

Parking Slot Detection for Autonomous Vehicles from Surround Camera Images

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Initial Plan

- The team initially aimed to detect the bounding boxes of parking spots.
- The idea was to rectify the birdseye camera images and then implement a groundplane projection to detect straight bounding boxes of parking spots using a custom mobile object detection deep learning model.

Initial Plan

- This plan had issues regarding the data preprocessing due to the nature of birdseye camera images.
- We later found that this was an infeasible approach for us and pivoted to object detection in order to determine the location of cars with regard to the vehicle coordinates

Algorithms

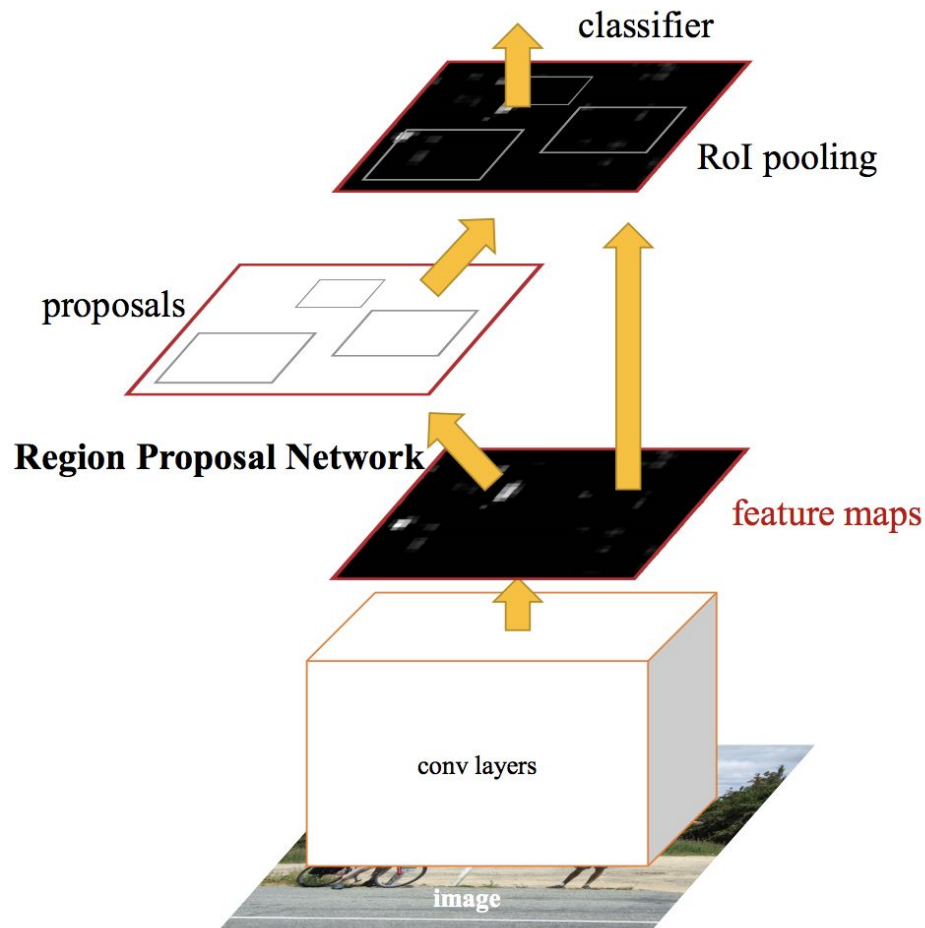
Object detection

Two-stage:

-R-CNN, Fast R-CNN, Faster R-CNN.

One-stage:

-YOLO, SSD.



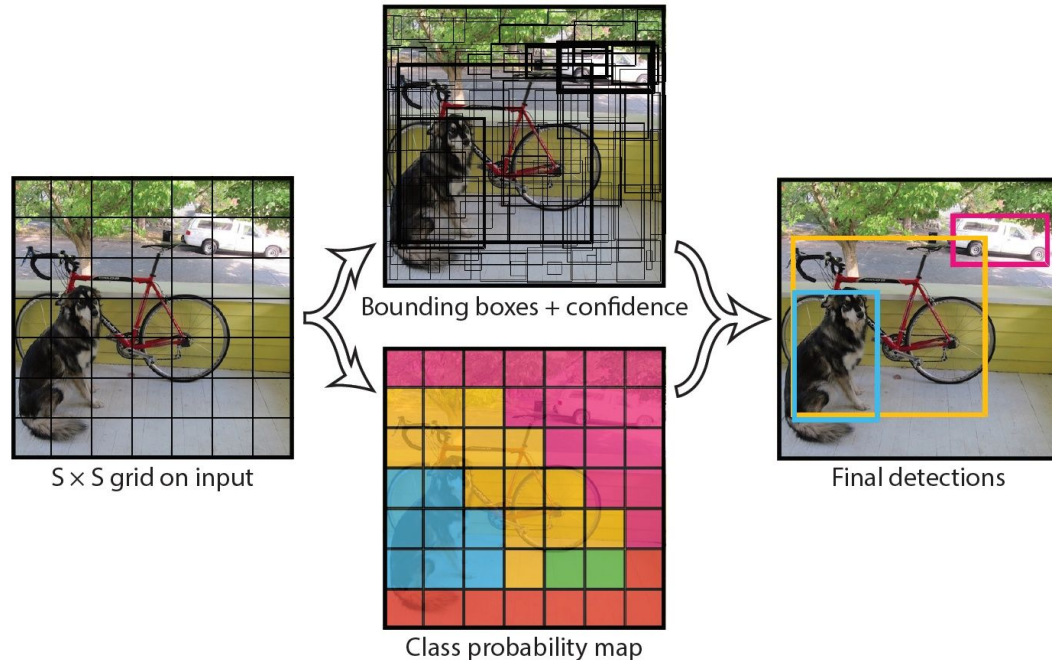
YOLOv3: You only look once

YOLO is a state-of-the-art, real-time object detection system and we use the latest variant of this popular object detection algorithm - YOLOv3:

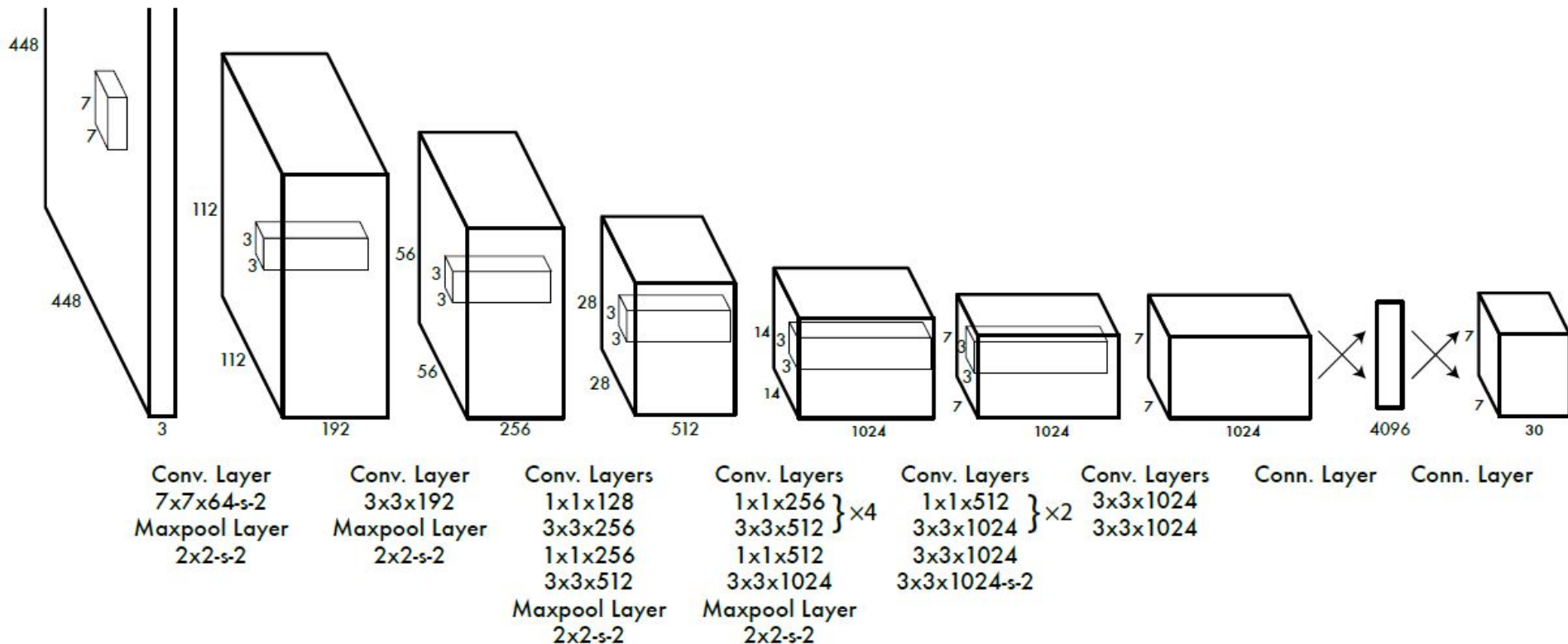
- Its predictions are informed by global context in the image.

- It makes predictions with a single network evaluation.

- Extremely fast, more than 1000x faster than R-CNN and 100x faster than Fast R-CNN.



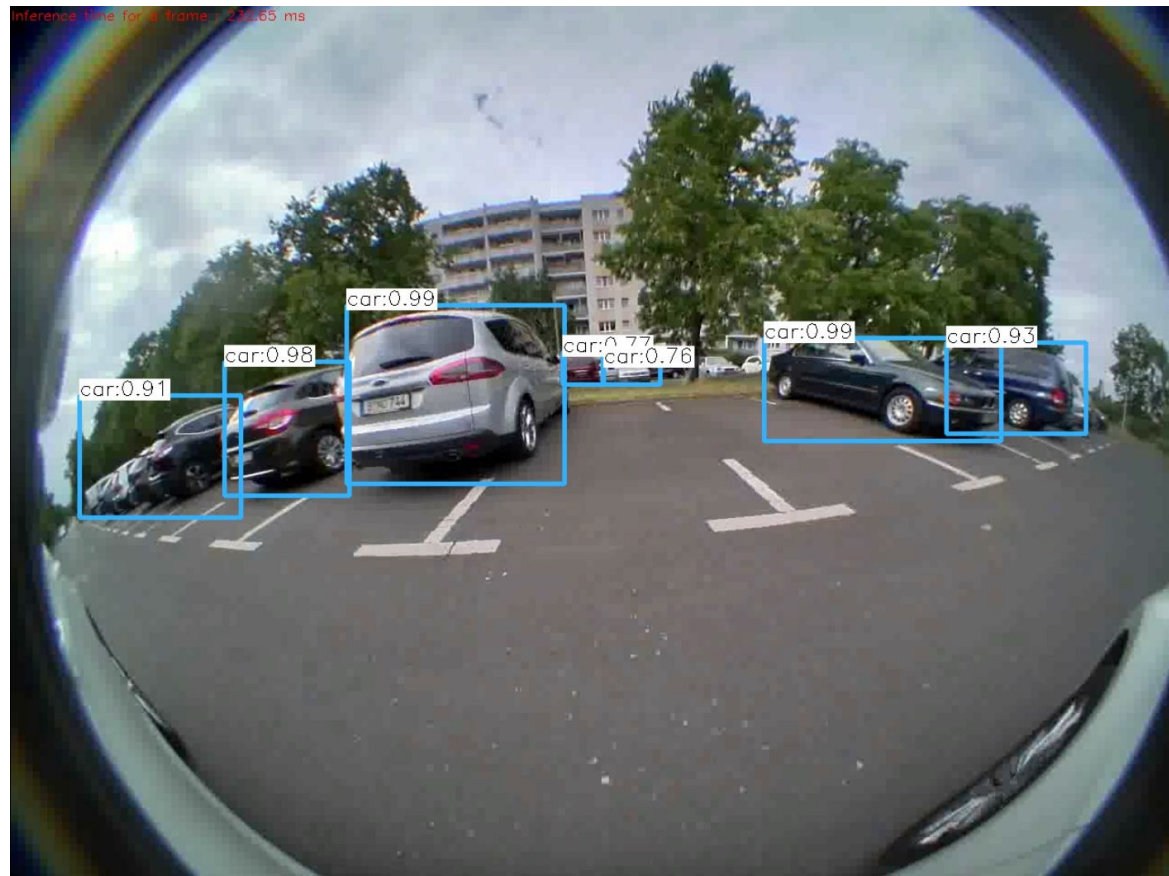
YOLO Architecture (Source: YOLOv1 paper)



YOLOv3: You only look once

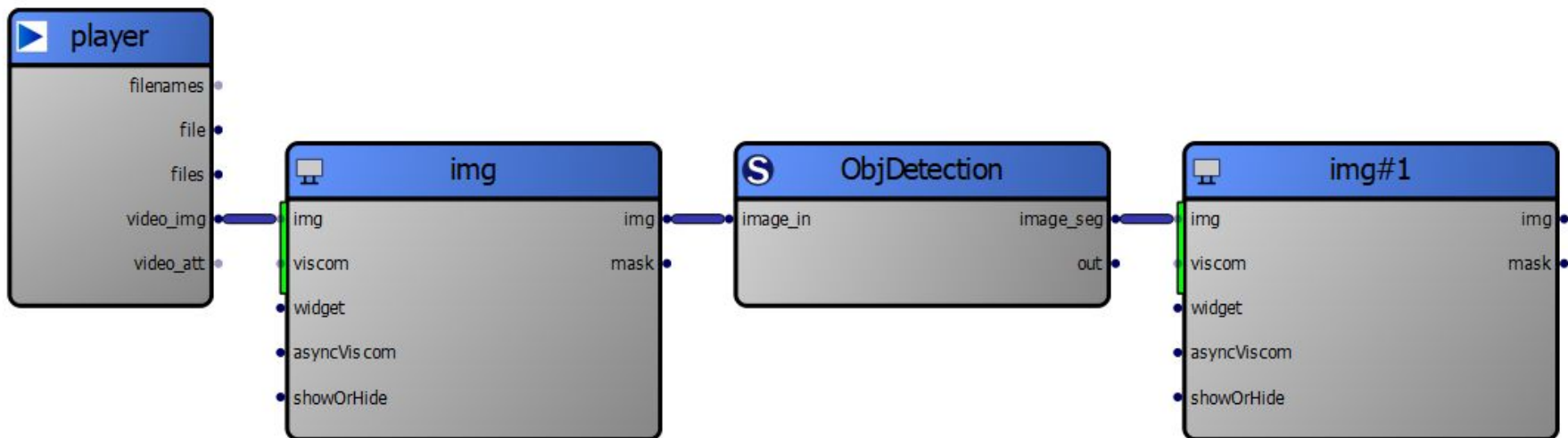
- The model was trained on COCO dataset by Darknet: an open source neural network framework written in C and CUDA.
- We can easily use `opencv_dnn` module to load YOLOv3 pre-trained models in our cpp code.

YOLOv3: You only look once



Architecture

The overall system pipeline:



Contribution to Fusion Group

Jiaqiao Peng: The object detection part.

Rudhi: Integration in Cassandra, Development of System Architecture.

Results

- The bounding boxes with the cars detected and their timestamps



DEMO

YOLOv3: You only look once

Reference:

1. J. Redmon, S. Divvala, R. Girshick, and A. Farhadi. You only look once: Unified, real-time object detection. arXiv preprint arXiv:1506.02640, 2015.
2. J. Redmon and A. Farhadi. Yolo9000: Better, faster, stronger. In Computer Vision and Pattern Recognition (CVPR), 2017 IEEE Conference on, pages 6517–6525. IEEE, 2017.
3. J. Redmon and A. Farhadi. YOLOv3: An incremental improvement. arXiv preprint arXiv:1804.02767, 2018.
4. J. Redmon. Darknet: Open source neural networks in c. <http://pjreddie.com/darknet/>, 2013–2016.

Thanks for listening!