



Sensor Fusion With Deep Learning

Motivation

- What is Sensor Fusion

- Why Fuse sensors Data

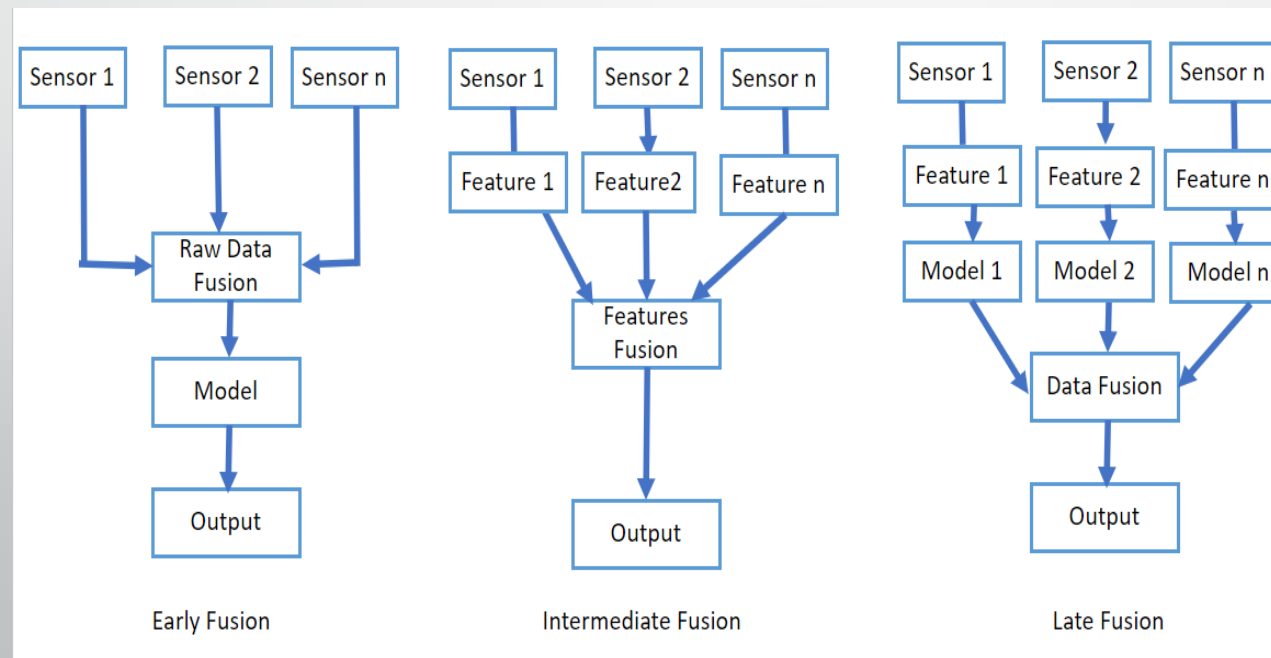
- 1) Reliability (check potential partial sensor failure & improve redundancy)
- 2) Robustness against noise (detect sensor exposed to noise & attenuate effect on system)
- 3) Extended spatial coverage
- 4) Extended temporal coverage (Each sensors update a different time interval)
- 5) Increased Resolution (combine data to increase resolution of measurement)

Benefits of using DL in Sensor Fusion

- The continuously train DL model helps to identify any potential changes in system behavior
- The DL model can predict possible sources of failures, which helps with preventative maintenance.

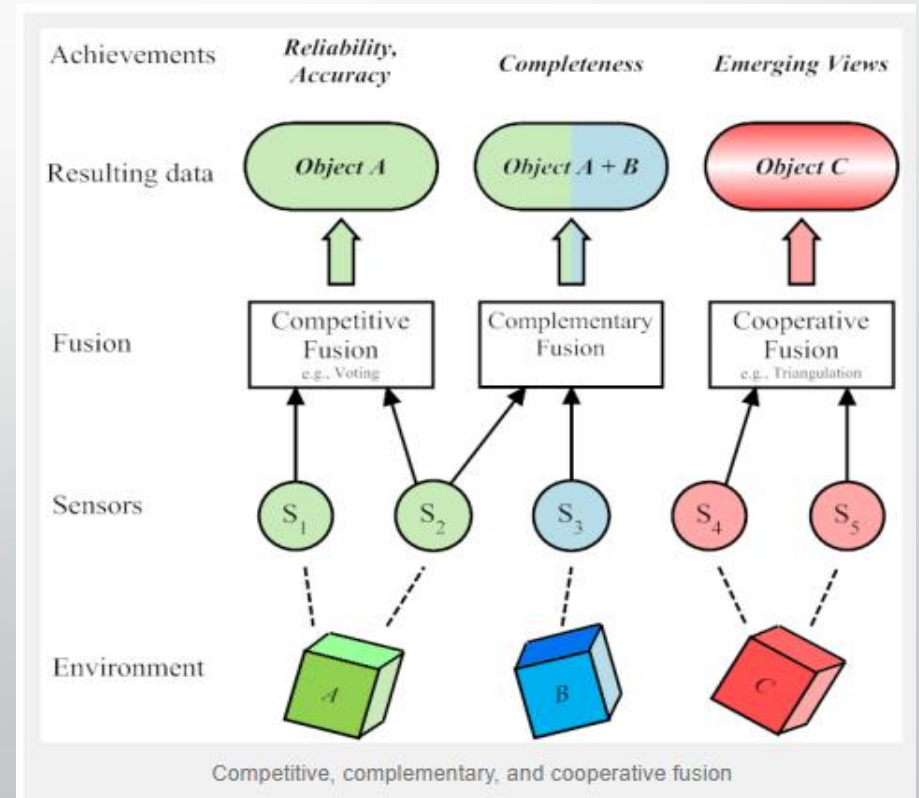
Different Types of Sensor Fusion

- Early Fusion
- Intermediate Fusion
- Late Fusion



Sensors Interaction Classification

- Complementary(work independent with possibility to combine their data)
- Competitive(sensors measure the same parameter & each of them will give its own measurement)
- Cooperative

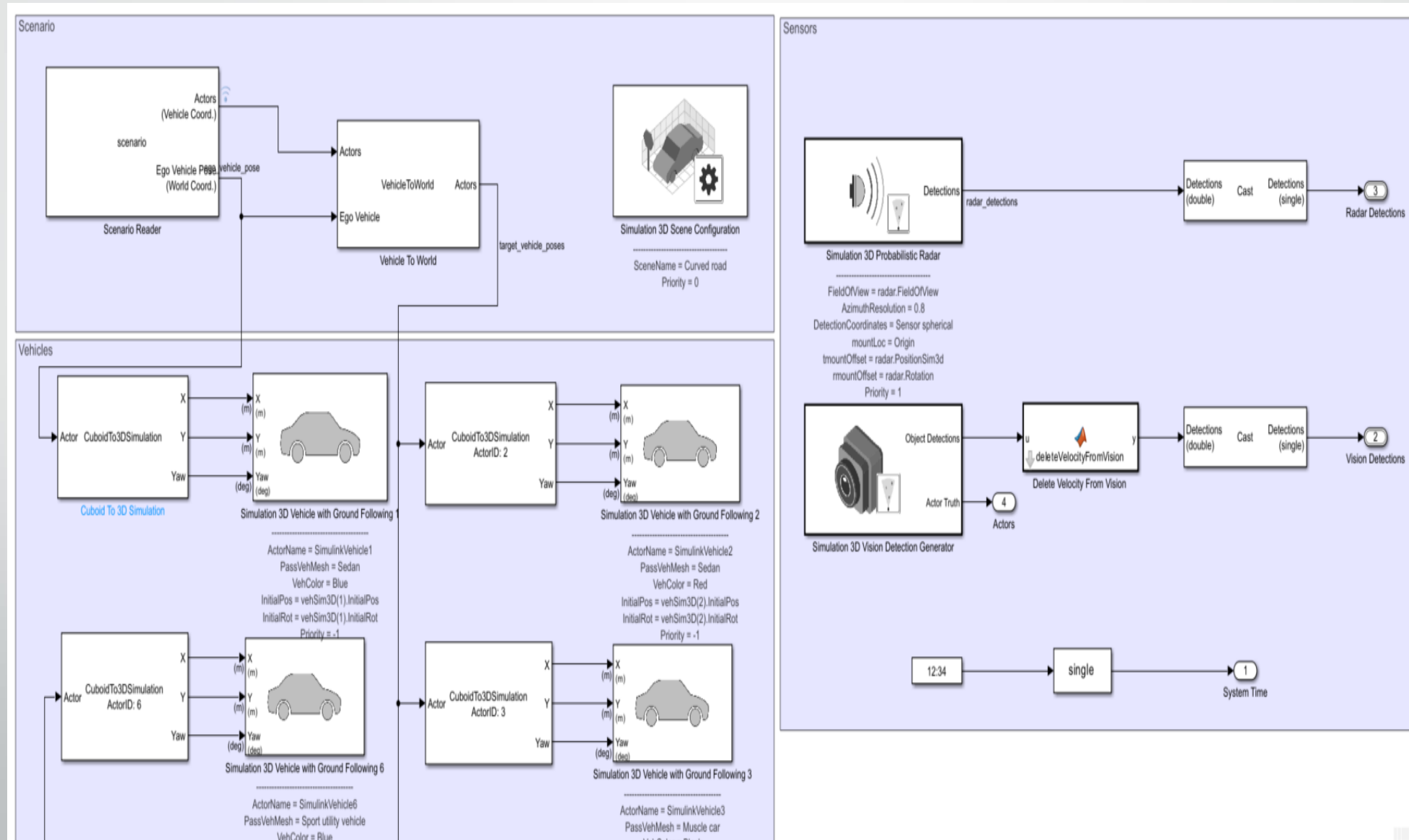


Practical Case: Forward vehicle SF with Matlab

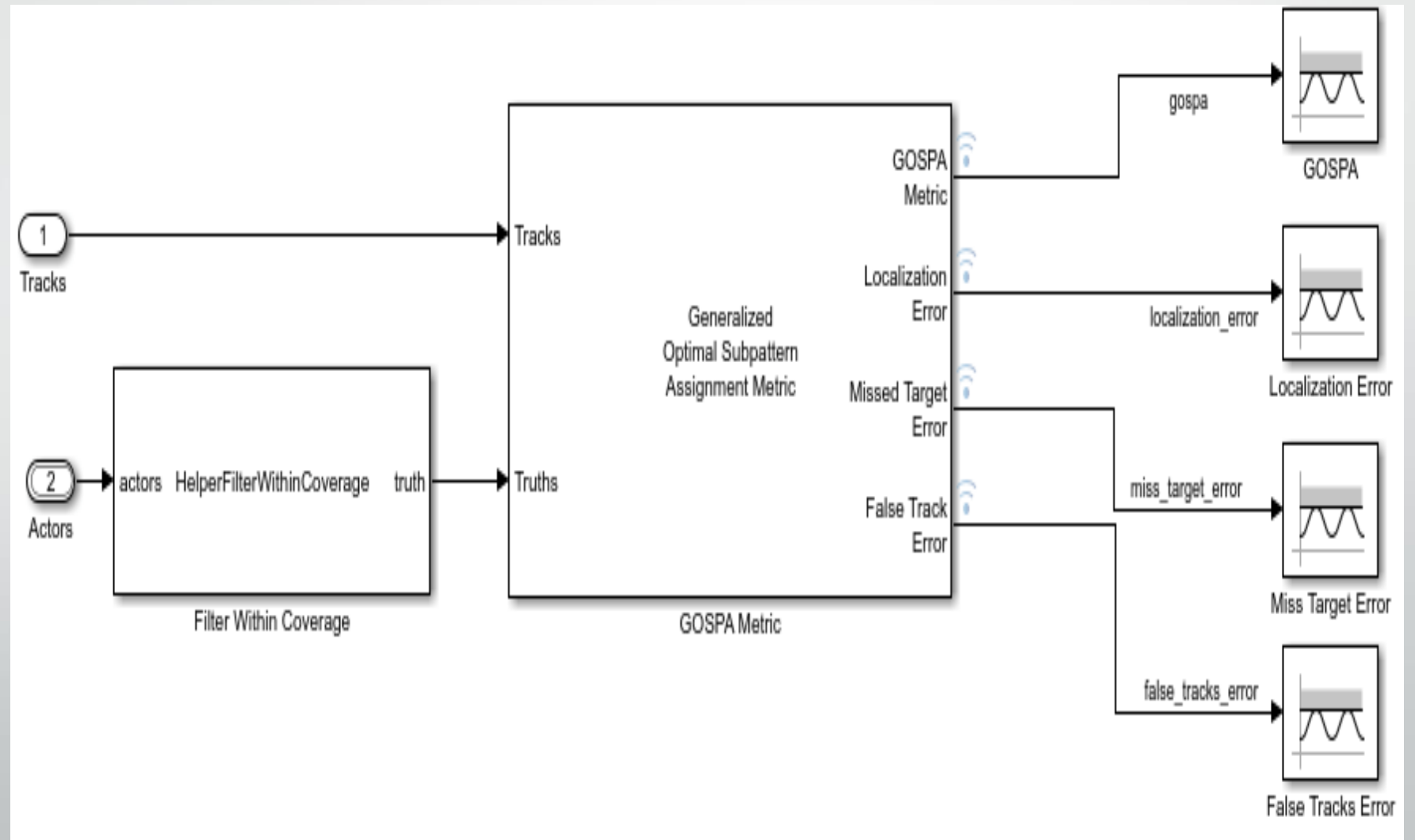
- Model Subsystems

- 1) Sensors and Environment (configuration related to the type of scene, vehicles and sensors)
- 2) Forward Vehicle Sensor Fusion(for camera, radar fusion and decision making related to the detection of objects)
- 3) Evaluate Tracker Metrics(check how good vehicles are detected)

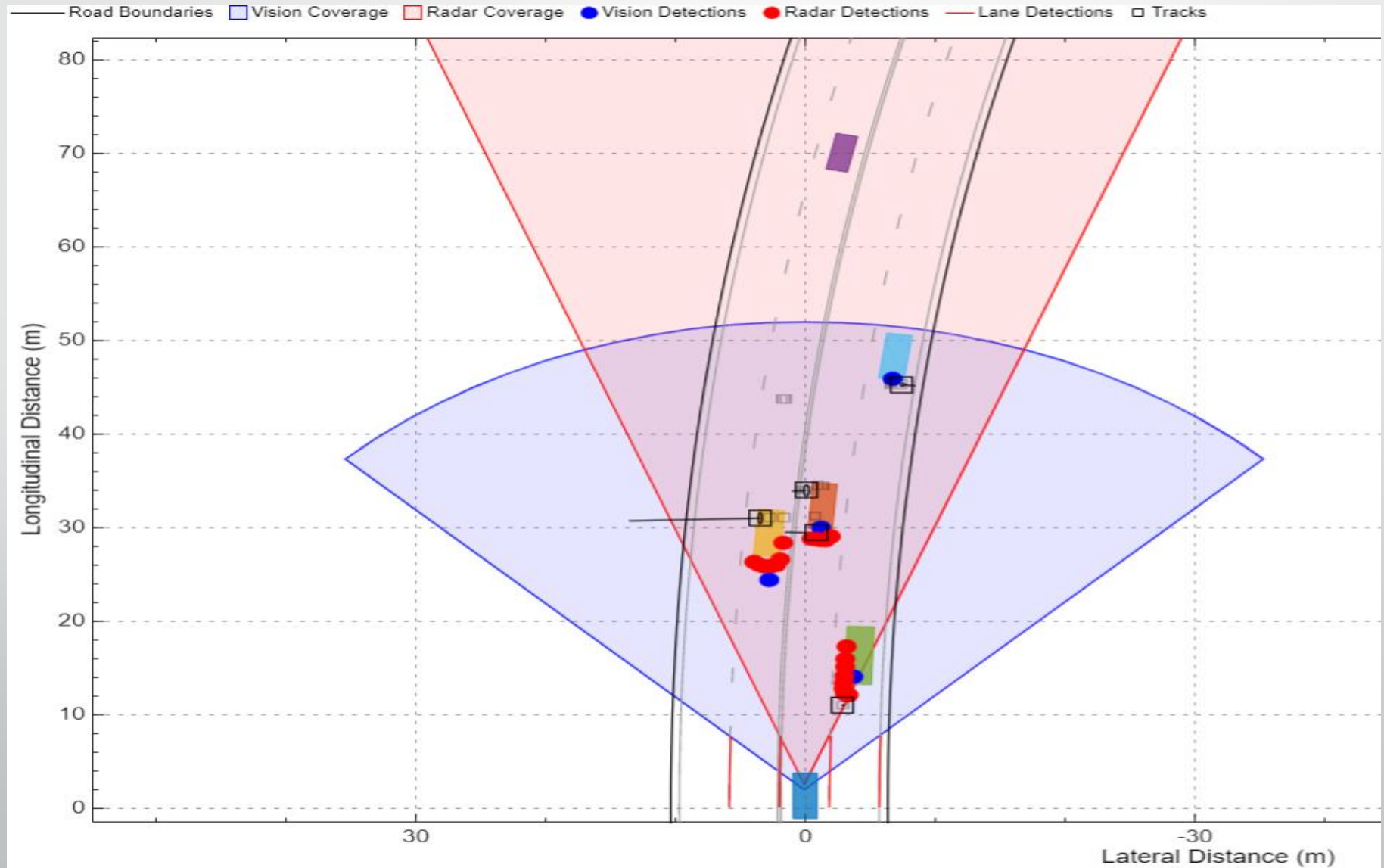
Sensors and Environment Block



Evaluate Tracker Metrics Block



Simulation



Limitations of using DL in Sensor Fusion

- Continuous Training with new data to make correct prediction