Mobileye – The sensing challenge

Preview

- How difficult is it to train a new DNN classifier?

- Pretty easy:
  - *import tensorflow as tf*
  - *myNet = tf.resnet() …*

TensorFlow ™

  - Train it on ImageNet where we have for example:

IMAGENET

- 1,000 object classes (categories).
- Images:
  - 1.2 M train
  - 100k test.

Preview

- This looks pretty promising but …
  How many of you will place their life on the classifier?

- Training a classifiers to work on **real world data**, in a **real-time** environment is one of our main challenges…

Mobileye – A Short Summary

- Mobileye was launched in 1999
- First products were based on single-lensed camera (mono-camera) to enable ADAS - Advanced Driver Assist Systems. (inspired by human vision).
- Mobileye's vision safety technology for ADAS is deployed on over 15 million vehicles with more than 25 automaker partners including some of the world's largest.
- We used our vast experience in ADAS technologies and product like Automatic Emergency Braking (AEB) and Lane Keeping Assistance (LKA), as building blocks for higher level autonomous vehicles (AV) technology .

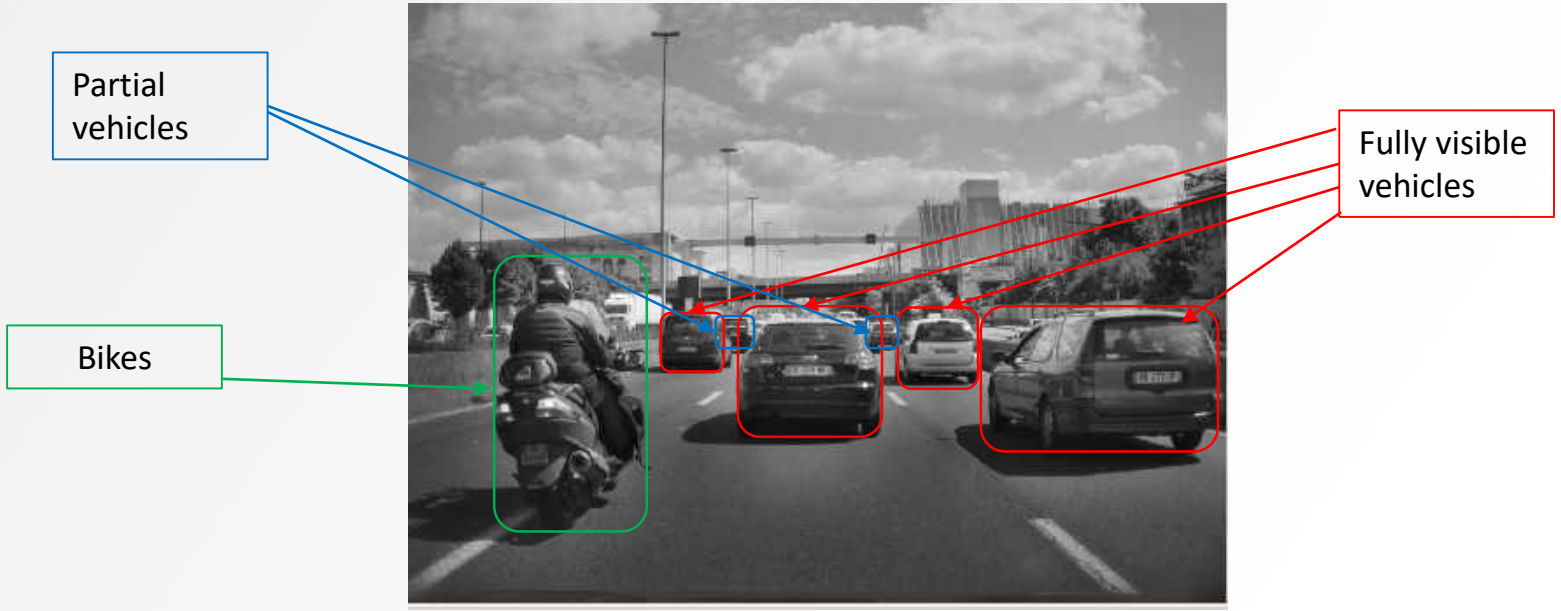
Three Pillars of Autonomous Driving

- **Sensing:** interpret the scene with 360 awareness and produce an “Environmental Model”.
- **Mapping:** either as part of sensing or a layer redundant to sensing. Mapping requires some sort of connectivity for the purpose of updates.
- **Driving Policy (Planning):** learn to negotiate a driving path in the presence of other moving agents

Vehicles Detection

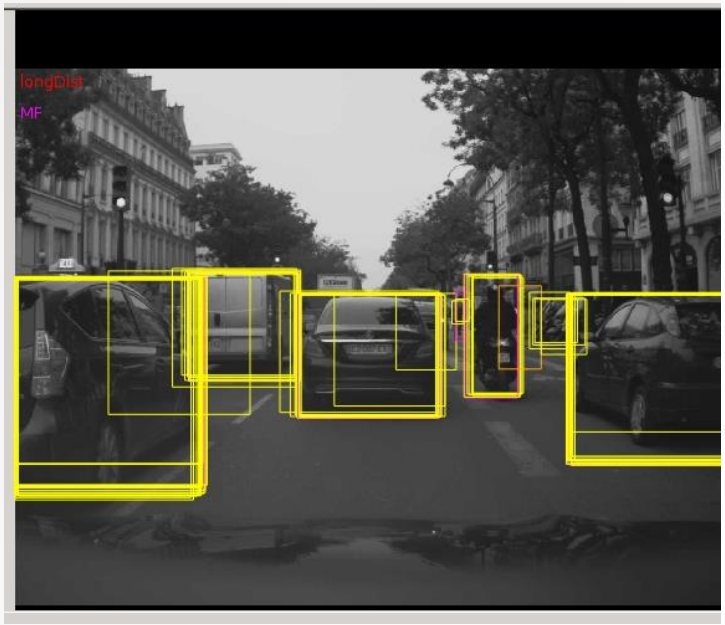
- How would you start detecting the vehicles in this scene:

Vehicles Detection

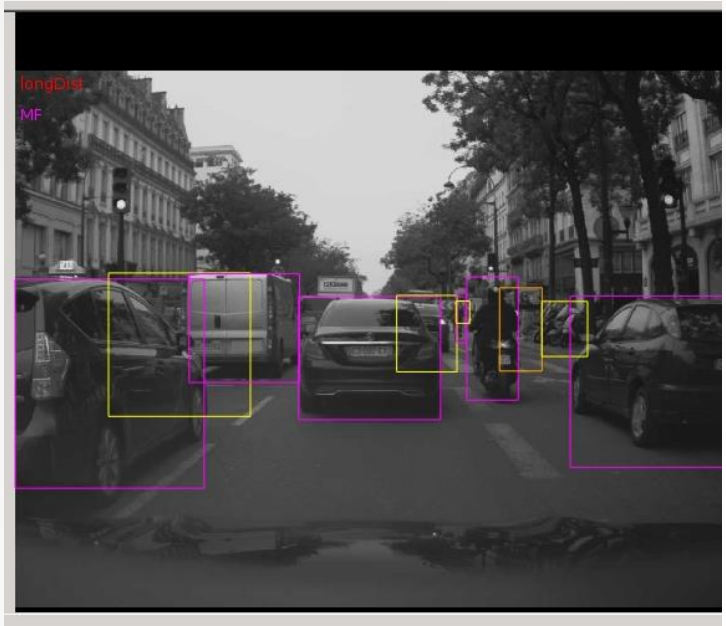


Vehicles Detection – trucks…

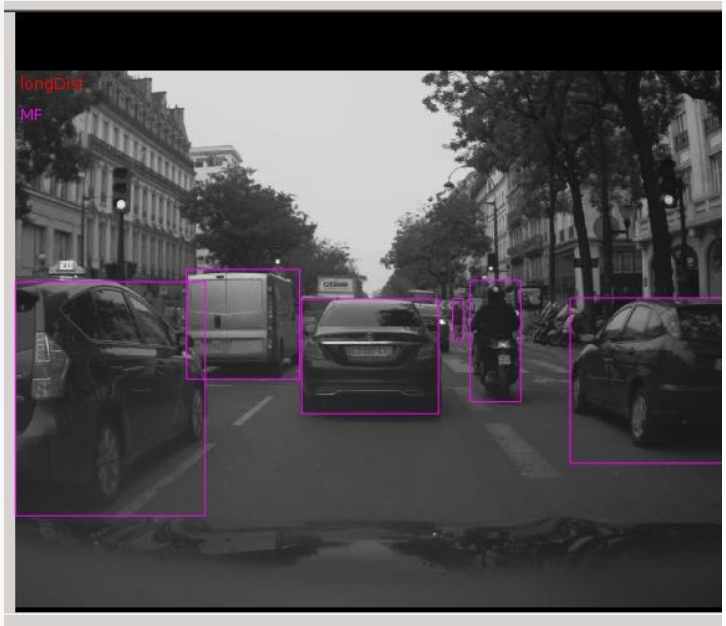
Vehicles initial Attention results



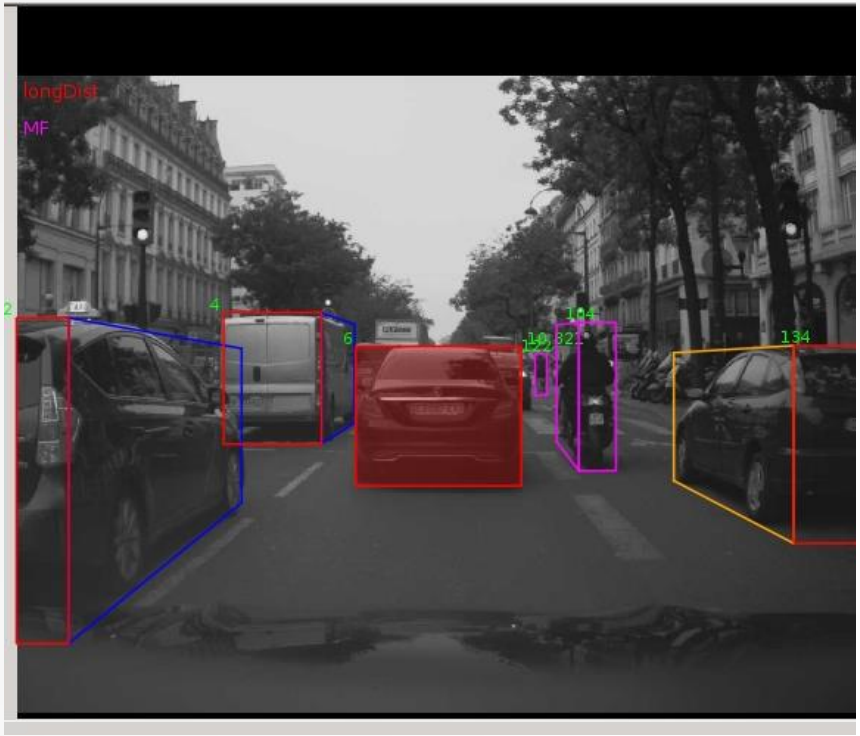
Clustering



Alignment + Filtering



Approval + Orientation



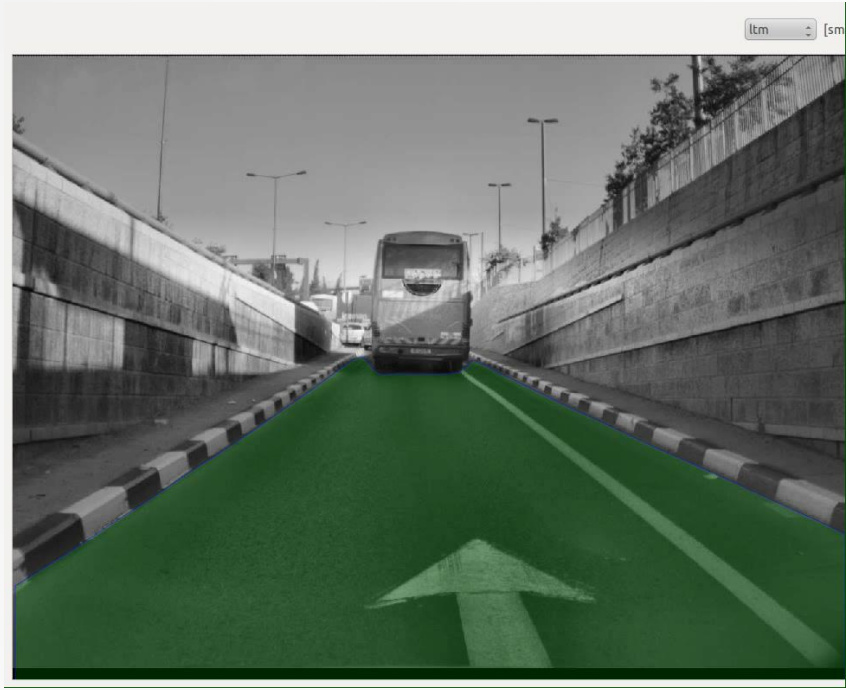
Weird Looking Vehicles

Wheels Detection

Wheels Detection won't always help…

Detecting other objects

Free Space



The Sensing Challenge

Perception of a comprehensive Environmental Model breaks down into four main challenges:

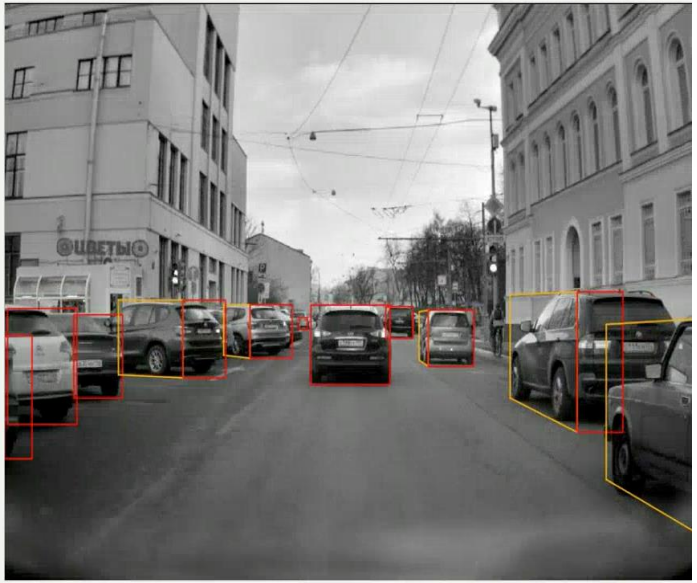
- **Free-space**: determining the drivable area and its delimiters
- **Driving Paths**: the geometry of the routes within the drivable area
- **Moving Objects:** all road users within the drivable area or path
- **Scene Semantics:** the vast vocabulary of visual cues (explicit and implicit) such as traffic lights and their color, traffic signs, turn indicators, pedestrian gaze direction, on-road markings, etc.

Other Semantics detection

- Following the AV new requirements:
  - Blinking/Braking/Hazard signals
  - Police officer gestures.
  - Emergency Vehicles .
  - Special scenes (car accident, vehicles on fire).

How to trap an Autonomous Vehicle…

Vehicles Detection Examples

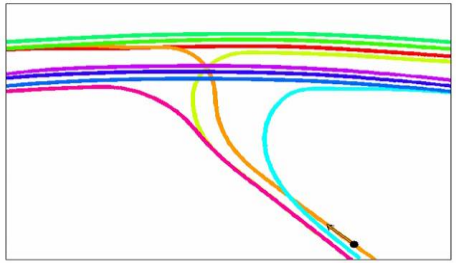


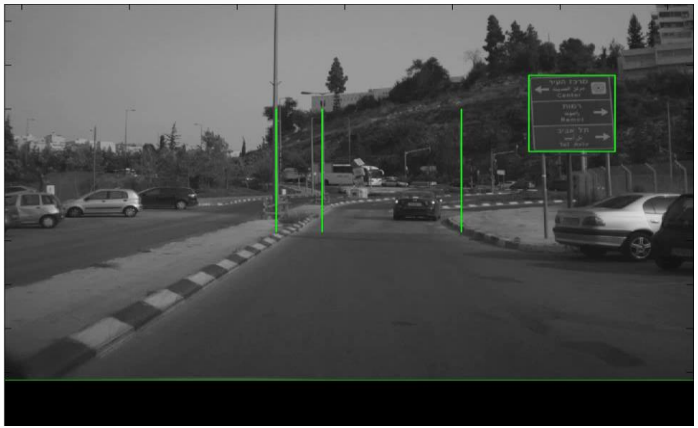
The Mapping Challenge

Road Experience Management™ (REM™)

Mobileye's Road Experience Management (REM™) is an end-to-end mapping and localization engine for full autonomy. The solution is comprised of three layers:

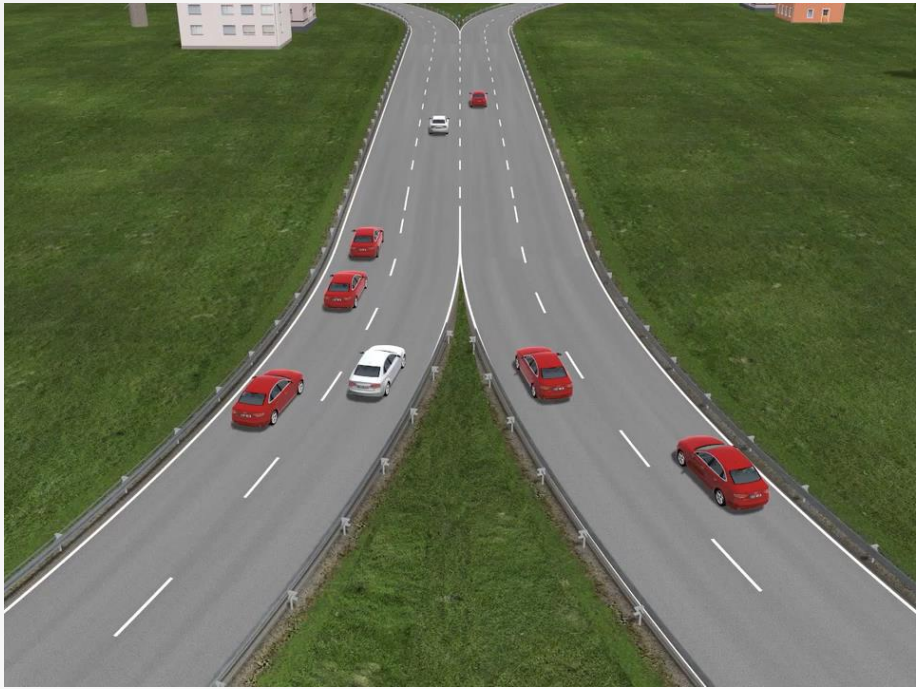
- harvesting agents (any camera-equipped vehicle)
- map aggregating server (cloud)
- map-consuming agents (autonomous vehicle).





Driving Policy

- Where sensing detects the **present**, driving policy plans for the **future**



Driving Policy

The End

But not for you,
We are hiring …