Running Lights and Cornering New Features Proposals

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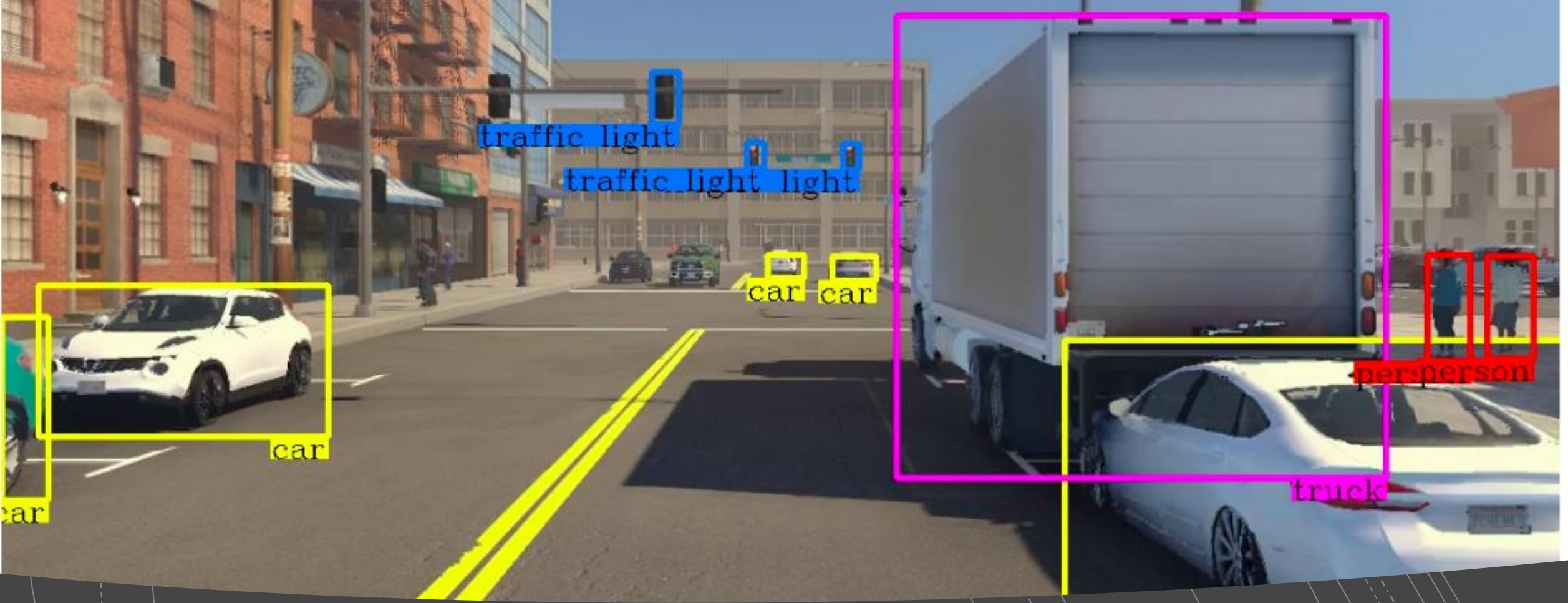


Typical Traffic Light Image

- Car, Traffic Light, Truck, Pedestrian, etc.

Outline

How can we incorporate new features into our Motor Score?

- Image detection
- Object Detection Inference
- New Features
  - Running lights
  - Cornering

Object Detection

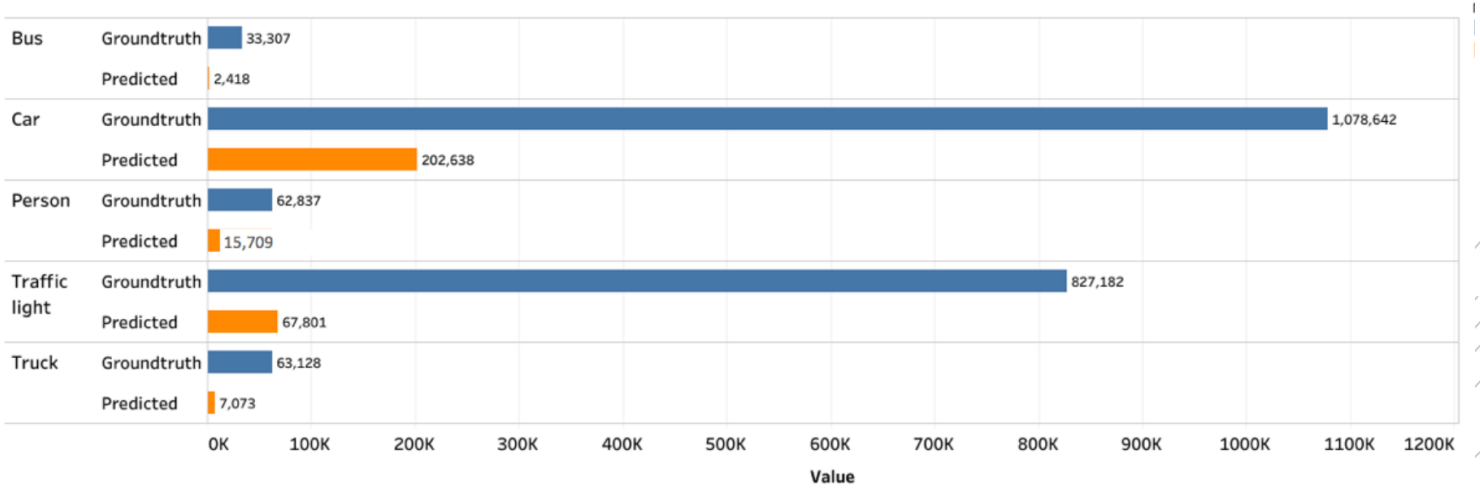
- What kinds of objects will be present in a typical traffic image including the traffic lights?

Class	Correct predictions (Count)	Overall accuracy (%)	Accuracy by class (%)
Car	172,583	8	16
Truck	2,525	1	4
Bus	2,332	1	7
Traffic Light	33,087	2	4
Pedestrian	15,709	7	25

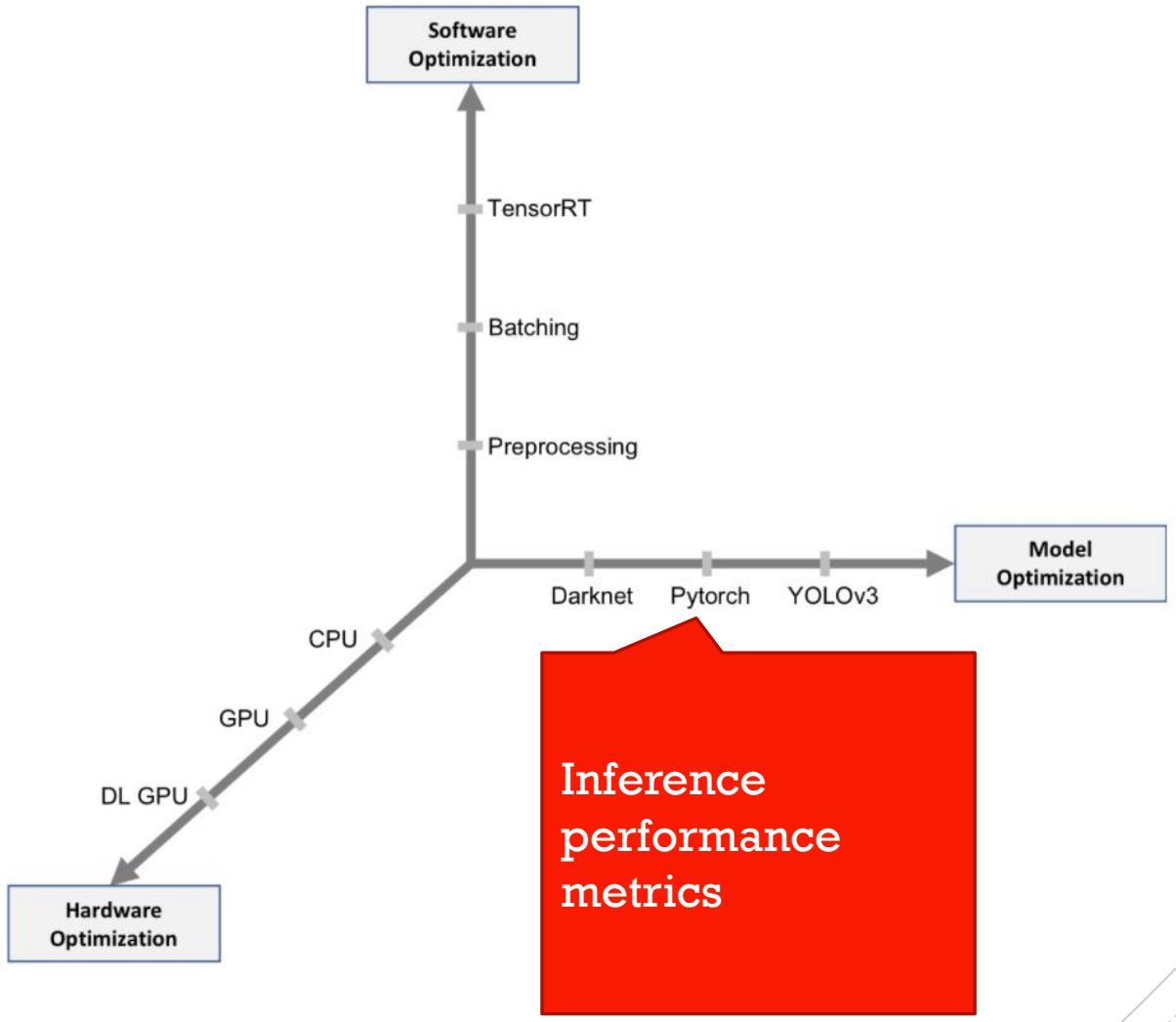
Table 2. Object detection accuracy.

Ground Truth vs Predicted

- The gap between the Ground Truth(the fact) and prediction



Pipeline


Software Optimization
TensorRT
Batching
Preprocessing
Model Optimization
Darknet
Pytorch
YOLOv3
CPU
GPU
DL GPU
Hardware Optimization
Inference performance metrics

Inference Performance Metrics

- Scale Variation
- Distortion
- Occlusion
- Illumination conditions
- Background
- Inter-class variability (Car, bus, and truck vehicle types)
- Intra-class variability (Green Car, Orange Car, Yellow Car)

Possible features affecting motor scores from running light perspective

New potential features which can impact motor score

- Speed - Effects of speed on crashes and crash severity
- Speed limitation - the maximum speed limit of the road
- Presence of alcohol, medicinal, or recreational drugs
- Color blindness
- Poor eyesight of road users
- Driving in darkness
- Running a red light at an intersection (counts for a third of crash fatalities)
- Mounted overhead (How the traffic light is mounted)
- Ego Driver going forward (no turns)
- Driver fatigue, stress and emergencies
- Driving too fast and unable to stop the vehicle
- Background (Localization)
- Scale

Effects of illumination

- The variations in illumination cause changes on the pixel level. The dataset include the traffic light during the day, evening, and in the night-time and they are essential to create a holistic view of driving conditions.


Figure 22. Daytime.


Figure 23: Evening twilight.

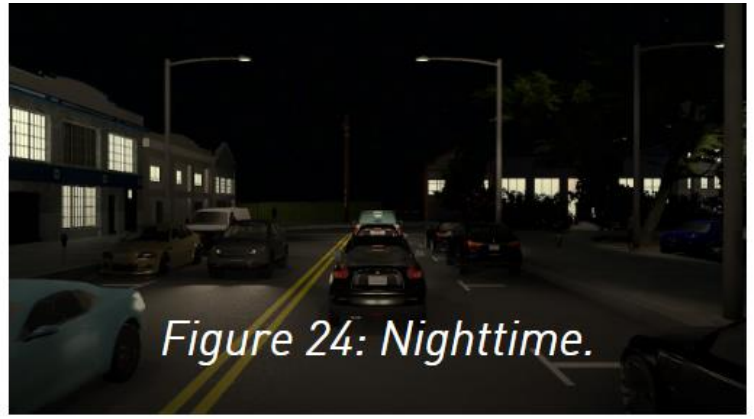


Figure 24: Nighttime.

Scale Variations

- Include the image of different object sizes to see if the model can detect and recognize close objects and far-away objects.

Figure 13. Car in large scale.


Figure 14: Car in medium scale.


Figure 15: Car in small scale.

Background

- The object of interest and the surrounding environment can blur, overlap, or merge and cause pixel interference, This will make it difficult for the model to successfully detect the object of interest.

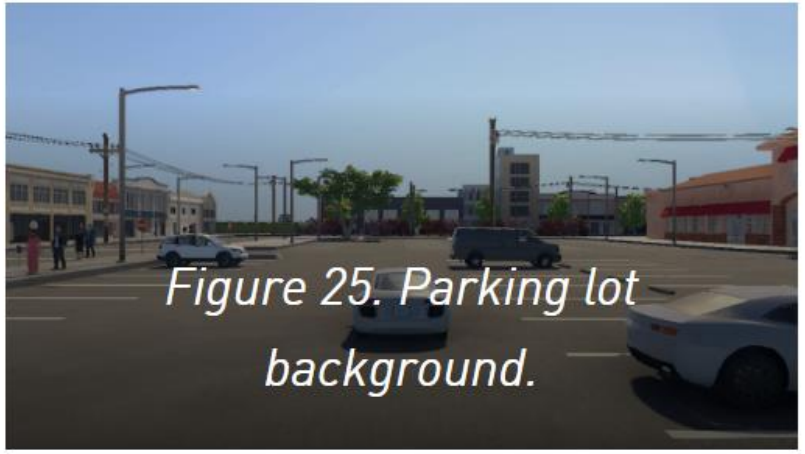


Figure 25. Parking lot background.

Figure 26: Highway background.

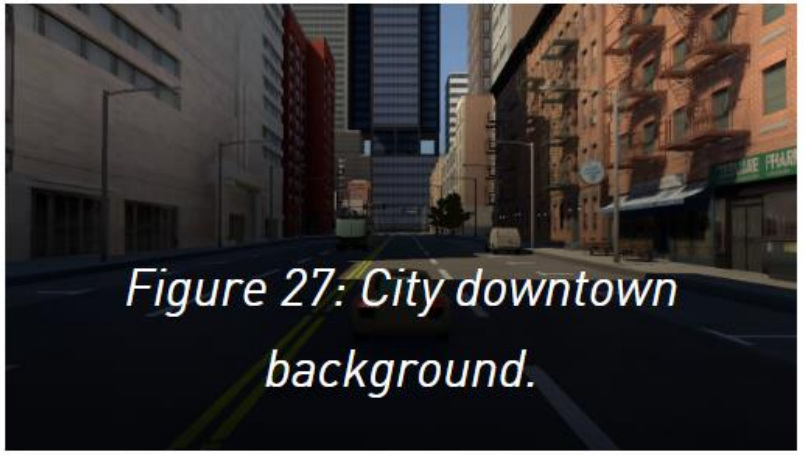
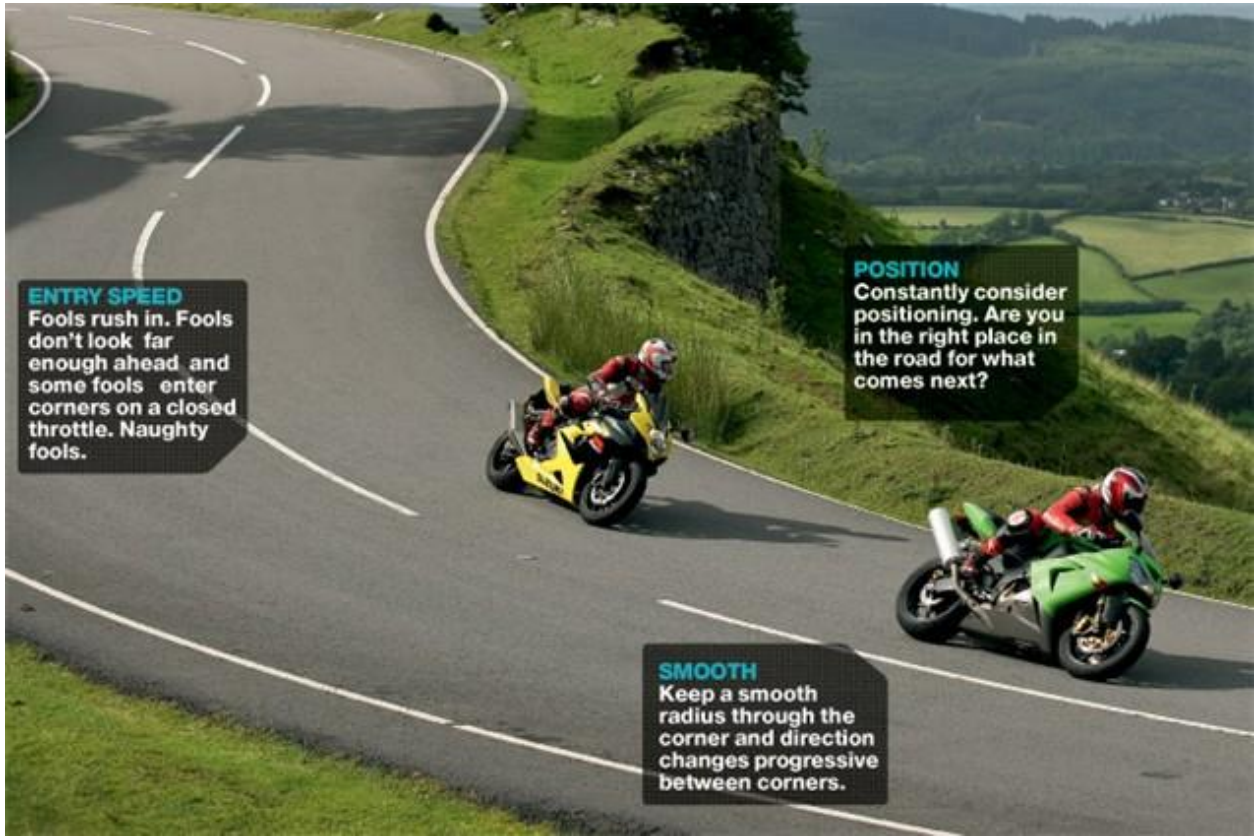


Figure 27: City downtown background.

Cornering


ENTRY SPEED
Fools rush in. Fools don't look far enough ahead and some fools enter corners on a closed throttle. Naughty fools.
POSITION
Constantly consider positioning. Are you in the right place in the road for what comes next?
SMOOTH
Keep a smooth radius through the corner and direction changes progressive between corners.

Possible features affecting motor scores from cornering perspective

New feature considerations

- Off path or out of control on curb
- Left cornering events - likely left turns
- At intersections only
- Right cornering events
- NSW1 fatalities recorded as “Off path or out of control on the curb.” (Australia)
- VIC2 fatalities recorded under “Run off-road on a curb.” (Australia)
- WA3 fatalities recorded as “Accidents on curves” (Australia)

Cornering study from Australia

- NSW1 fatalities recorded as “Off path or out of control on the curb.” VIC2 fatalities recorded under “Run off-road on a curb.” WA3 fatalities recorded as “Accidents on curves”

	2012	2013	2014	2015	2016	Avg
NSW1	22%	27%	22%	25%	22%	24%
VIC2	8%	11%	9%	10%	14%	11%
WA3	28%	24%	27%	28%	–	27%

Summary

- Traffic images with different classes are essential to reflect real-life situations
- Running Light features included in motor score correlation should be compatible with YOLO object detection models
- Cornering features included in motor score correlation should be compatible with YOLO object detection models