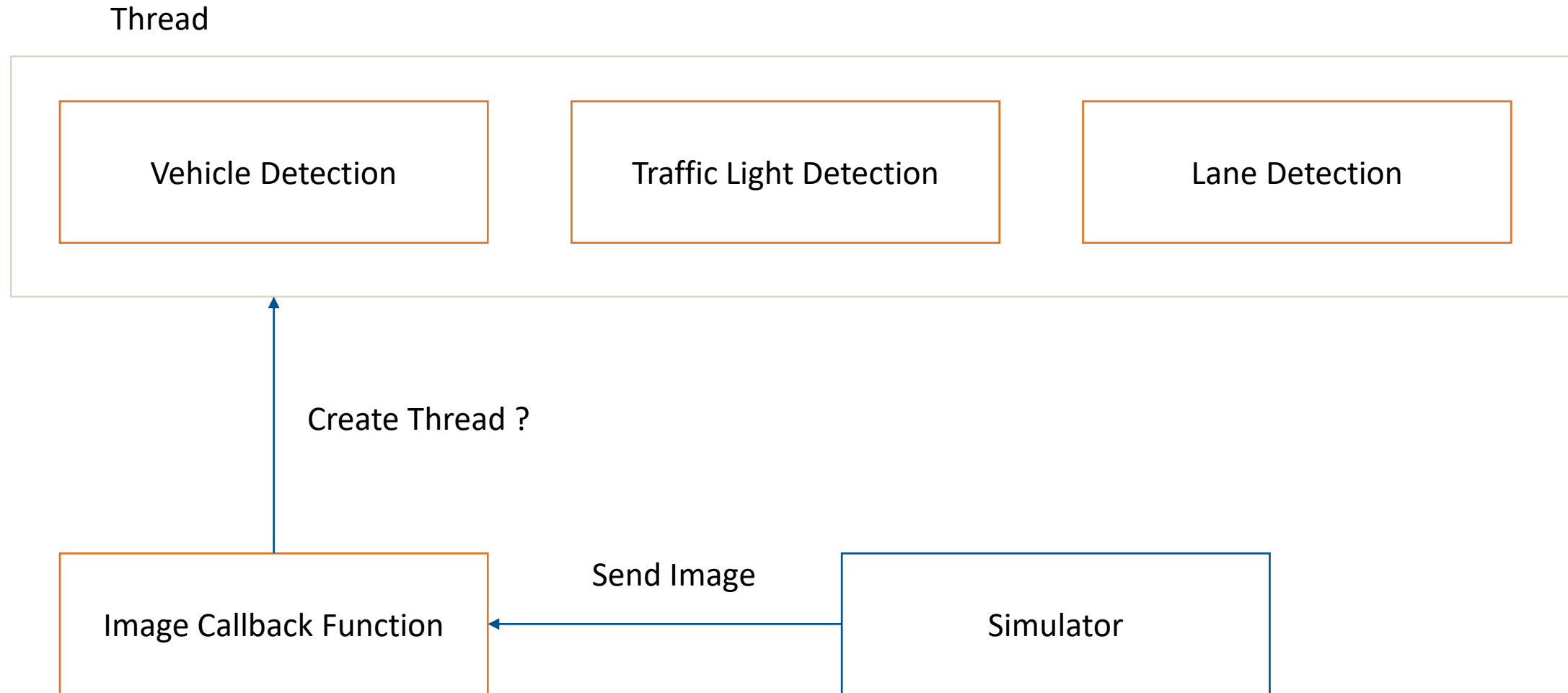
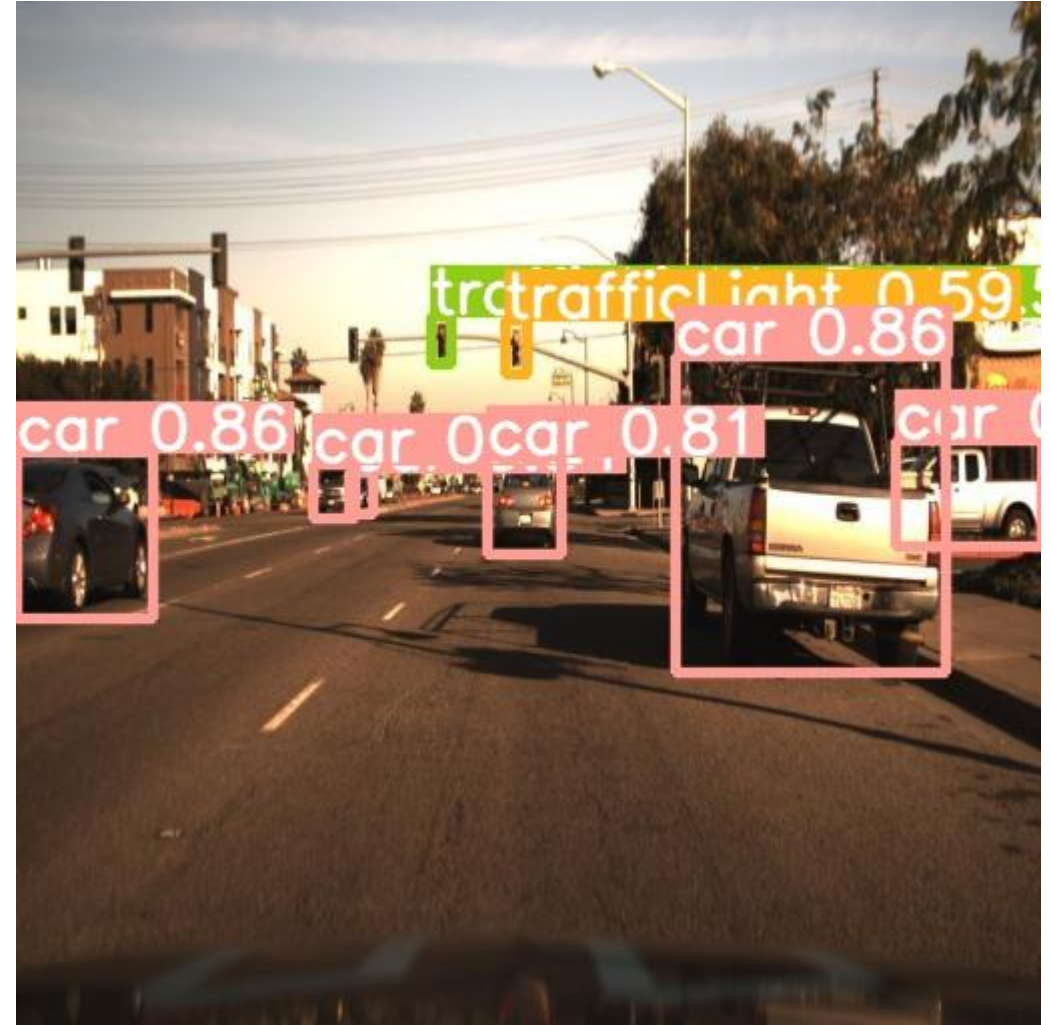


Simulation-Based Autonomous Driving in Crowded City



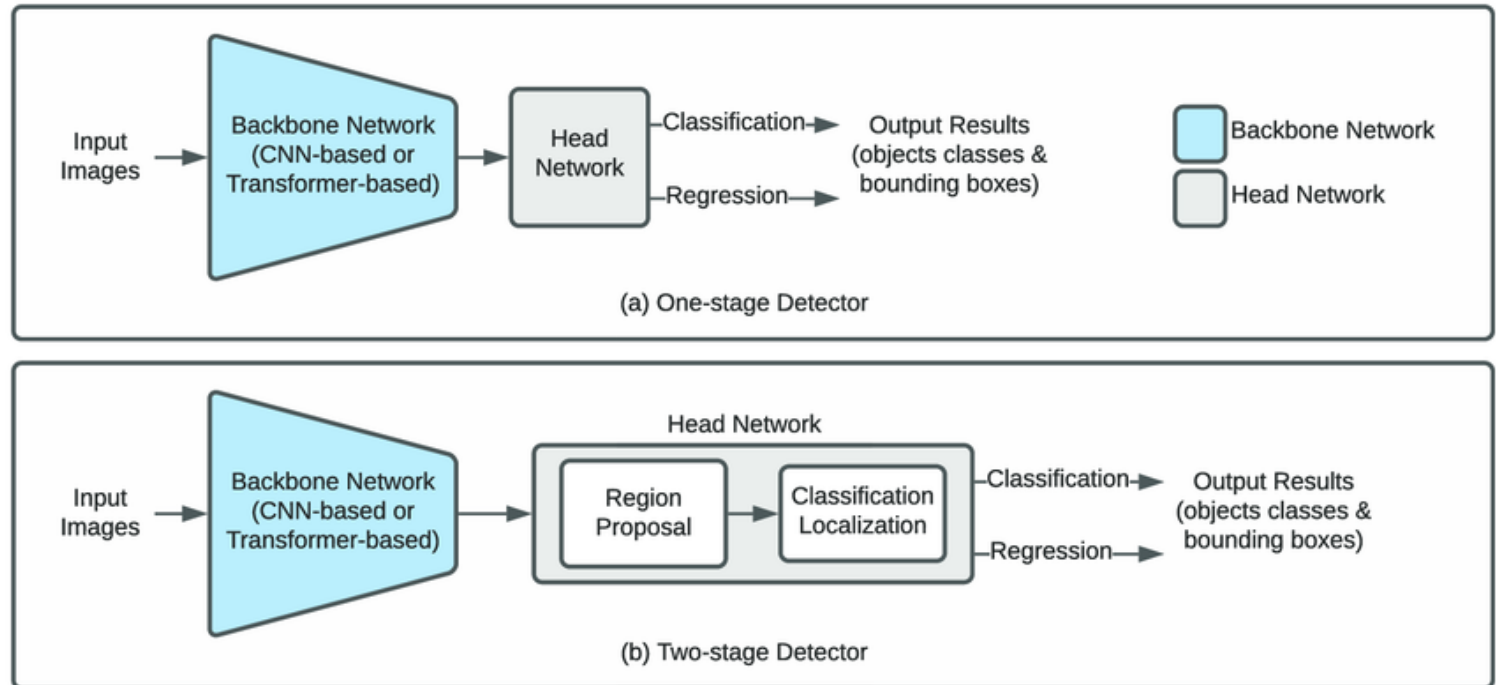
Object Detection

- Classes
 - Traffic light
 - Other Vehicles



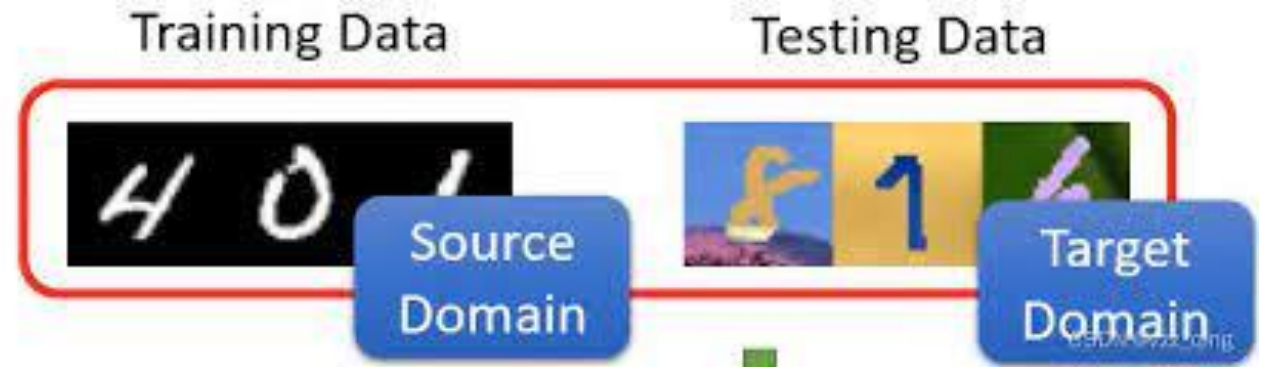
Choosing a Model

- R-CNN
 - Slow Inference - ~10 seconds
 - Two-stage Detector
- YOLOv8
 - One-Stage Detector
 - Wrong Traffic Light Detections

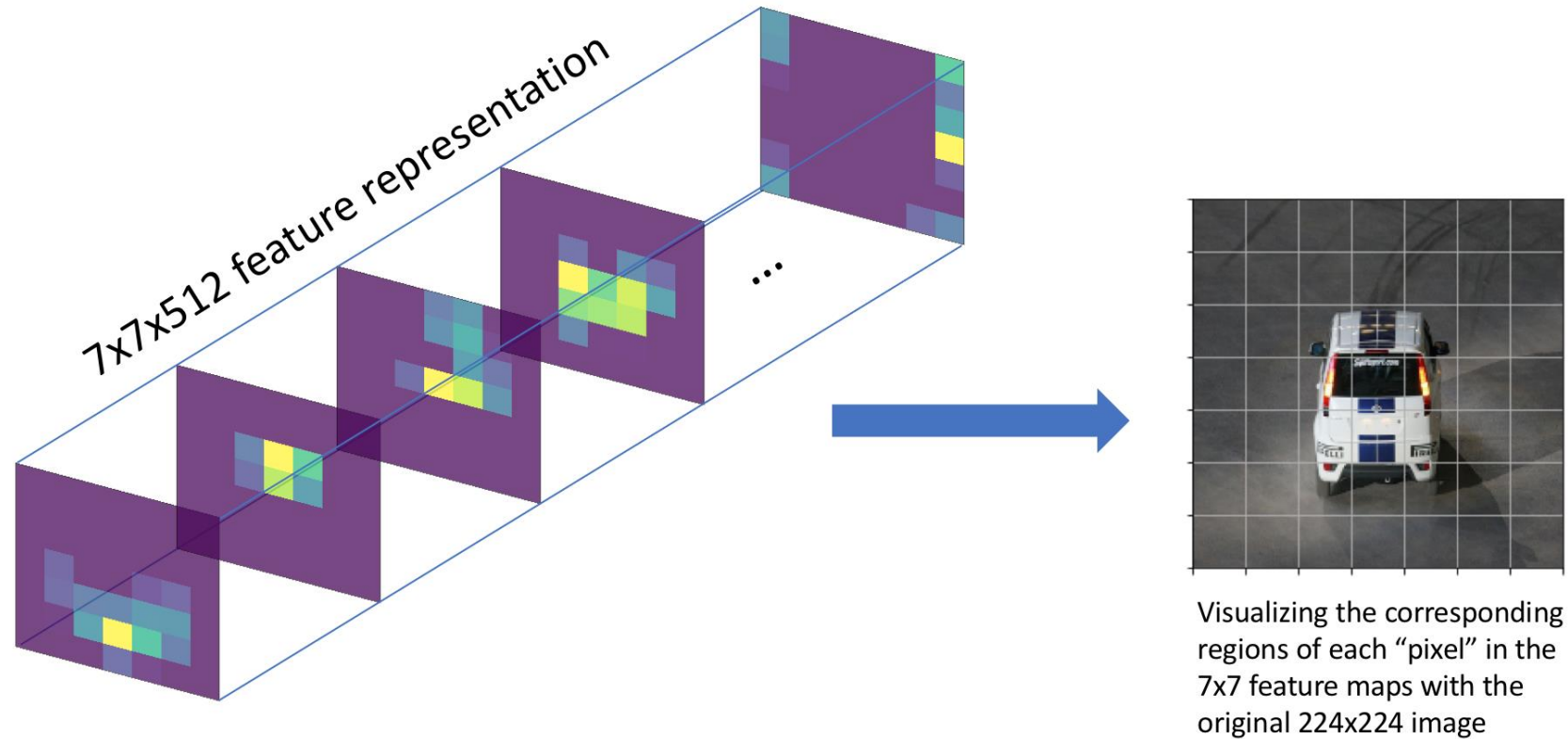


Fine Tuning

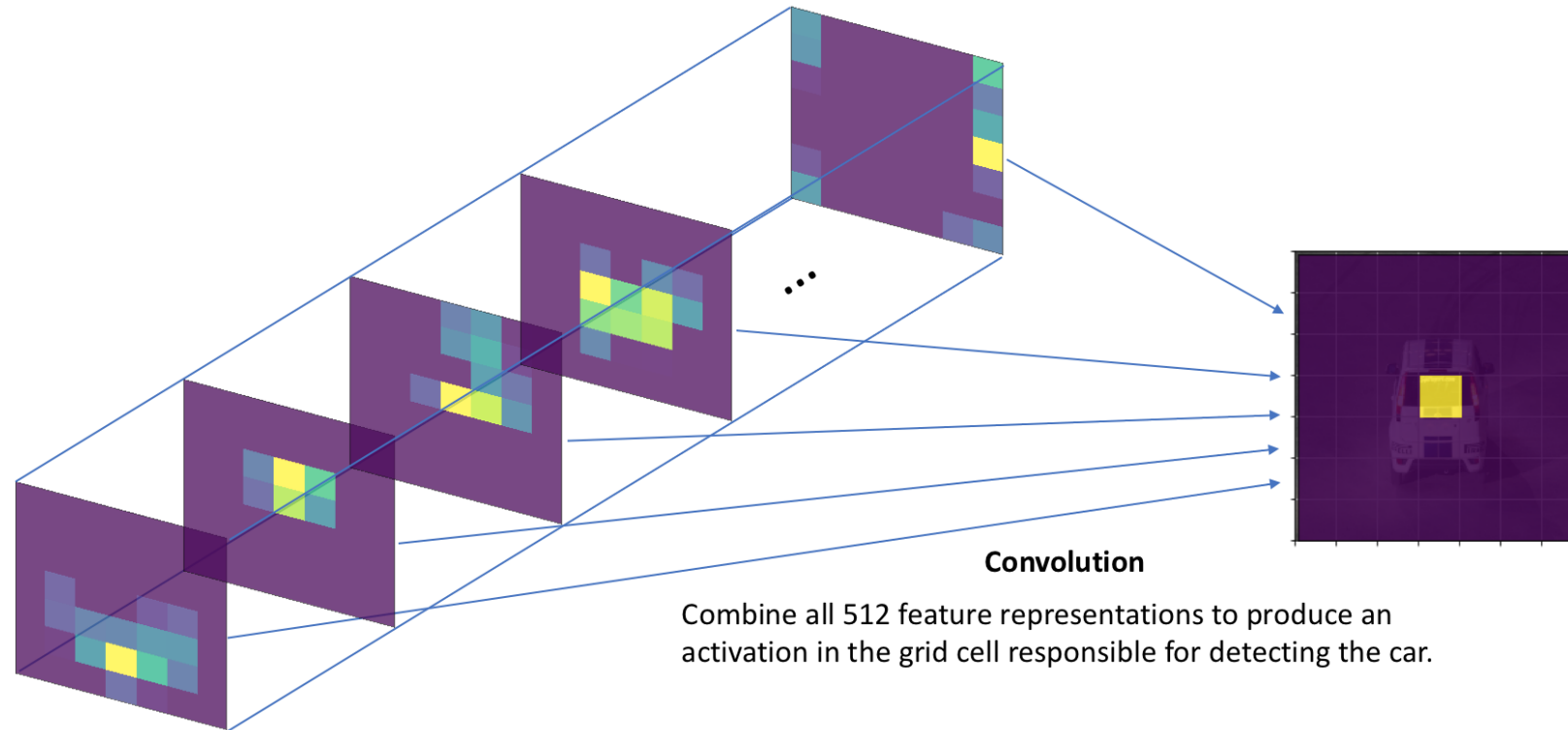
- To Fix Wrong Traffic Light Detections
- Domain Change
- Fine tuned on a dataset
- Removed some classes - bikes, ...



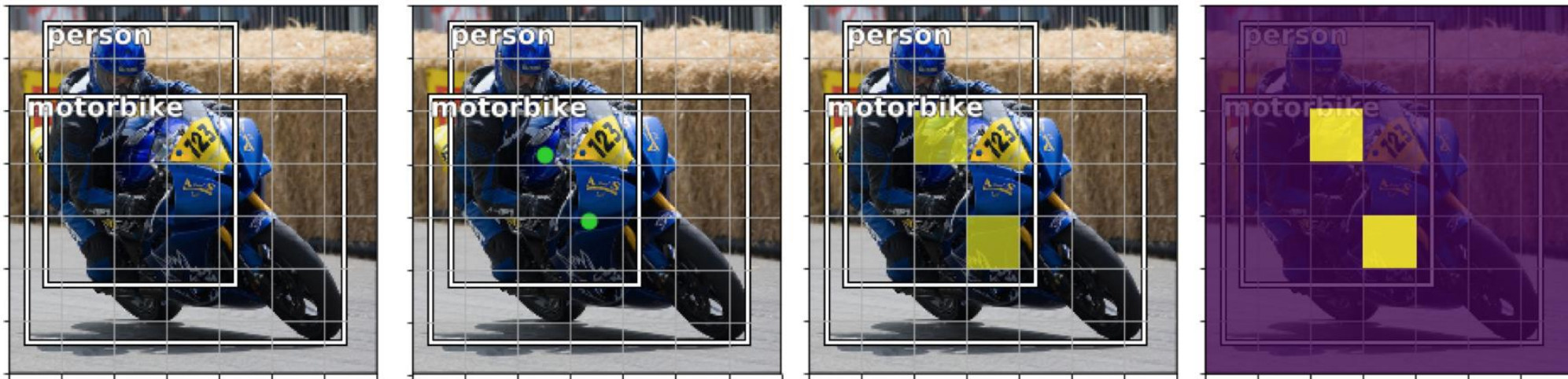
YOLO



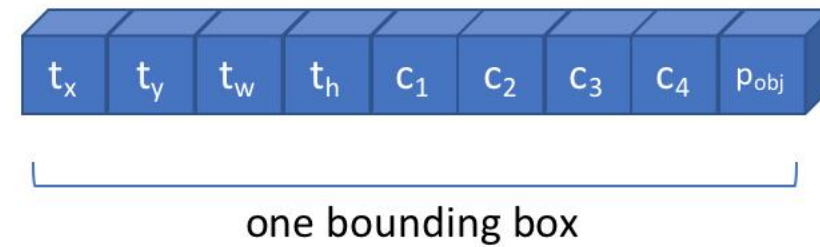
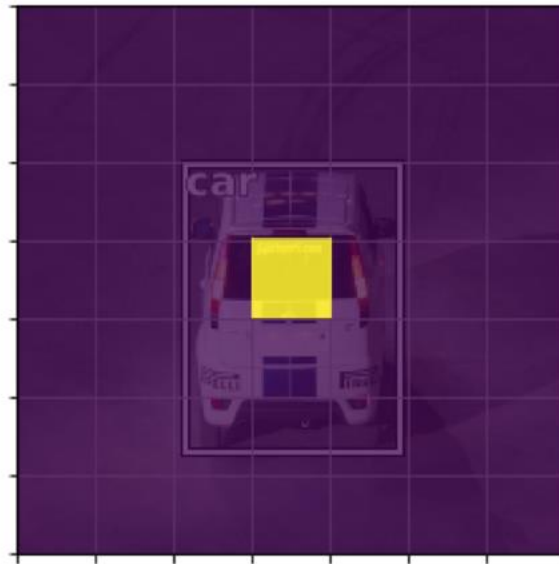
YOLO



YOLO

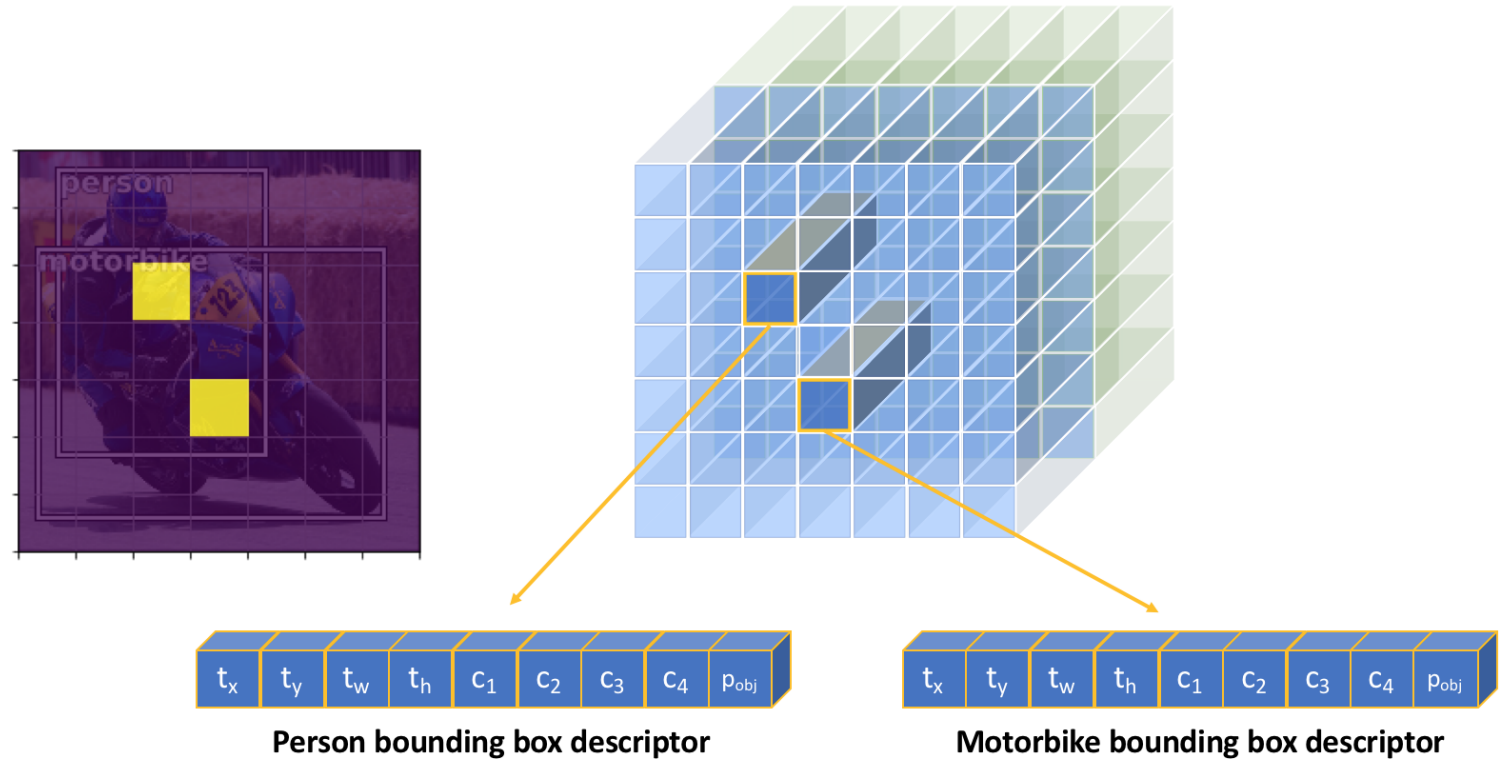


YOLO

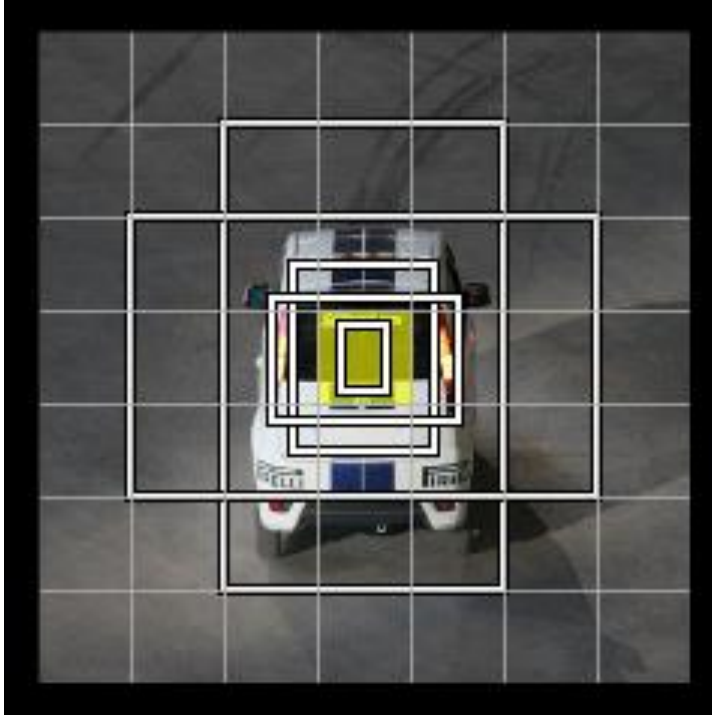


YOLO

A fixed number of multiple objects can be detected in parallel



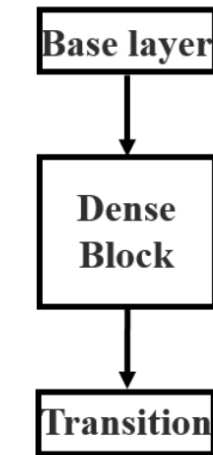
Anchors



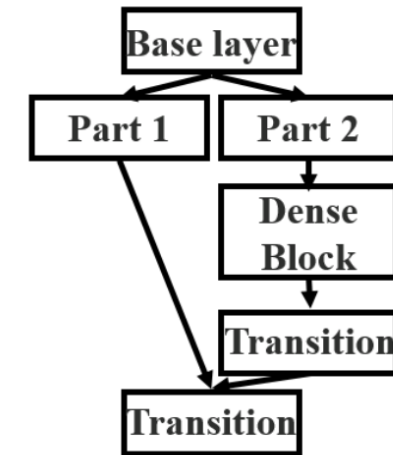
- YOLO uses anchors
- YOLOv8 does not
- Predicts directly the center of an object
- Produces fewer predictions
- NMS is faster

YOLO

- Cross Stage Partial Network
- Used with Dense Net, ResNet blocks
- FPN
- Path Aggregation
 - Skip connections

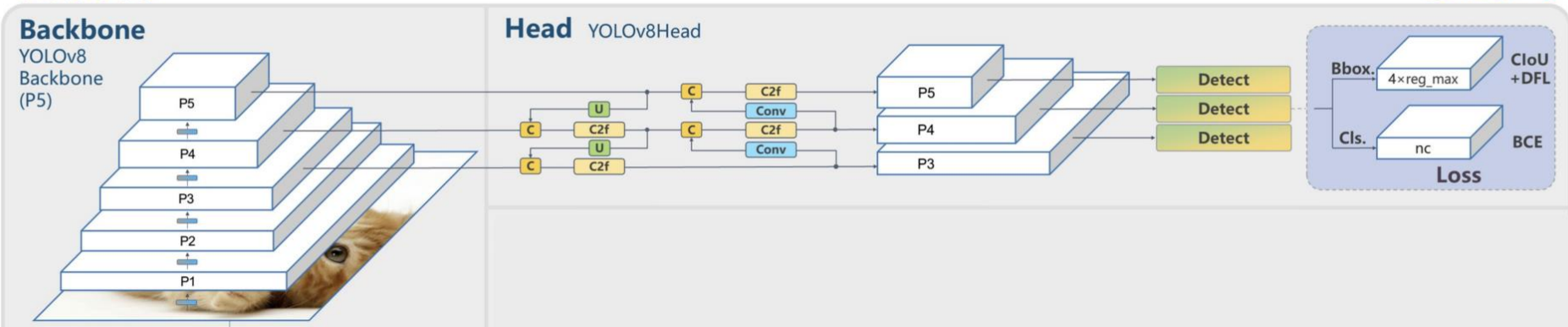


(a) DenseNet

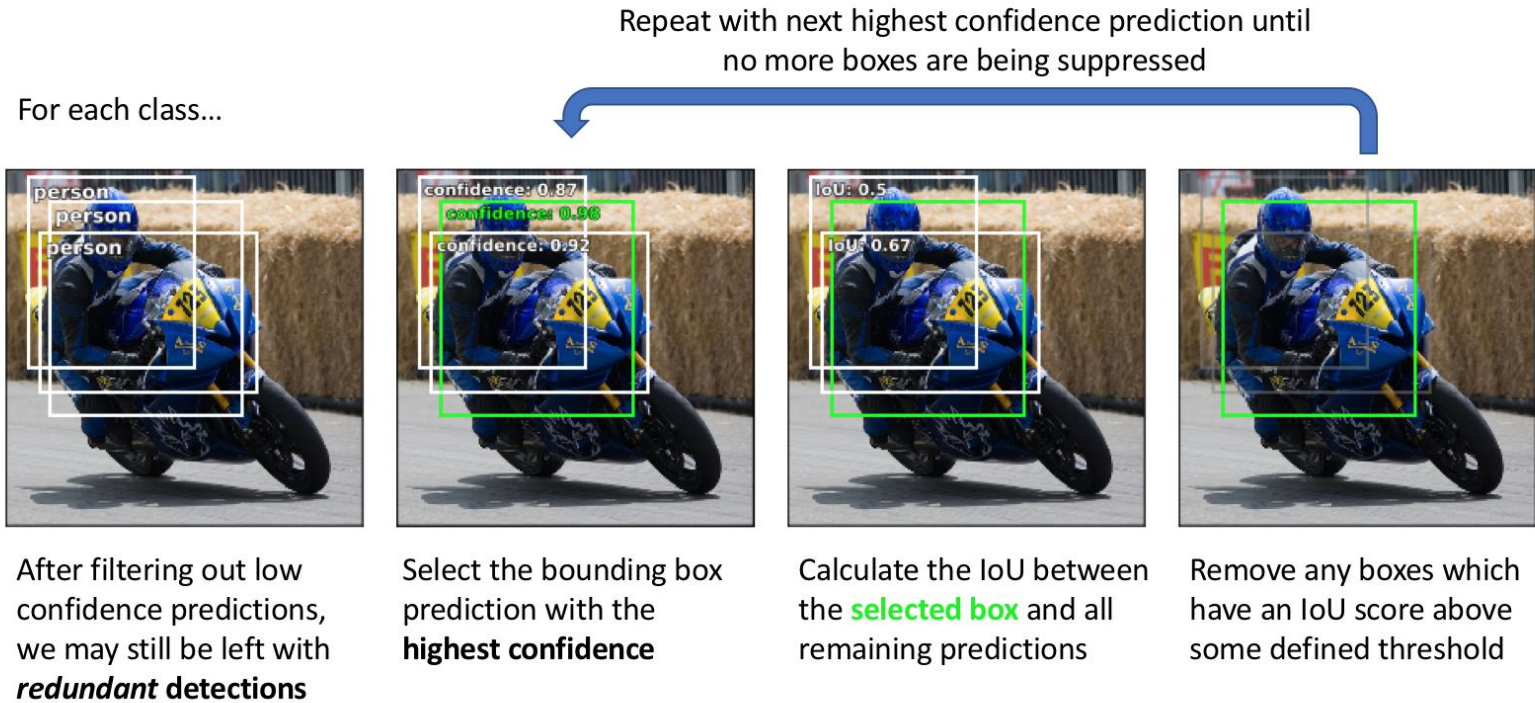


(b) CSPDenseNet

YOLOv8



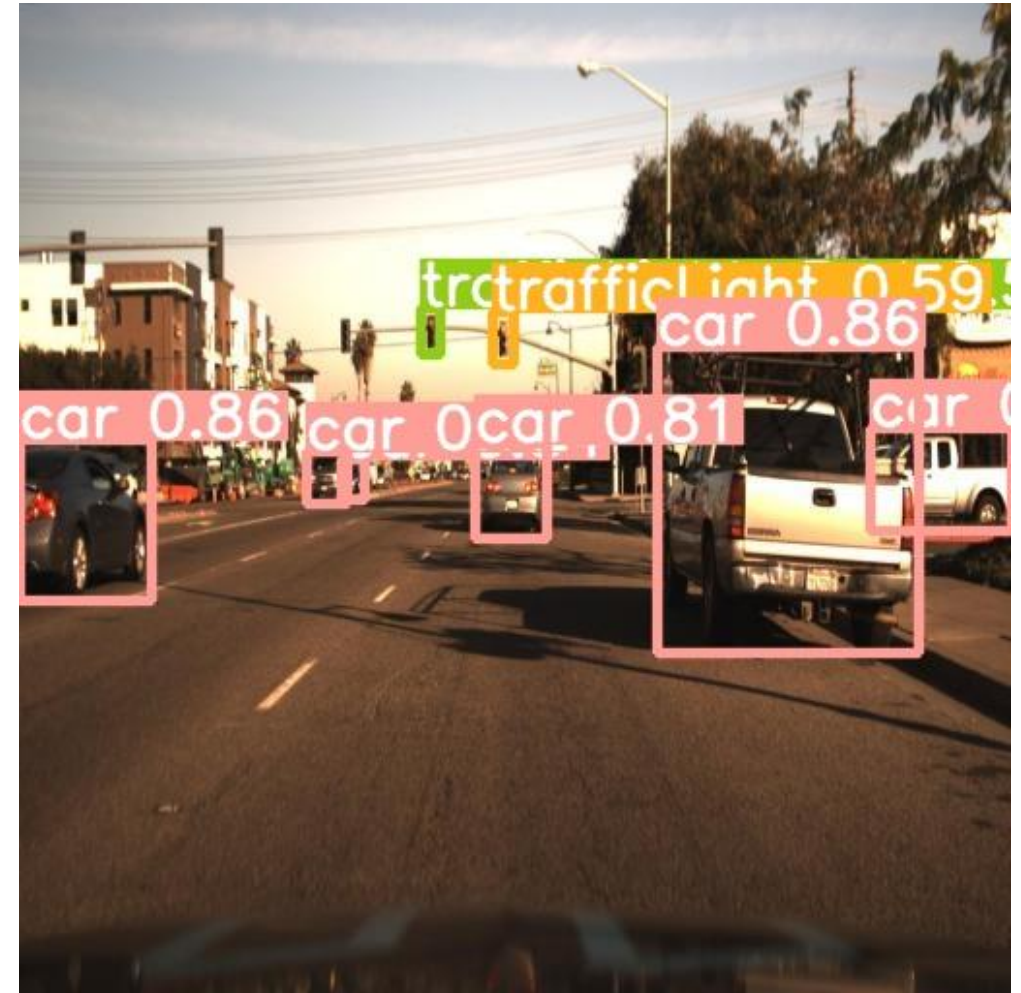
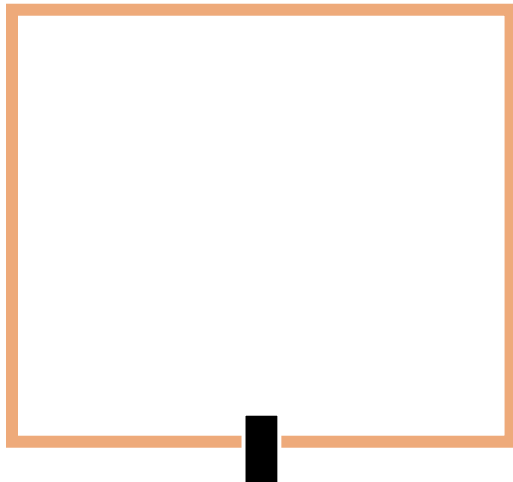
NMS



- YOLOv8 uses Soft NMS – reduces confidence instead of removing

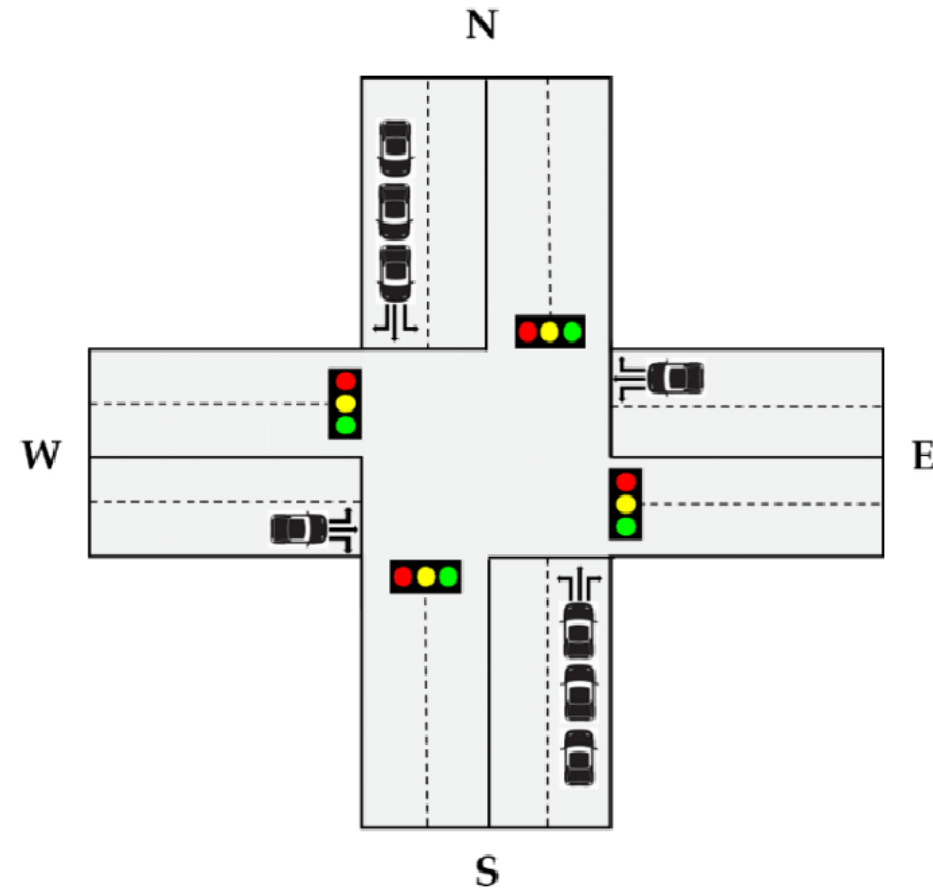
Decision to Brake

Car



Decision to Brake

- Multiple detections?



Intersection

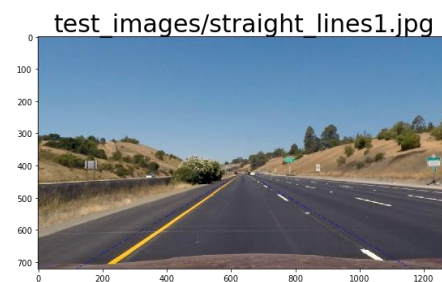
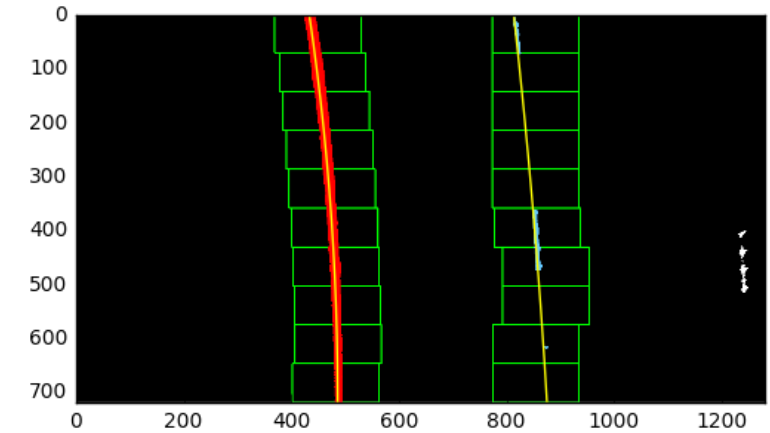
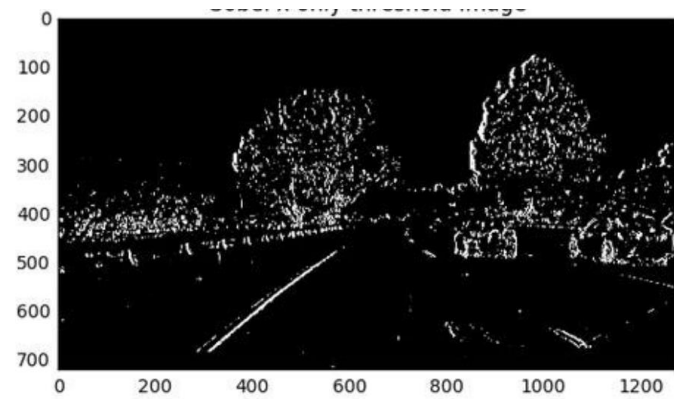
- Need to Detect Intersections
- Car stops at wrong place
- SegFormer model for Road Segmentation
 - Too Slow
 - Couldn't make it accurate enough

Lane Detection

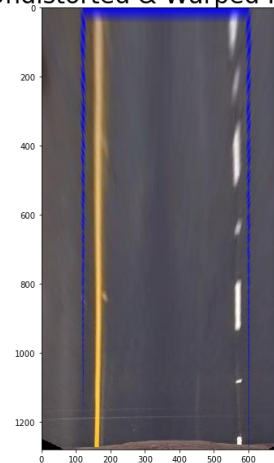
- CNN based
 - Problem with Low FPS
- Traditional Method



Lane Detection



Undistorted & Warped Image



FPS

- Reduced Speed Limit
- Use of probability
- Start one Thread per Decision
- Ignore new images in callback temporarily