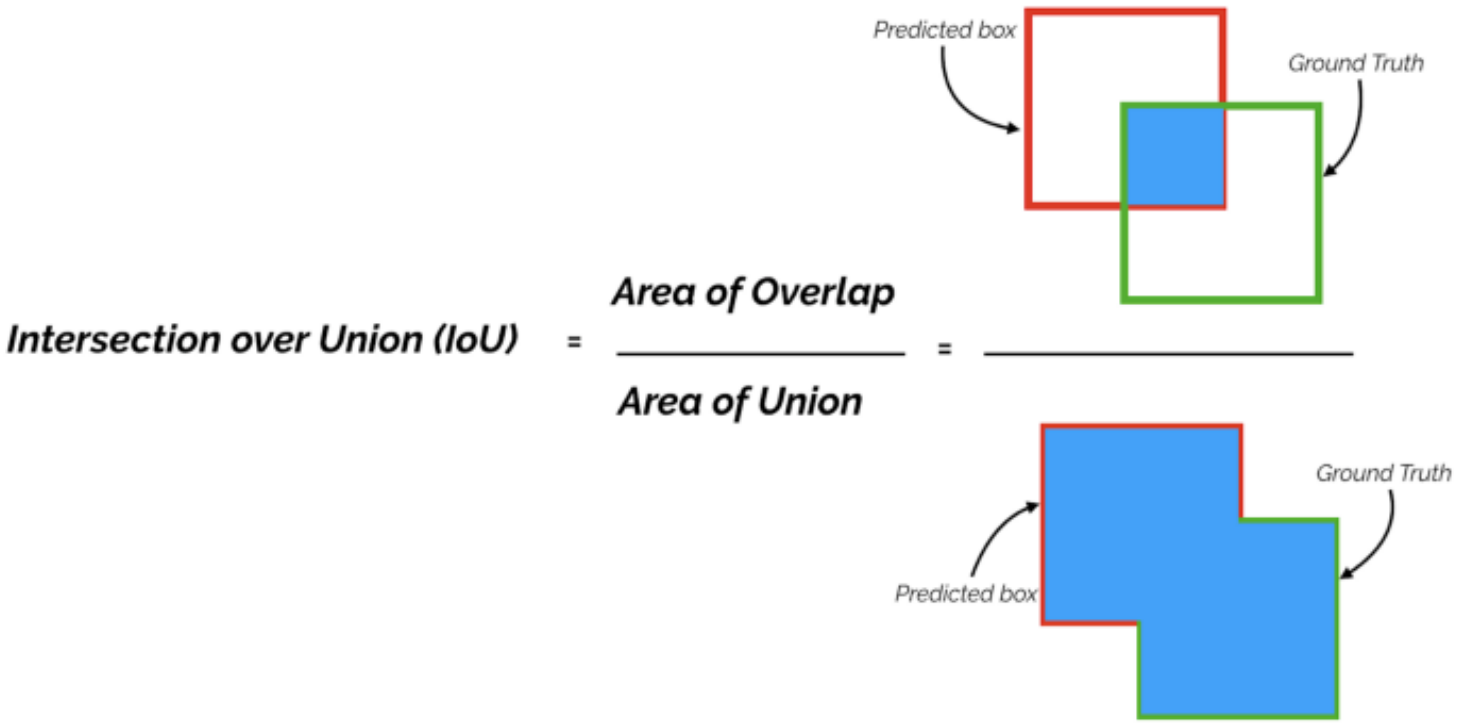


Source: https://theconversation.com/whos-to-blame-when-a-self-driving-car-has-an-accident-150941

Real Time Object Detection (2)



Object Detection Metrics (1)

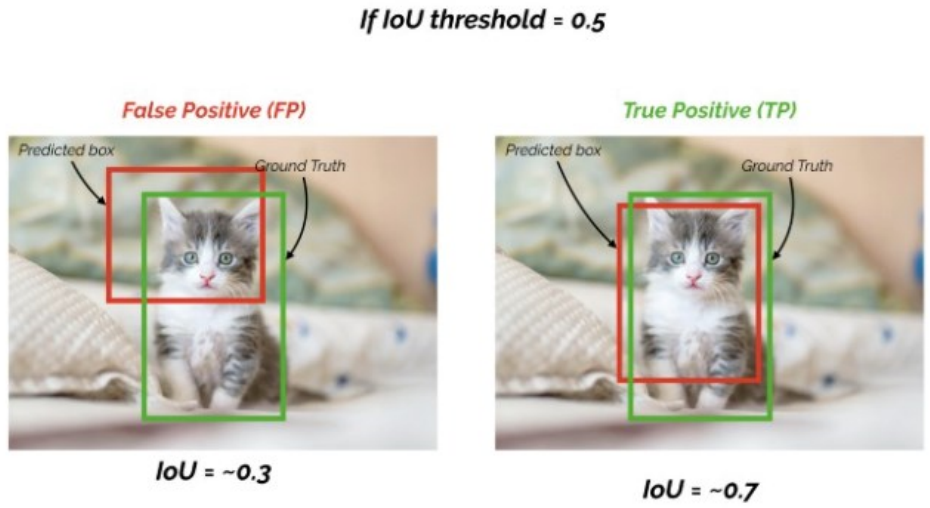


Source: https://towardsdatascience.com/map-mean-average-precision-might-confuse-you-5956f1bfa9e2

Object Detection Metrics (2)

Mean Average Precision (mAP):

- For object detection tasks, we calculate **Precision** and **Recall** using IoU value for a given IoU threshold.
- The general definition for the Average Precision (AP) is finding the area under the precision-recall curve above.
- The mean Average Precision or mAP score is calculated by taking the mean AP over all classes and/or overall IoU thresholds, depending on different detection challenges that exist.
- mAP is usually used as the standard metric for evaluating the performance of object detection models.



$$Recall = \frac{TP}{TP + FN}$$

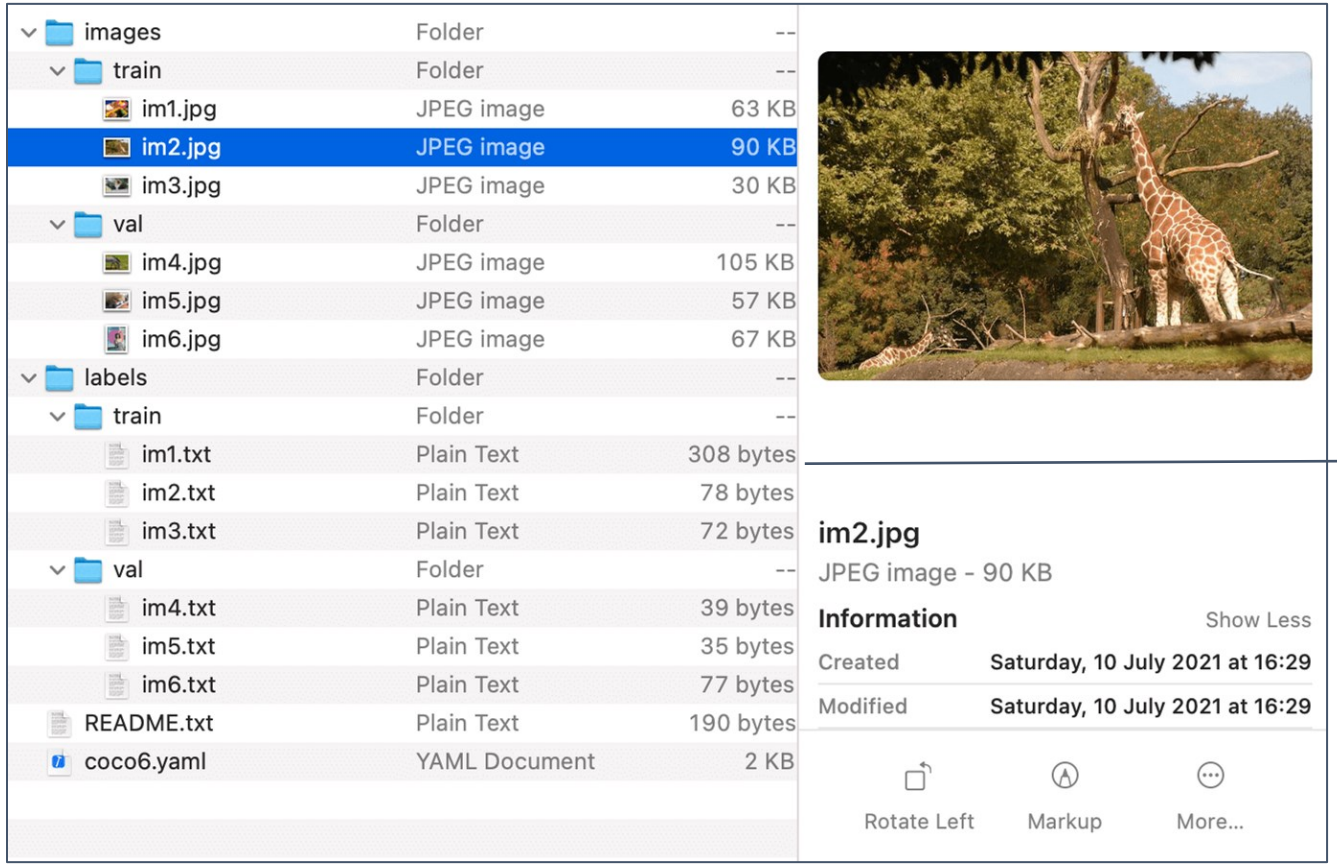
$$Precision = \frac{TP}{TP + FP}$$

Source: https://towardsdatascience.com/map-mean-average-precision-might-confuse-you-5956f1bfa9e2

Part 2

DATA

What Kind of Data Do We Need?



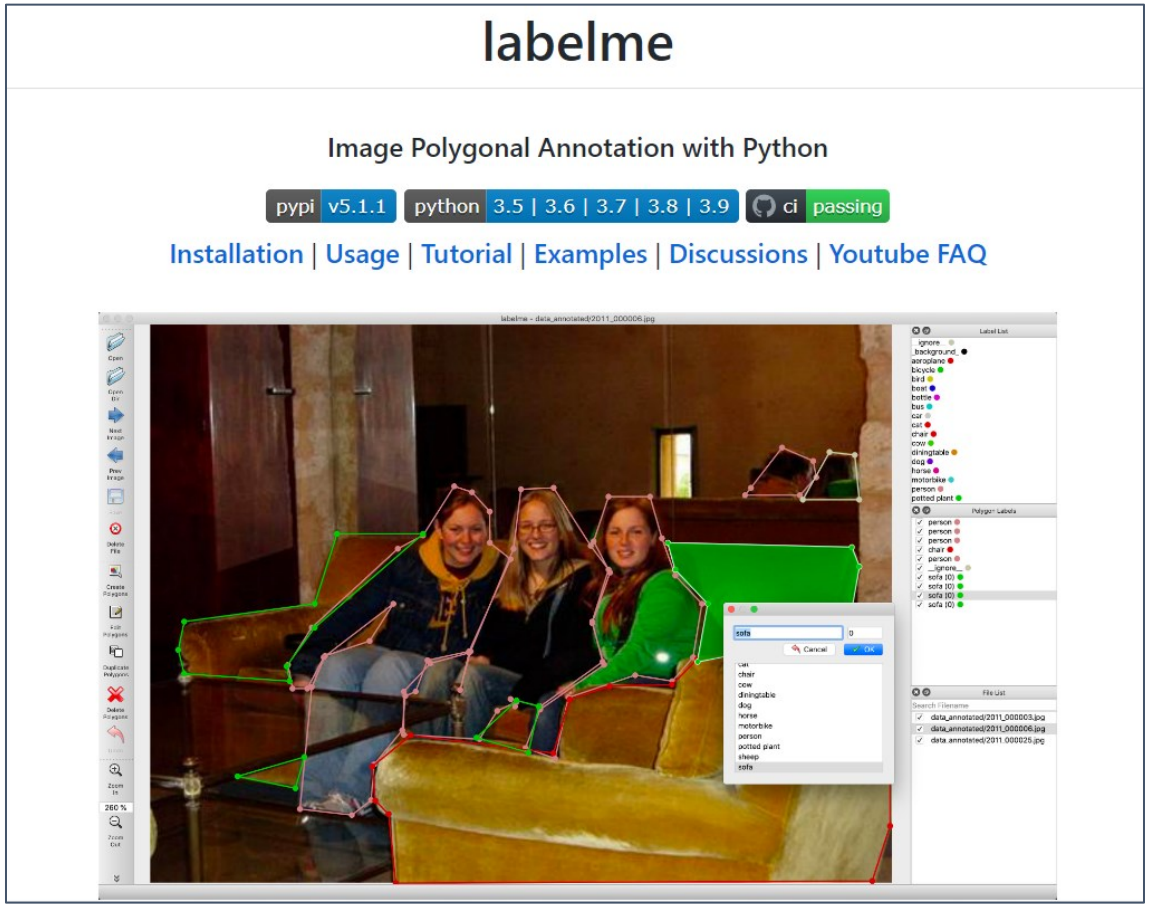
Im1.txt

1 120 156 456 519
2 89 120 311 421

….
….

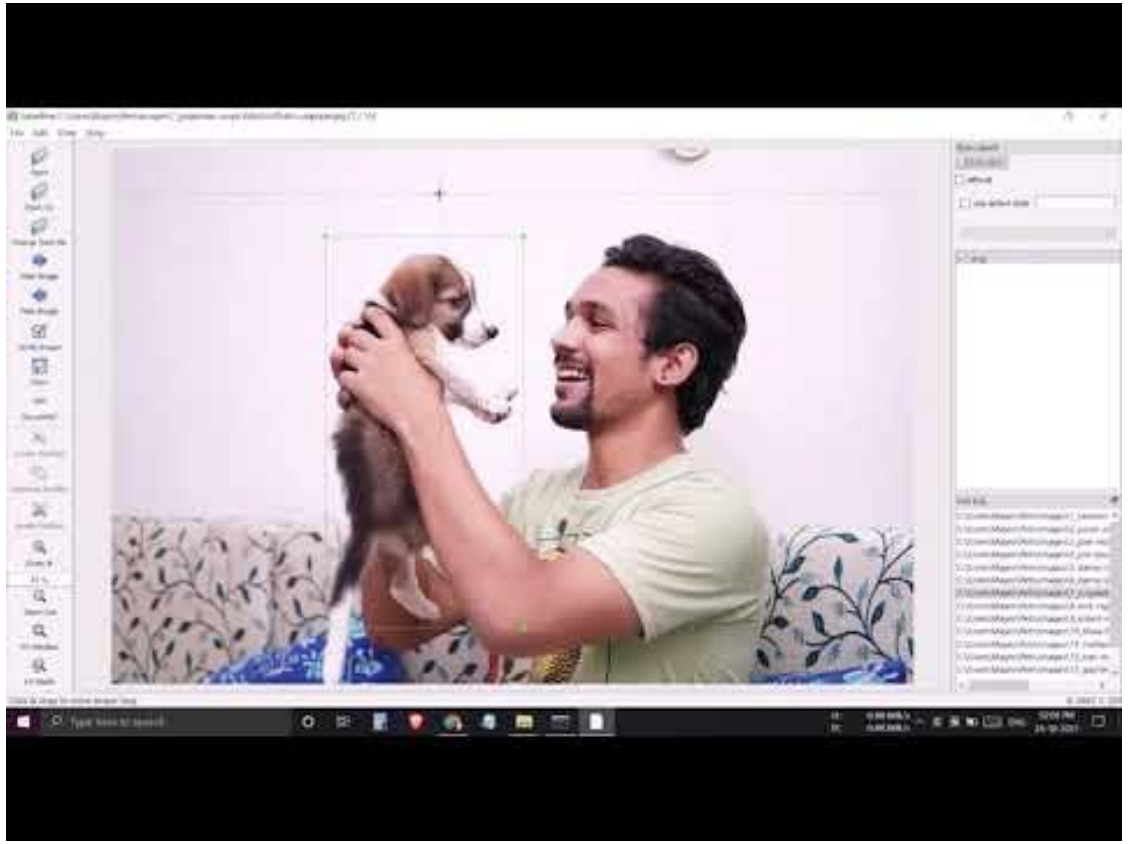
C Xmin Ymin Xmax Ymax
C Xcenter Ycenter Width Height

How to Label Custom Datasets? (1)



https://github.com/wkentaro/labelme

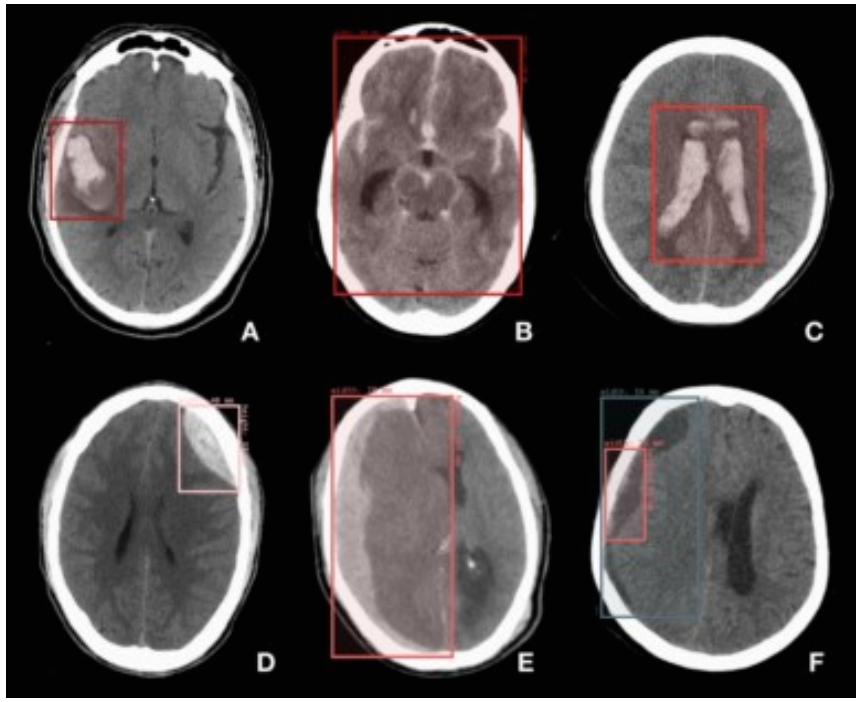
How to Label Custom Datasets? (2)



A Nice Tutorial on How to Use labelme:

https://www.youtube.com/watch?v=ydHI8SUe58Y

Let's Prepare the Data for Our Workshop!

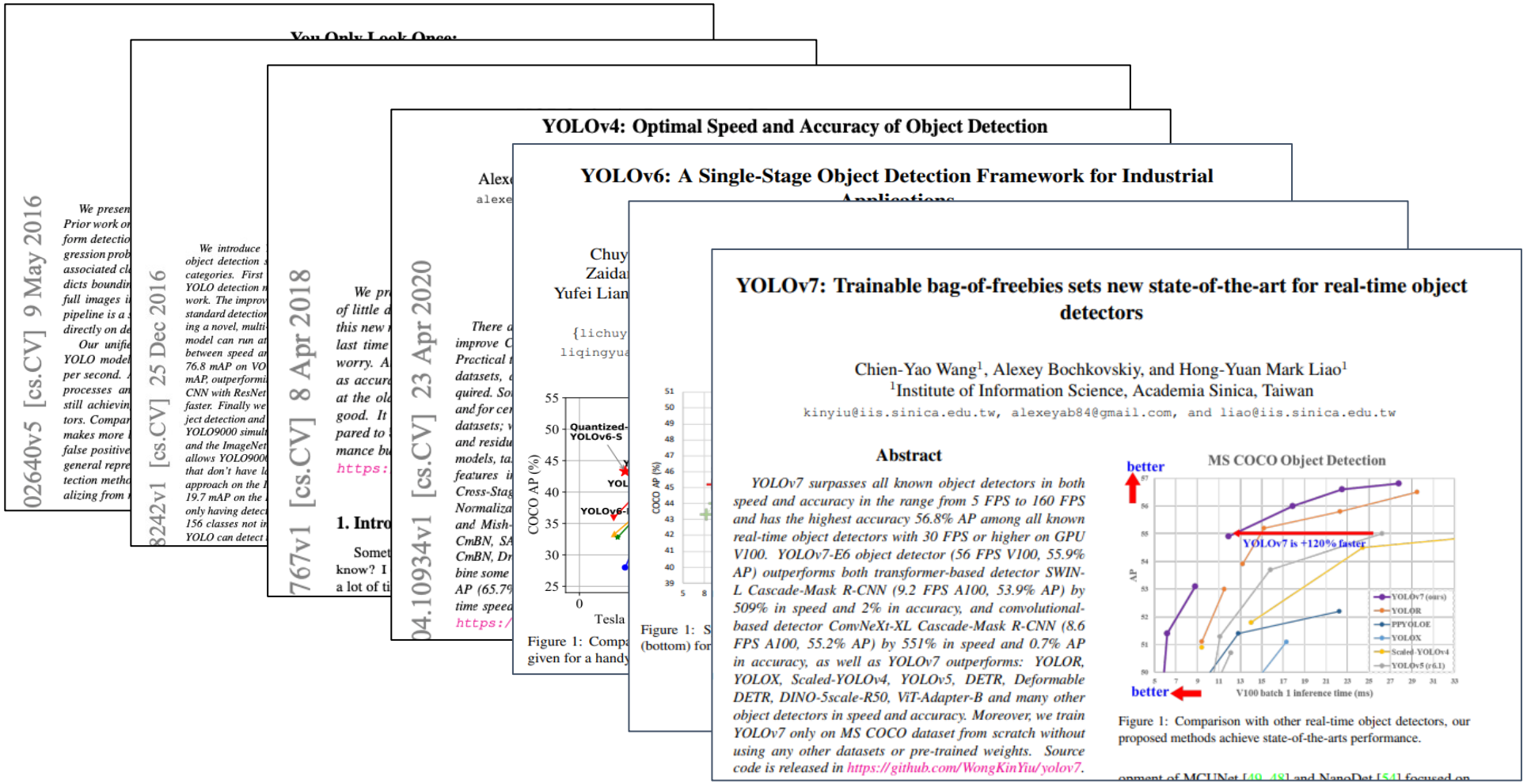


In this workshop, we will train an object detection deep learning model to detect
brain hemorrhage lesion on Head CT scans!

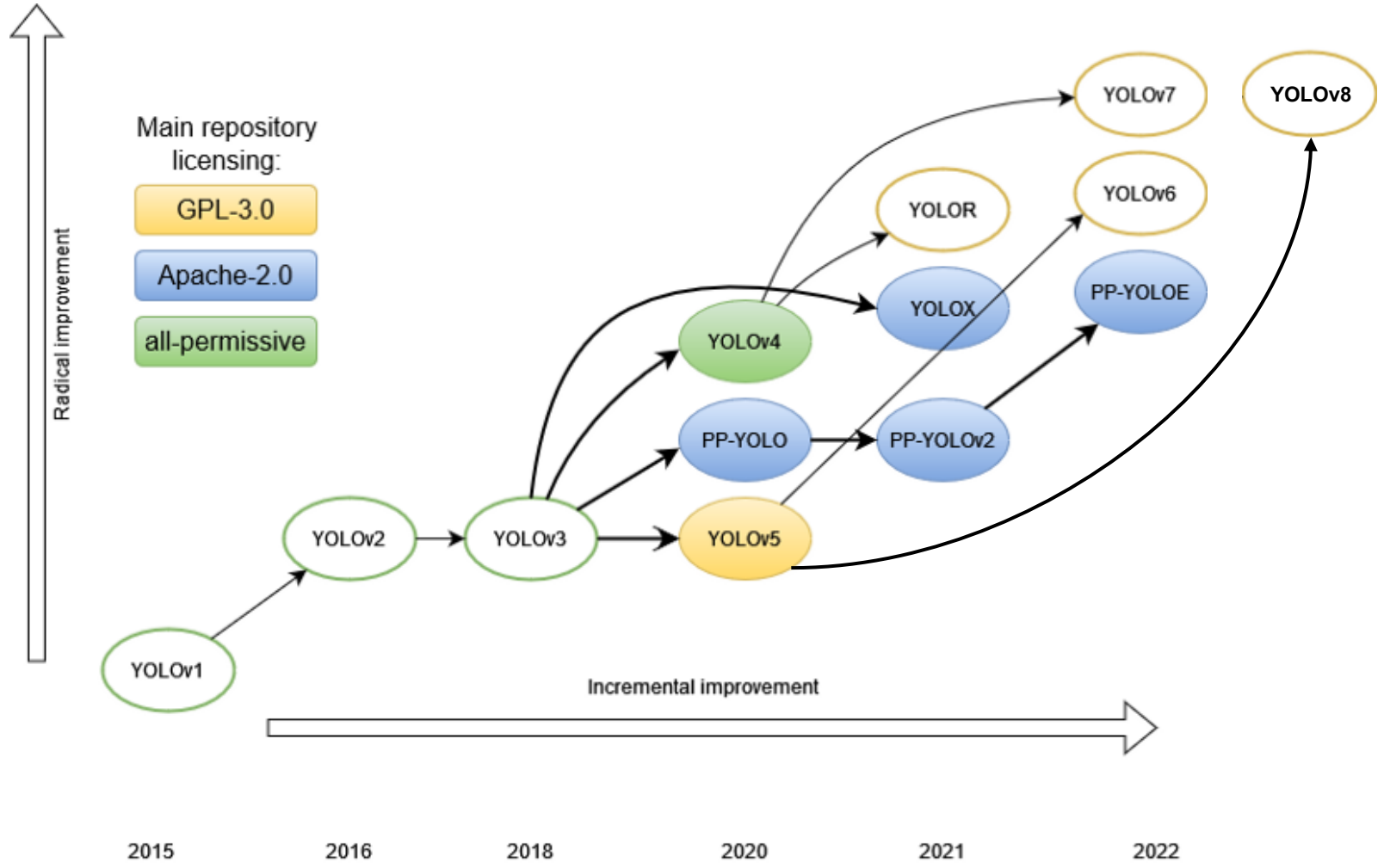
Part 3

YOLO

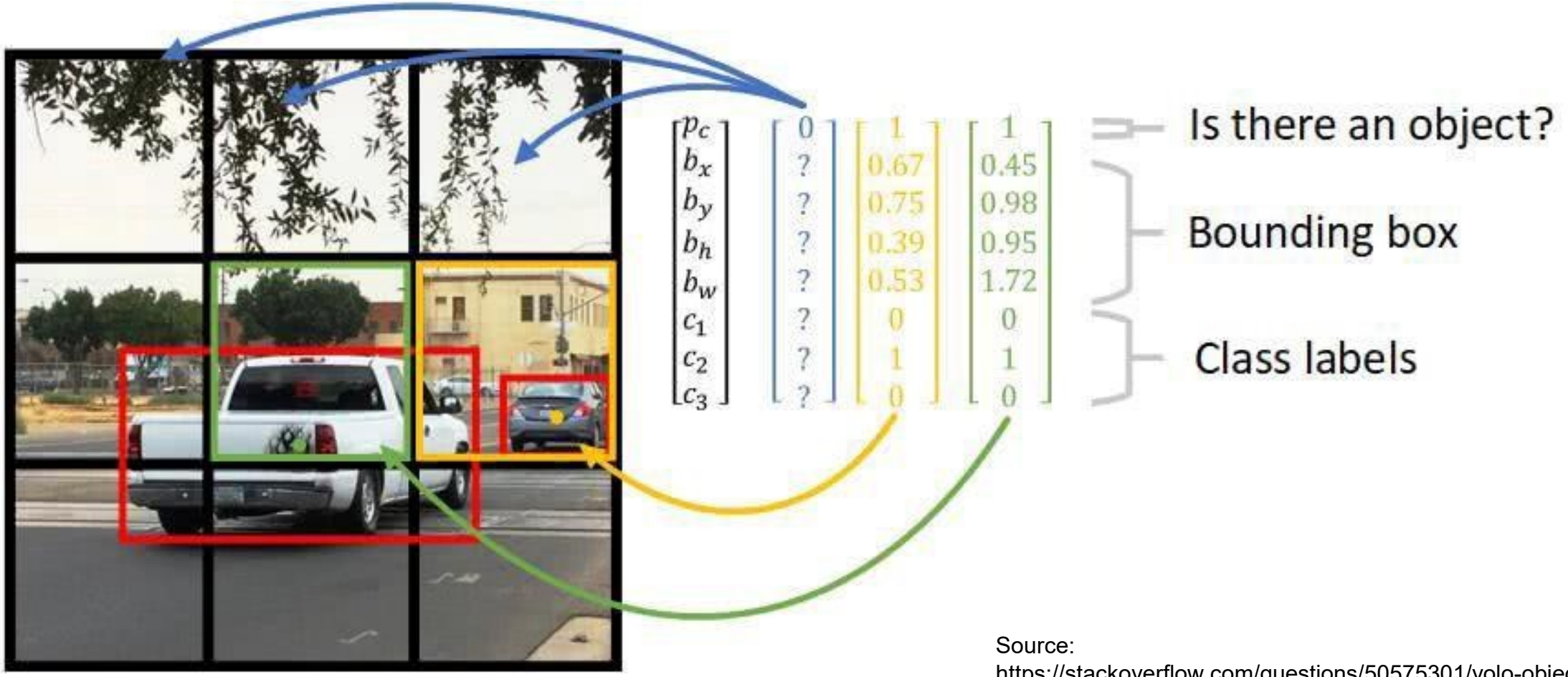
You Look Only Once (YOLO)



You Look Only Once (YOLO)



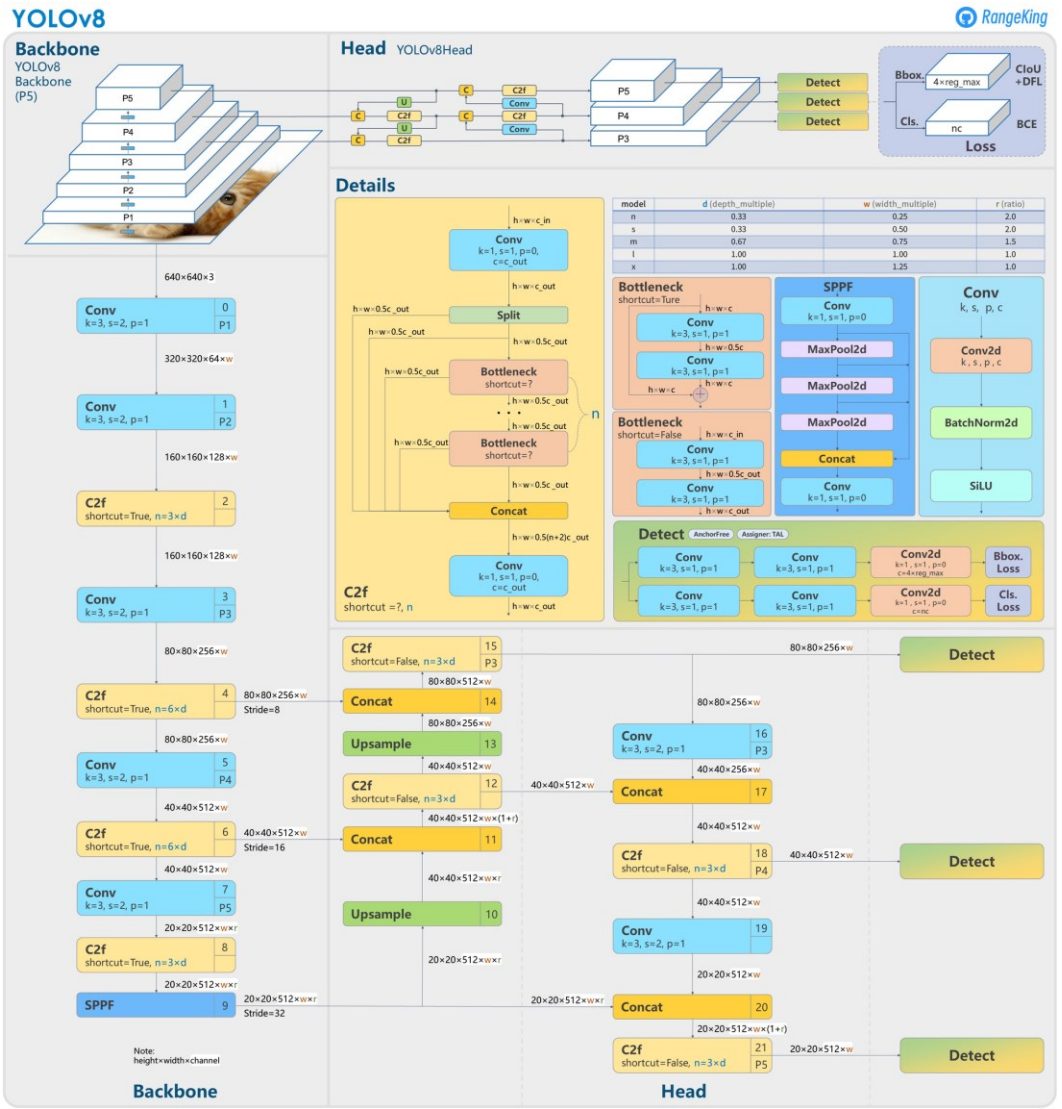
What Does YOLO Output?



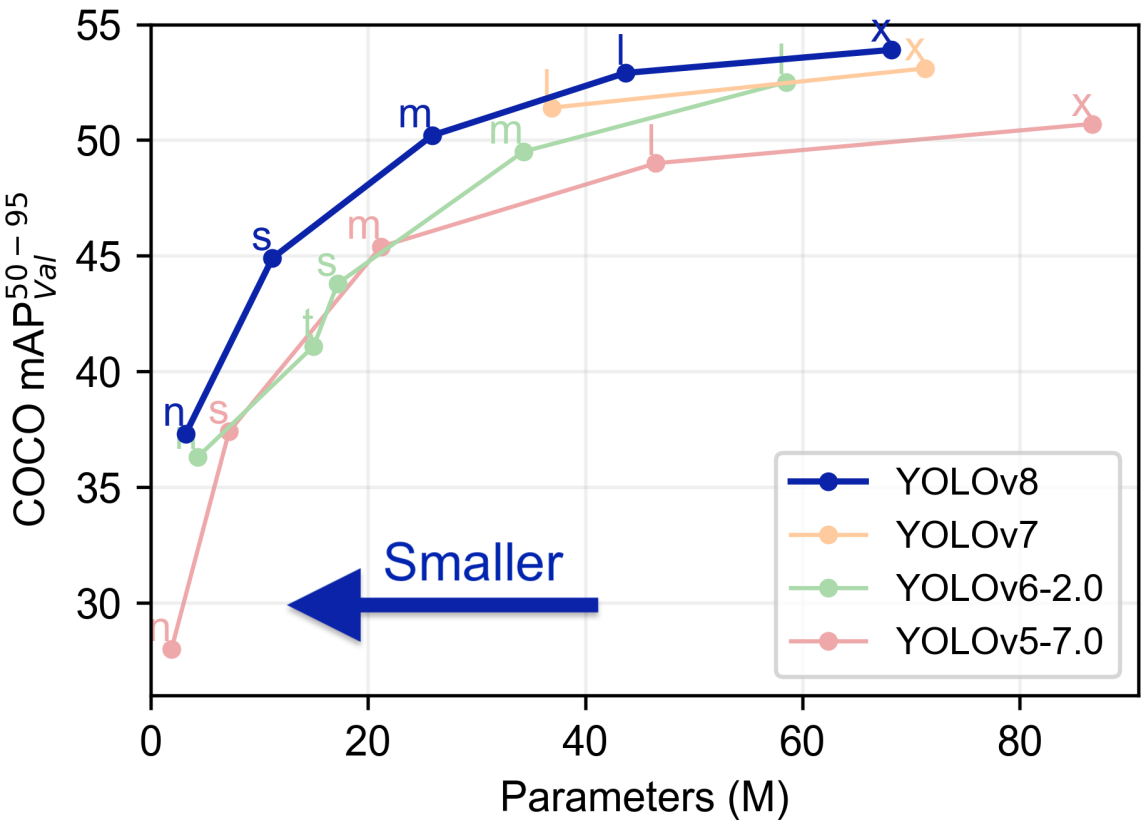
Source: https://stackoverflow.com/questions/50575301/yolo-object-detection-how-does-the-algorithm-predict-bounding-boxes-larger-than

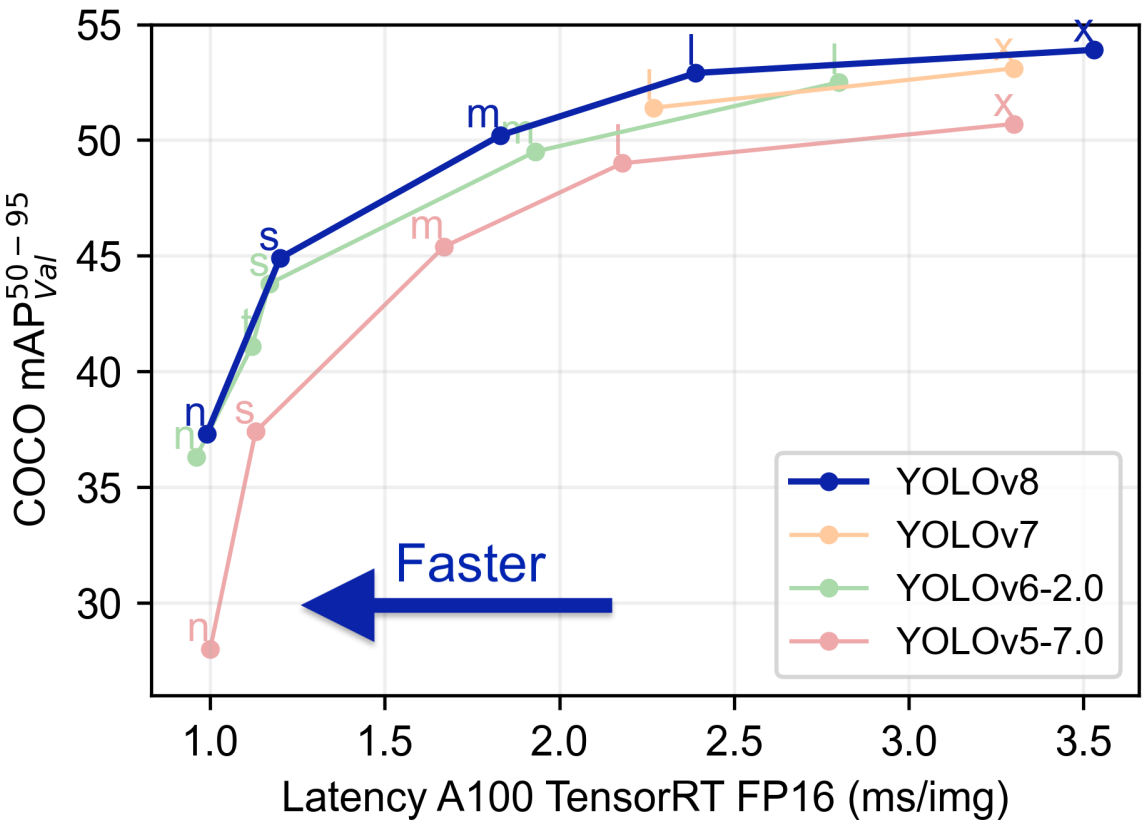
How Does YOLO Work?

Modern YOLO architectures leverage complicated data handling pipelines, model architectures, and training schemas.



YOLOv8: State-of-the-art YOLO Model

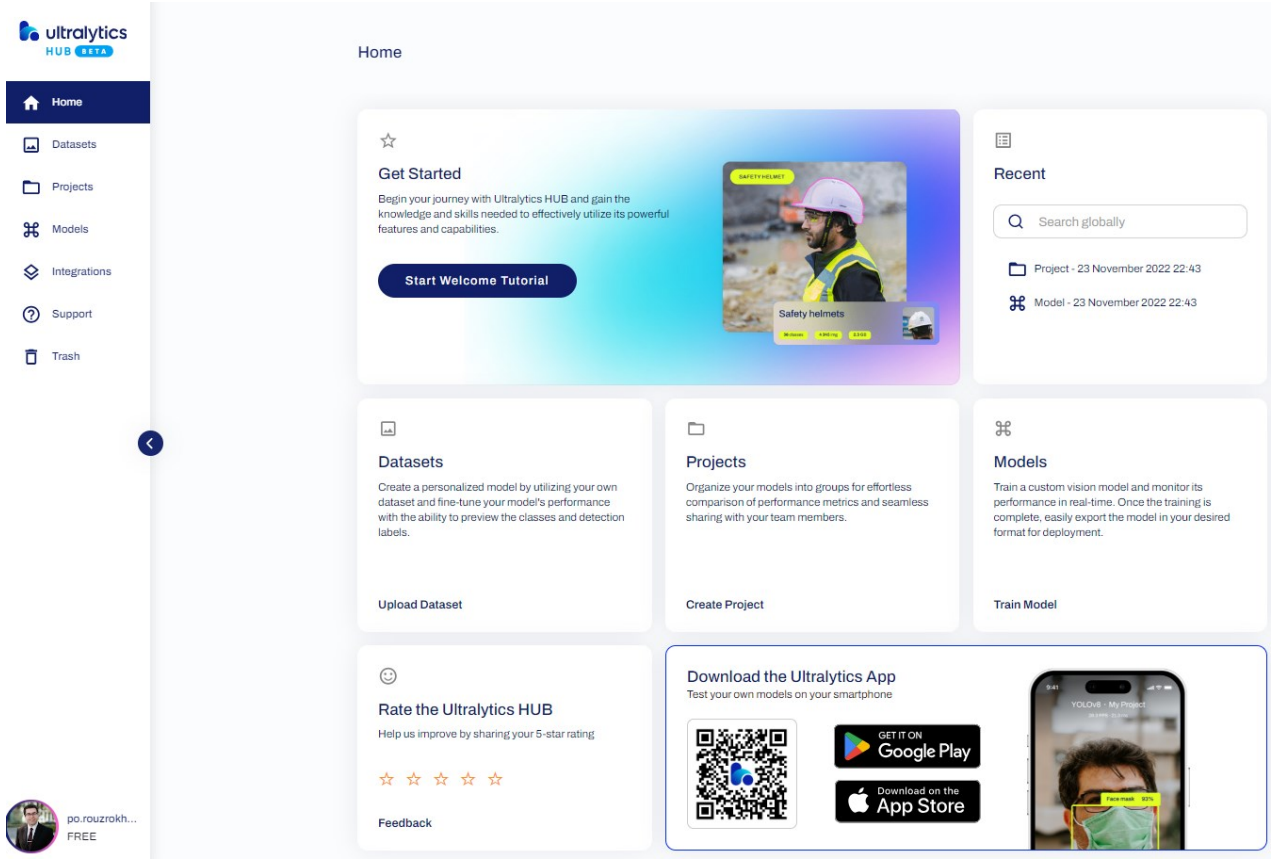




How to use a YOLO model without coding?

You can use **Ultralytics hub** to train (fine-tune) a custom YOLOv8 model on your own data:

https://hub.ultralytics.com/home



Advantages:

- No coding required.
- Easy use cases.

Disadvantages:

- Less flexibility in deployment
- Data privacy issues

How to use a YOLO model with coding?

This is what we will learn today! But before that…

Do you have any questions?

Thank you for your attention!
Please open the Google Colab notebook Prepared for this workshop!