Trajectory Prediction for ADAS

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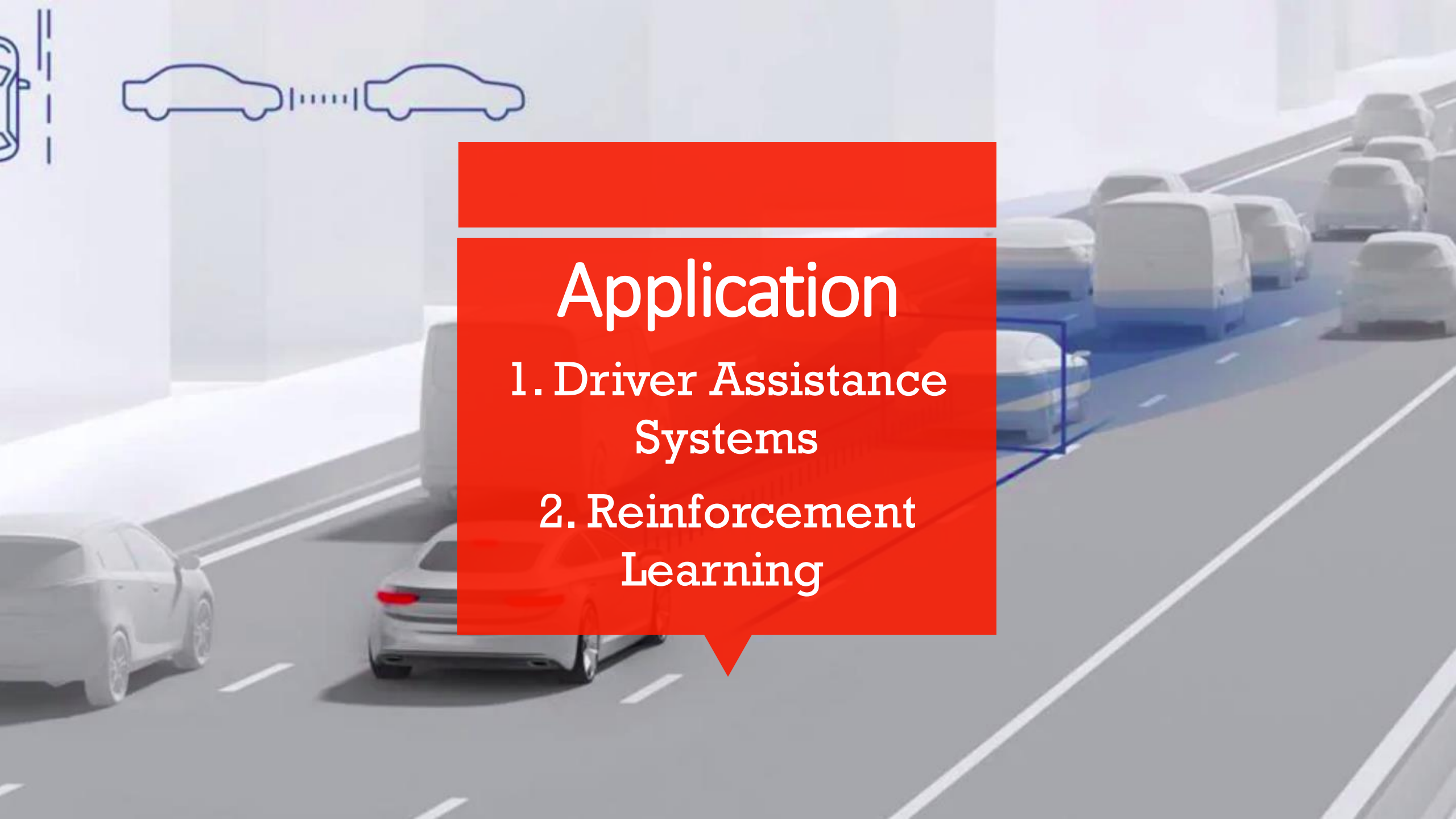
Supervisor: Prof. Luigi di Stefano

Problem Statement

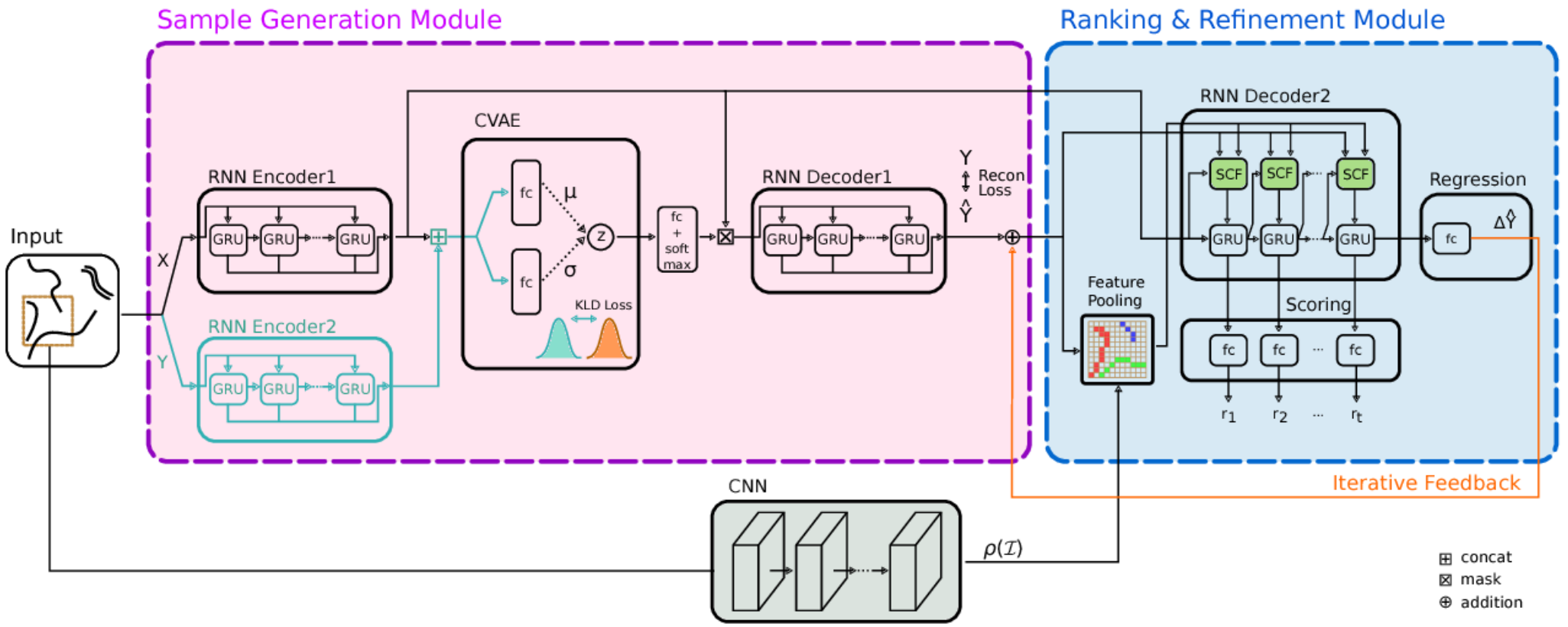
1. Predict trajectory of other dynamic objects
2. Only do it from ego-centric perspective!



Application

1. Driver Assistance Systems
2. Reinforcement Learning

Summary of research so far



DESIRE

Deep Stochastic IOC RNN Encoder-decoder (2017)

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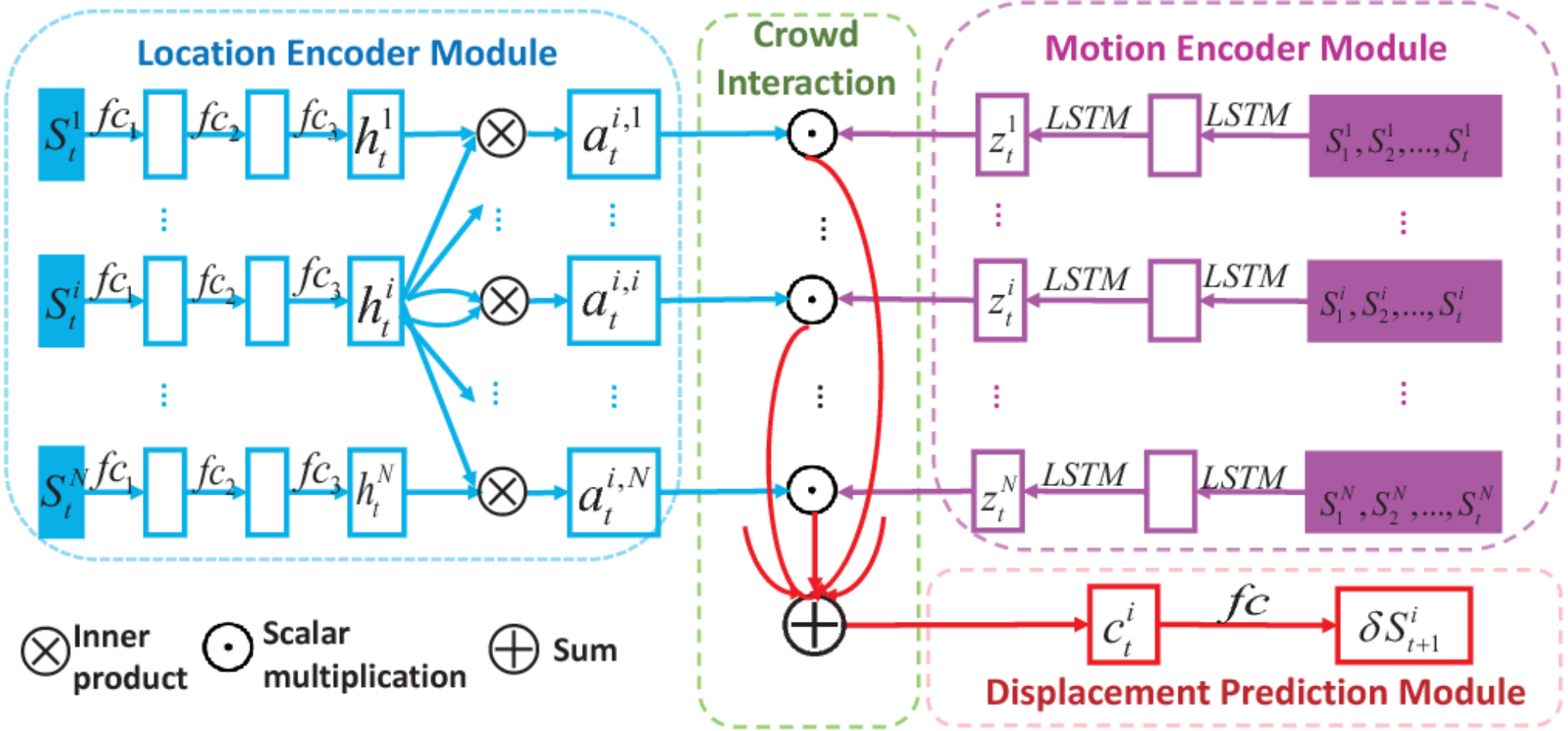
(2017)



Deep Neural Network for Pedestrian Trajectory Prediction (2018)

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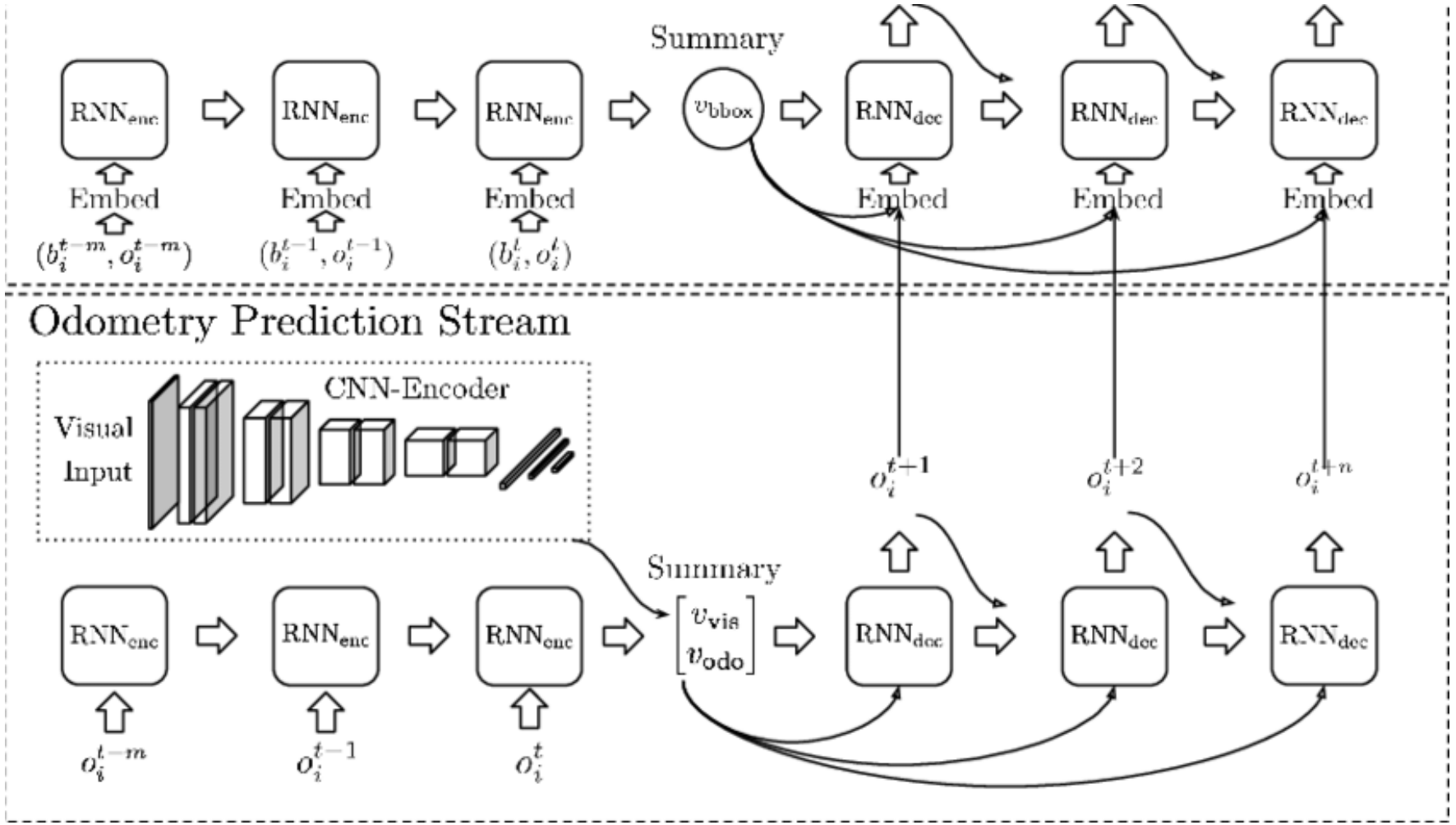
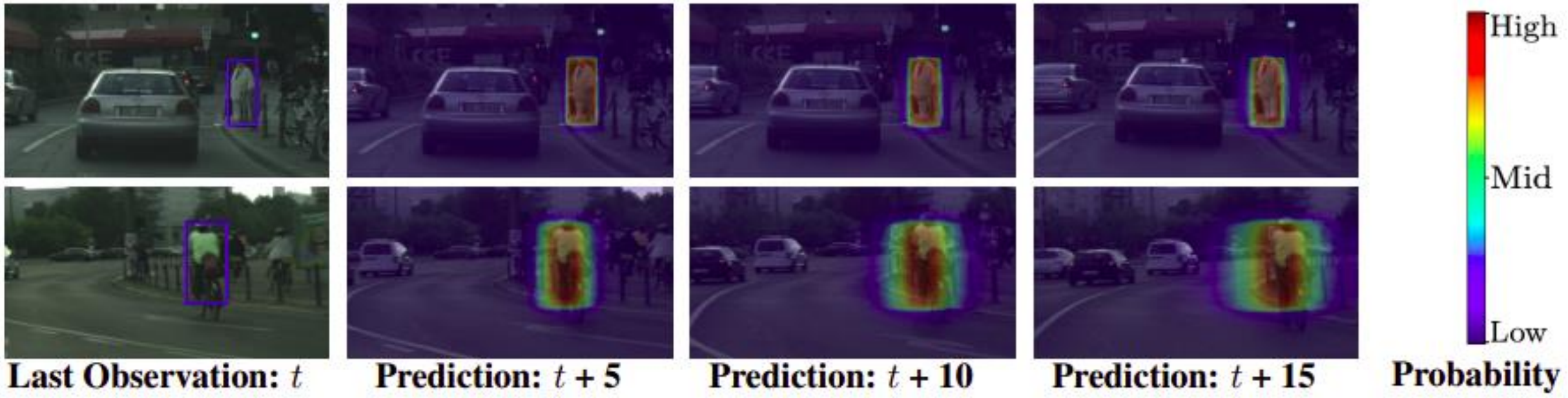


Uncertain Pedestrian Trajectory Prediction (2018)



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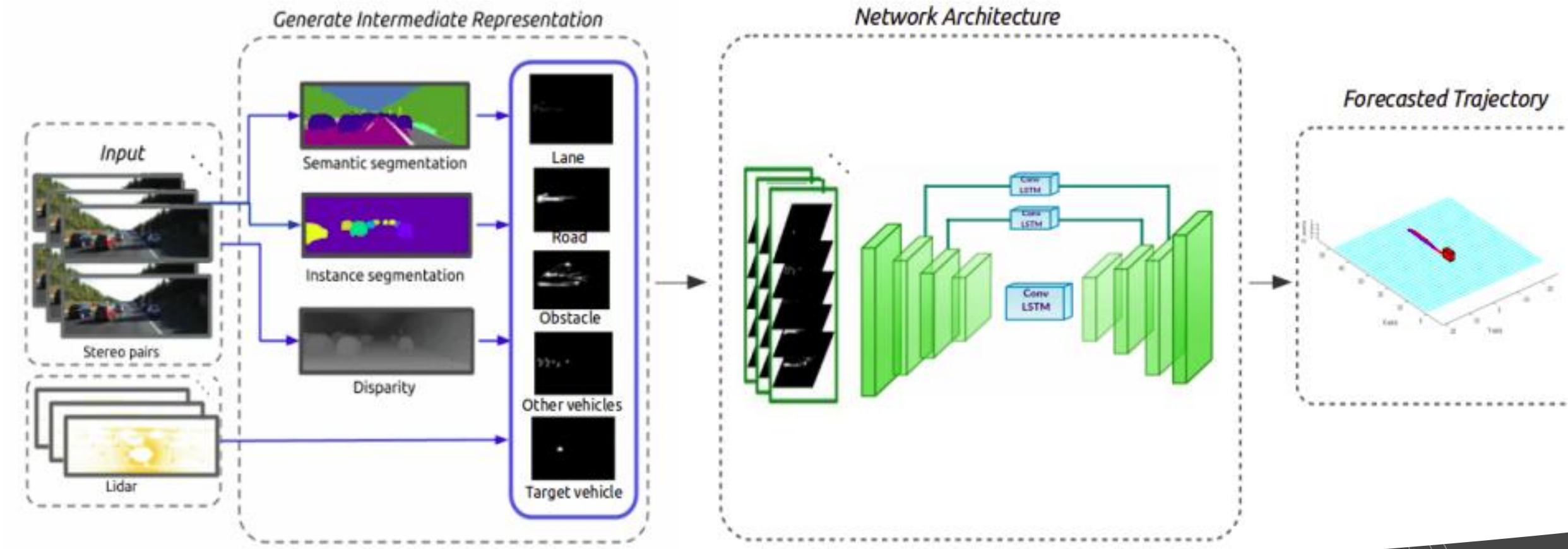
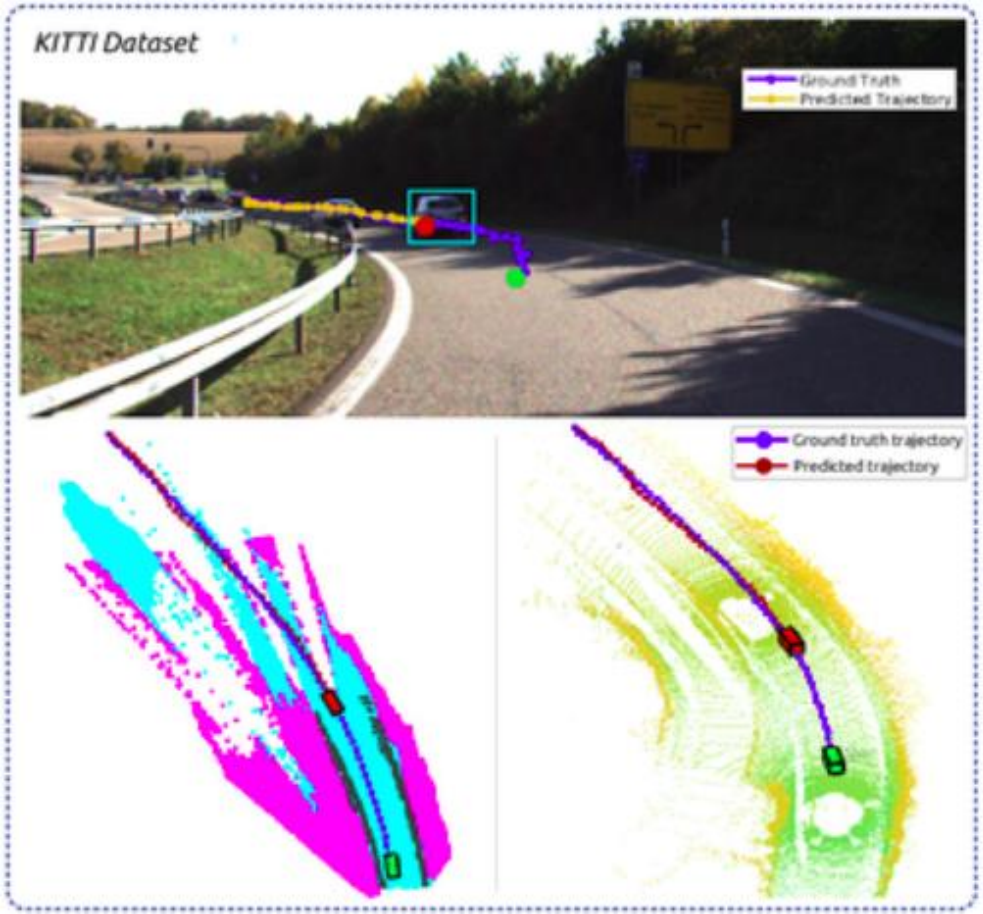


INFER: INtermediate representations for FuturE pRediction (2019)

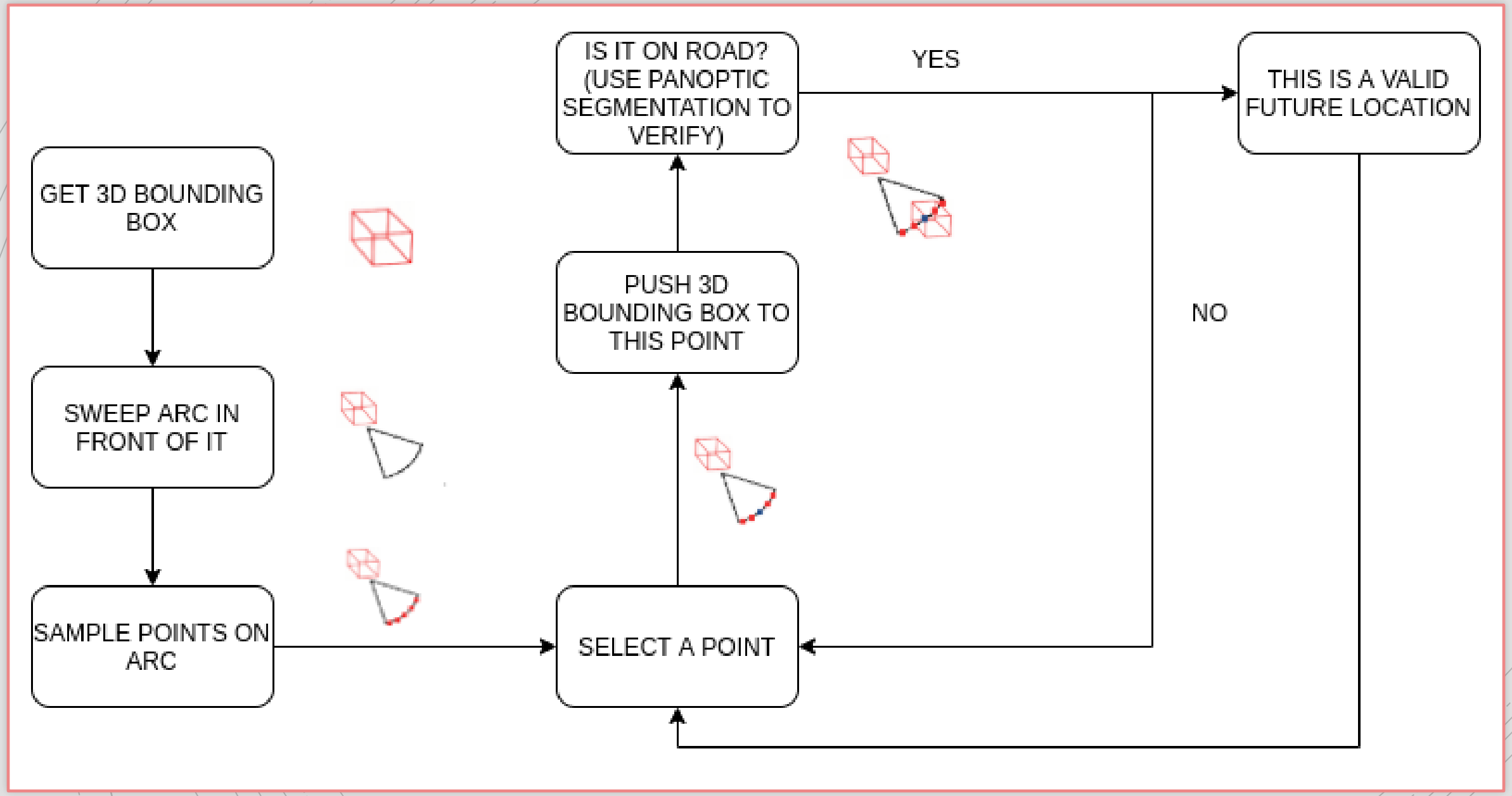


INFER: INtermediate representations for FuturE pRediction (2019)

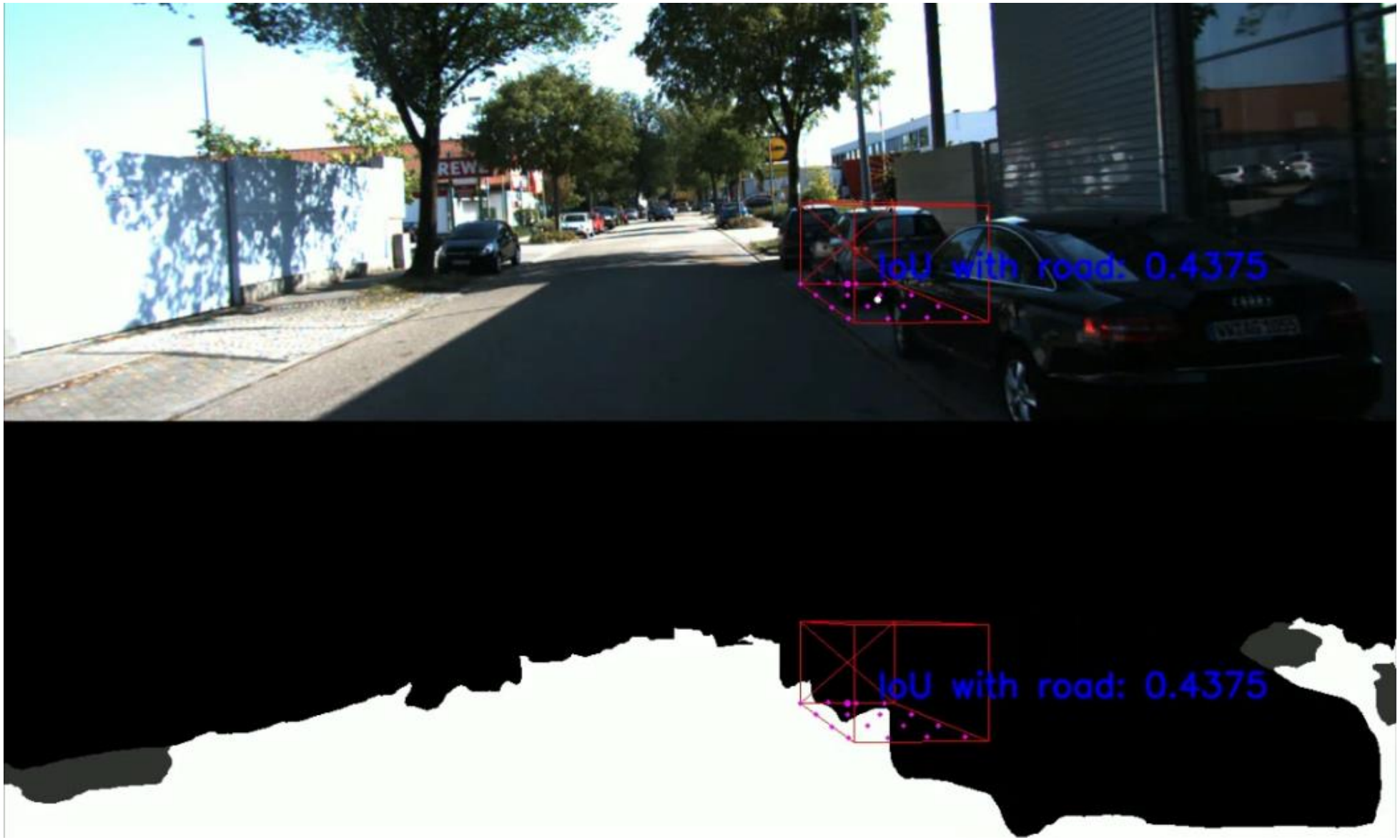
Problems with previous approaches

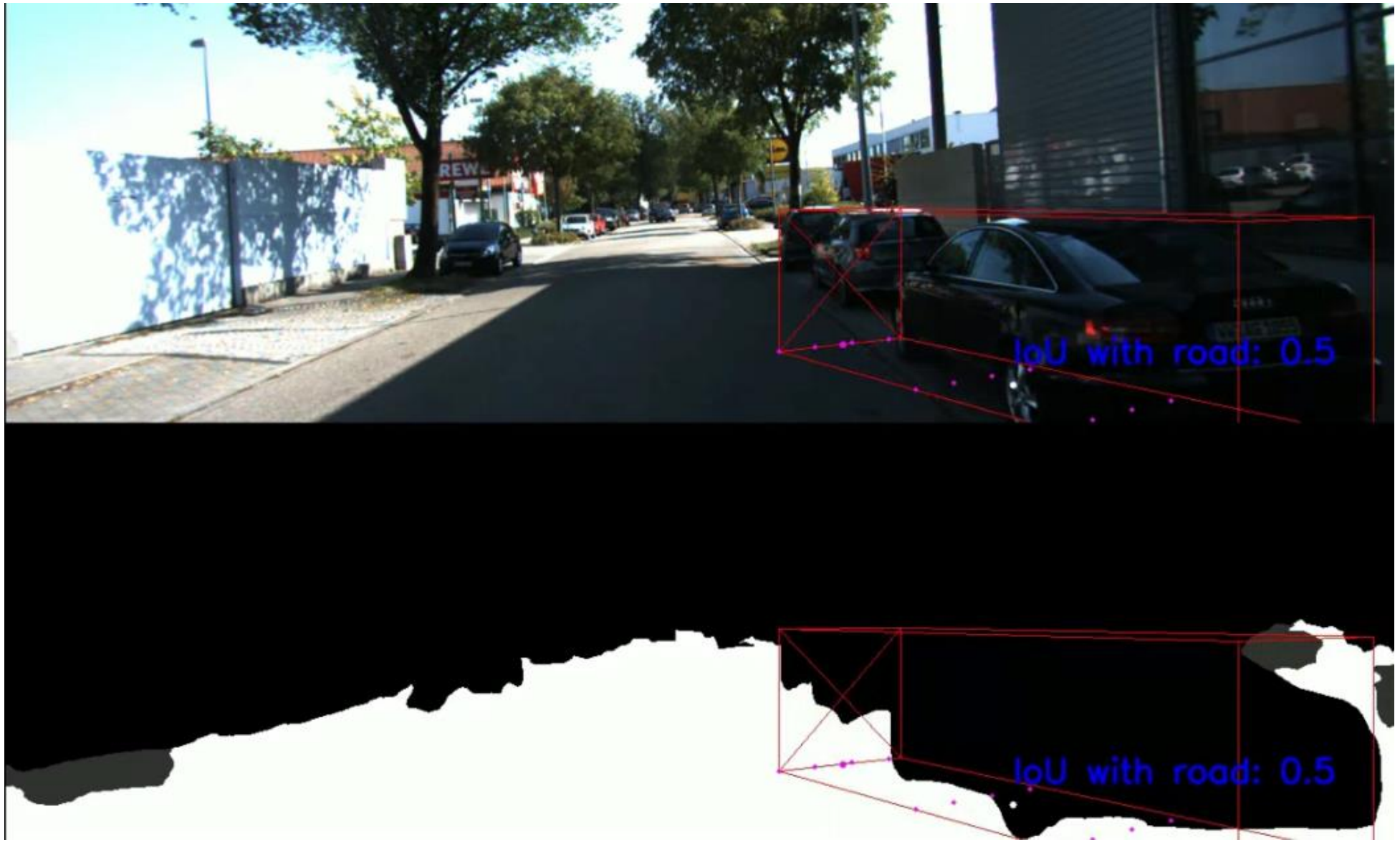
1. Static background image
2. Very complicated neural net architecture
3. Predictions made in 2D space
4. Mostly supervised learning approaches

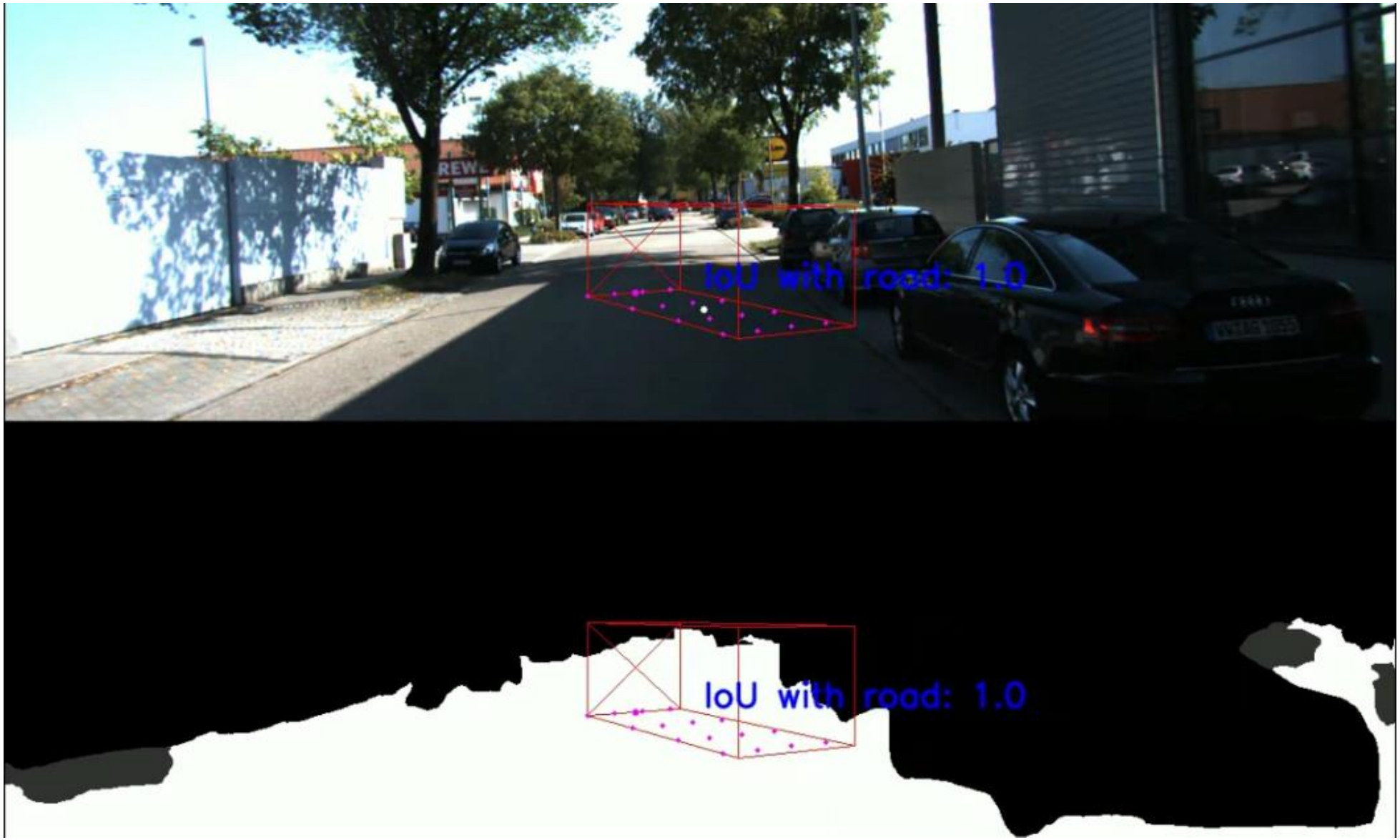
New Approach

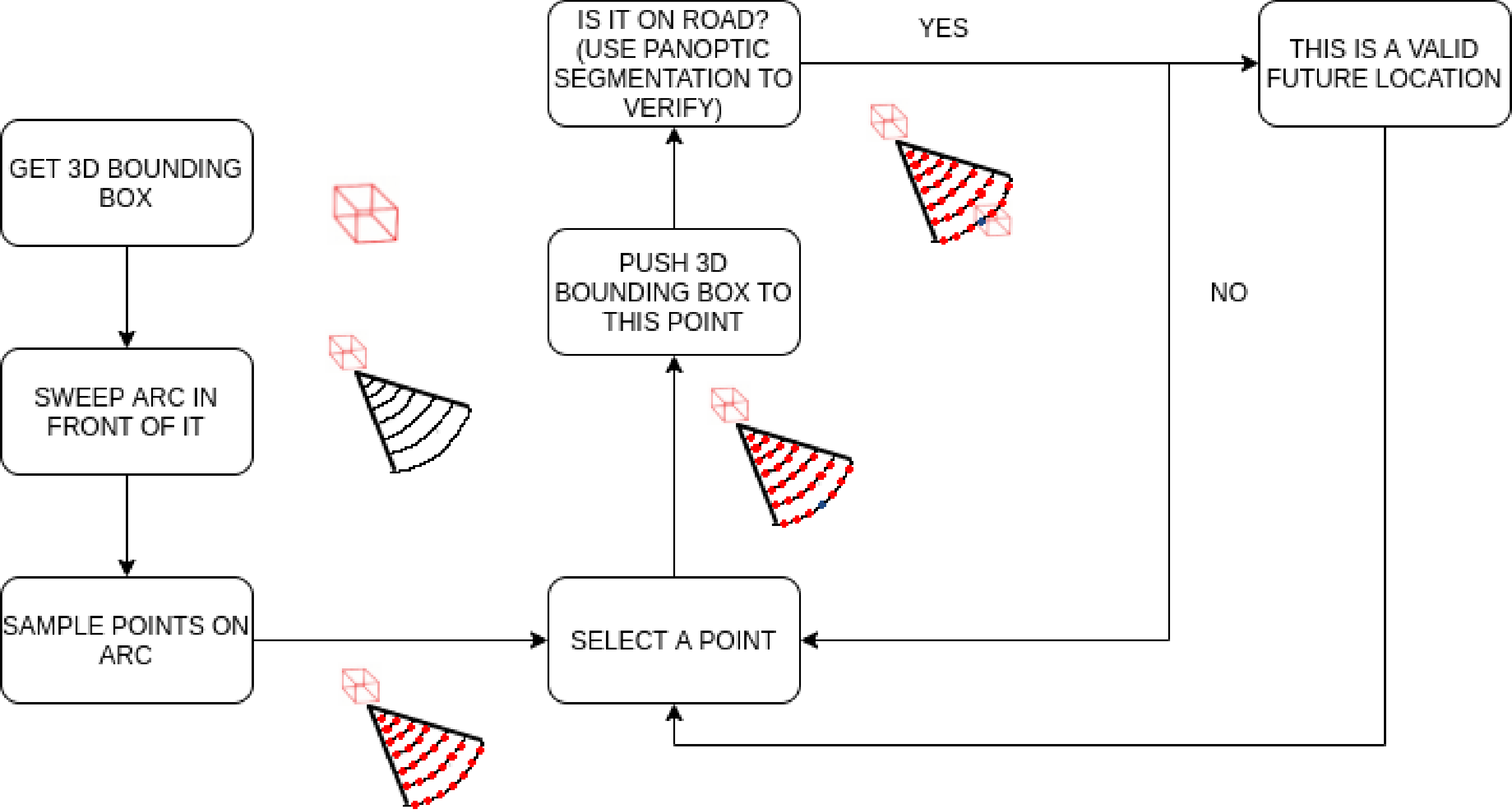

GET 3D BOUNDING BOX
SWEEP ARC IN FRONT OF IT
SAMPLE POINTS ON ARC
SELECT A POINT
PUSH 3D BOUNDING BOX TO THIS POINT
IS IT ON ROAD? (USE PANOPTIC SEGMENTATION TO VERIFY)
YES
NO
THIS IS A VALID FUTURE LOCATION


IoU with road: 0.437
IoU with road: 0.437


IoU with road: 0.4375
IoU with road: 0.4375


IoU with road: 0.5
IoU with road: 0.5


IoU with road: 1.0
IoU with road: 1.0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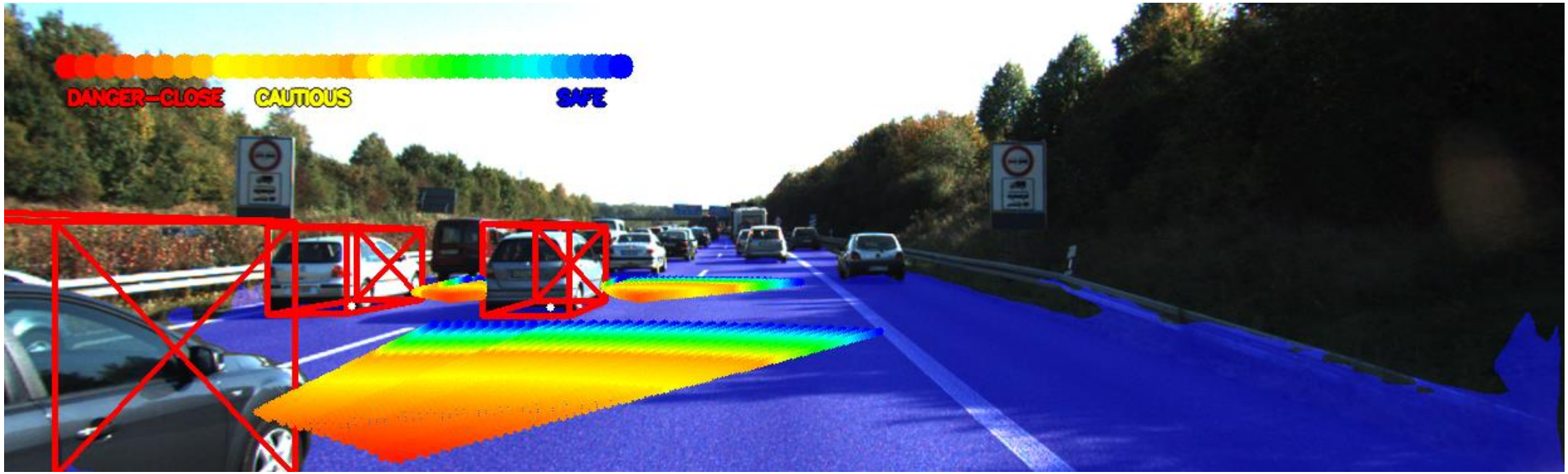
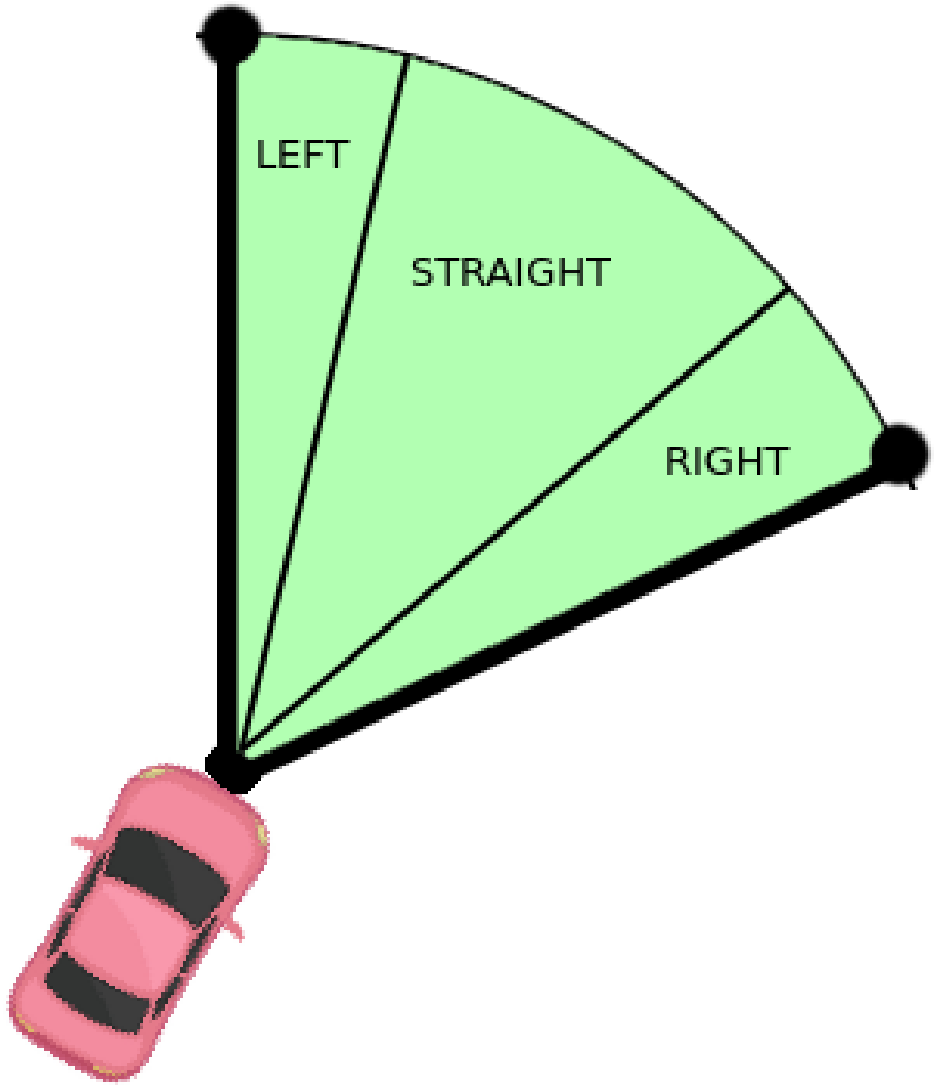
REWE

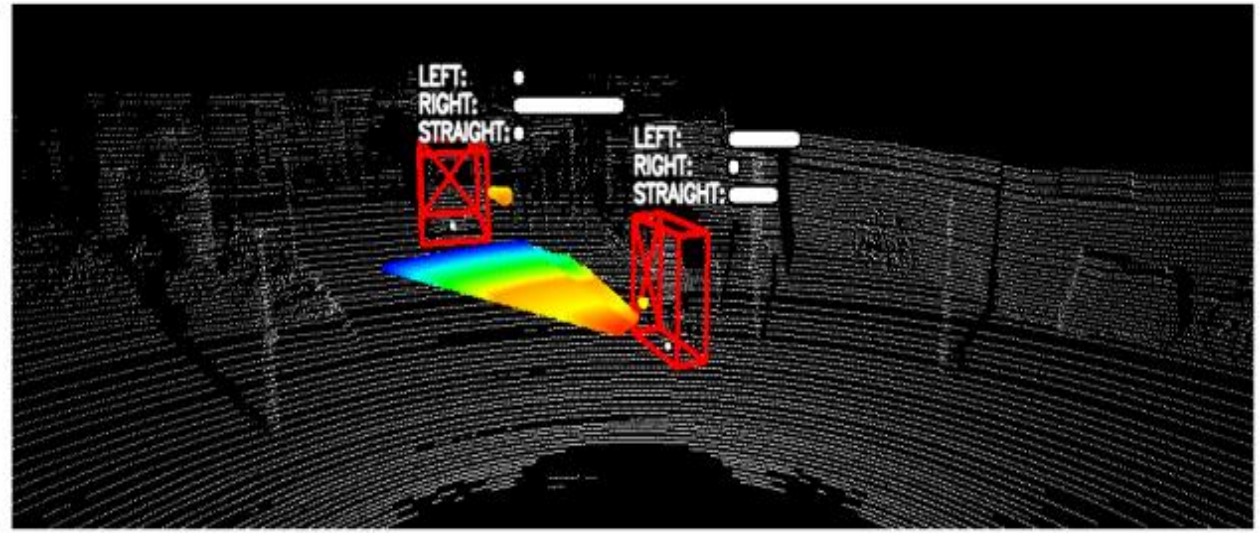
Make it more dense!


DANGER-CLOSE
CAUTIOUS
SAFE

Predict direction!


LEFT
STRAIGHT
RIGHT


DANGER-CLOSE
CAUTIOUS
SAFE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LEFT:
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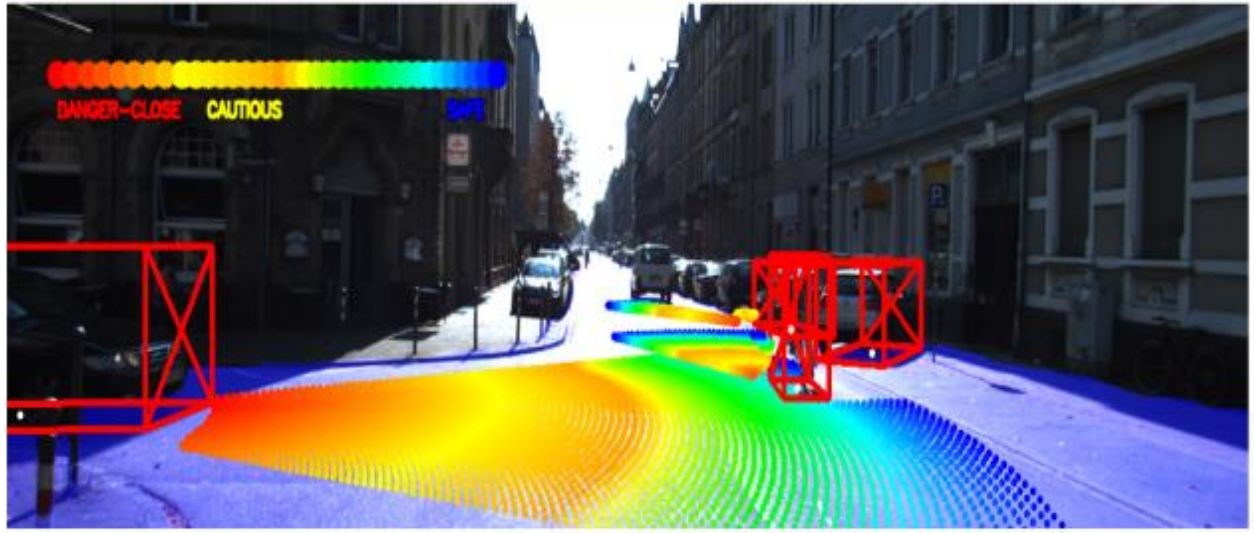
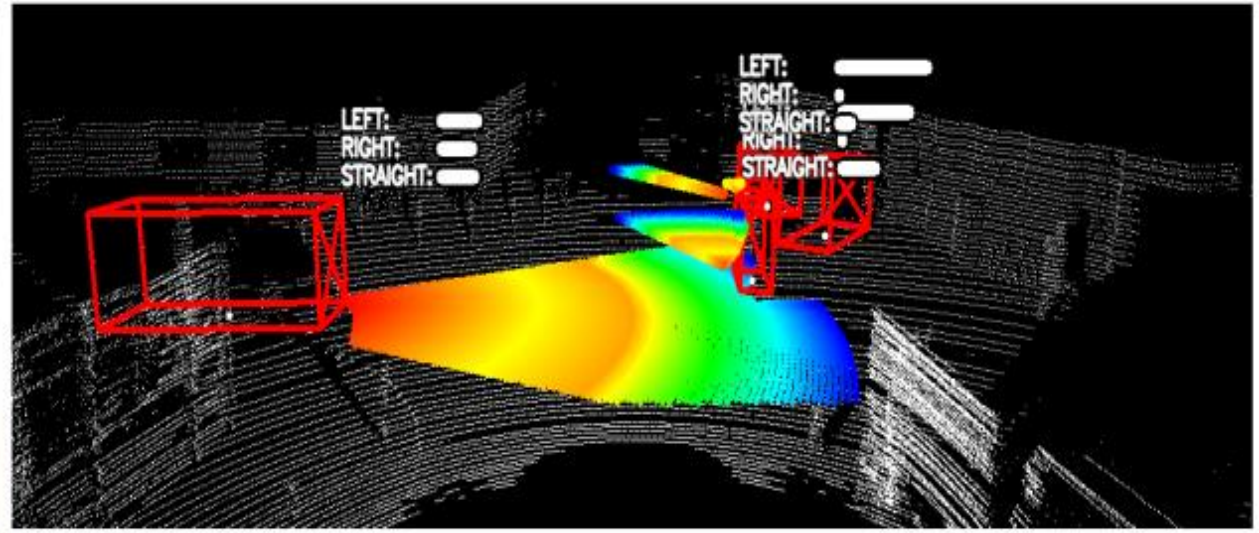

DANGER-CLOSE
CAUTIOUS
SAFE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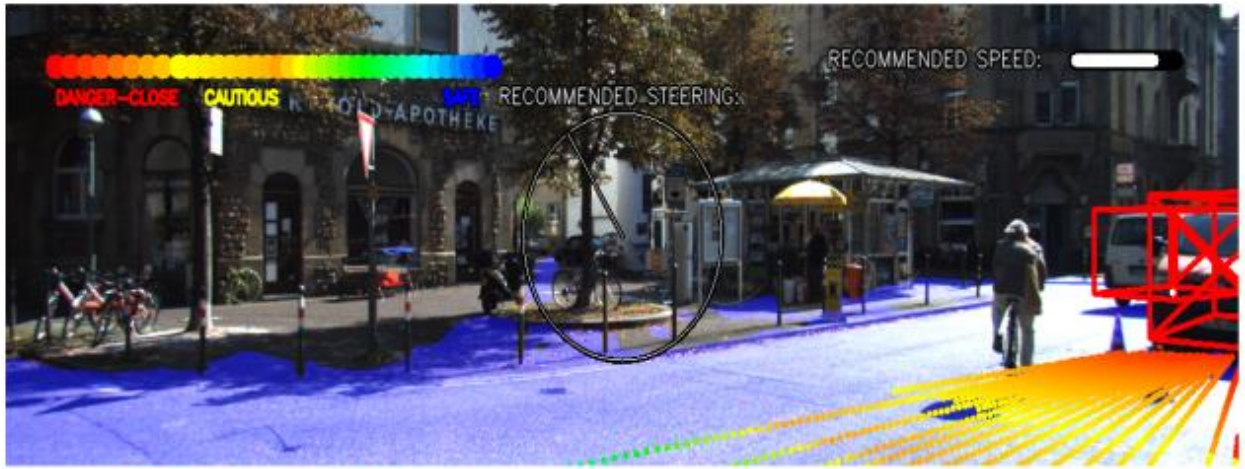
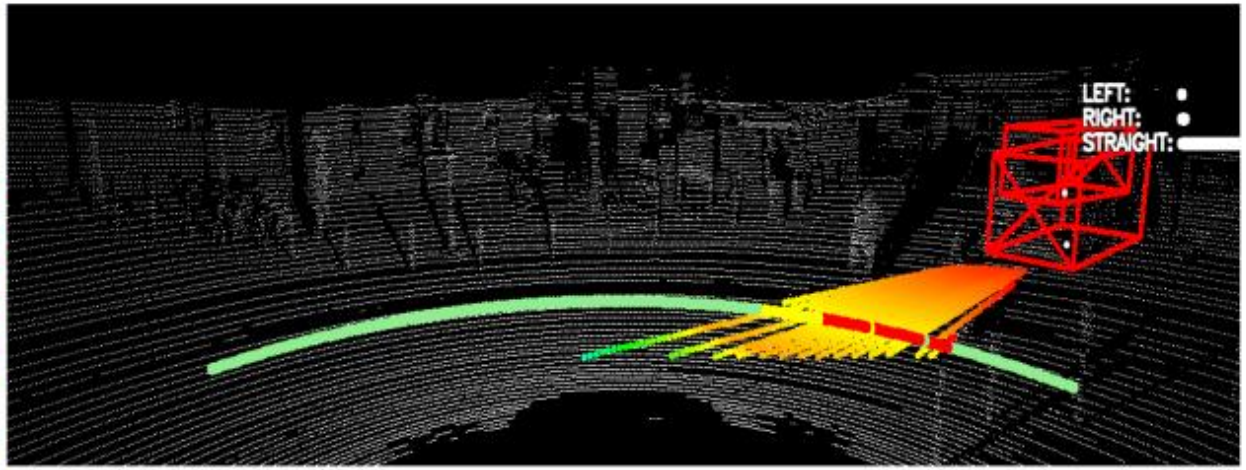
BONUS: Speed & Steering Recommendation


DANGER--CLOSE
CAUTIOUS
SAFE
RECOMMENDED STEERING:
RECOMMENDED SPEED: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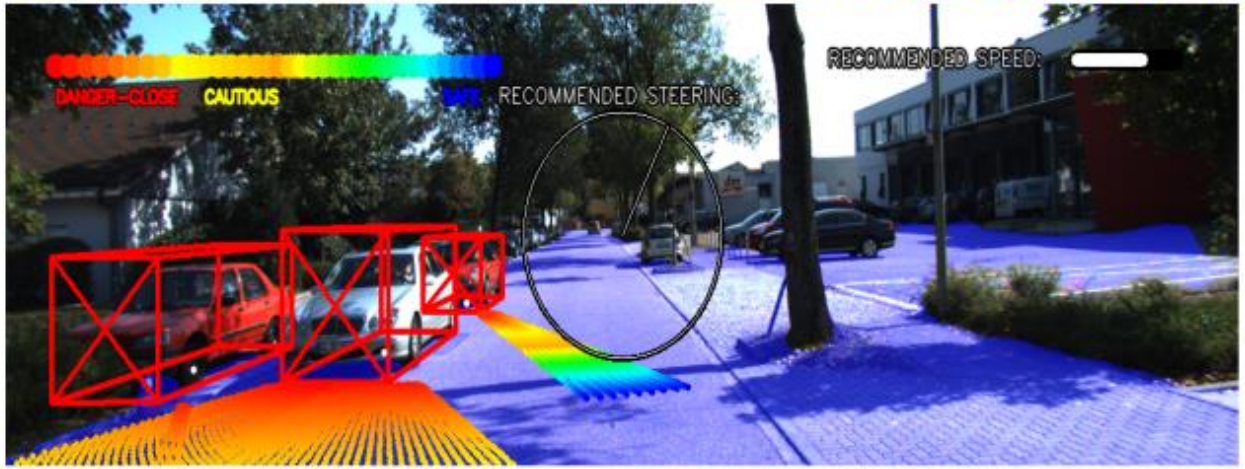
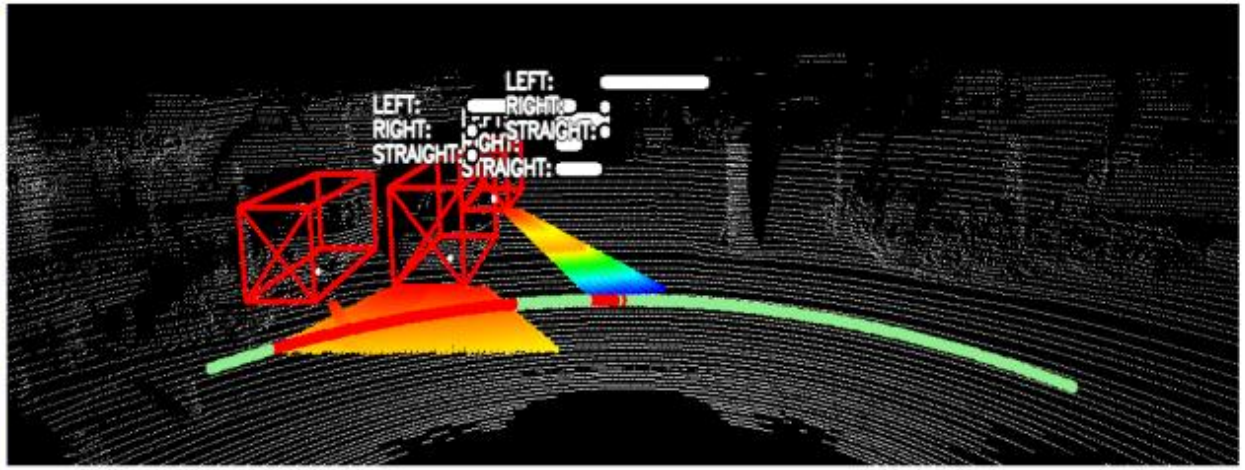

DANGER--CLOSE
CAUTIOUS
SAFE
RECOMMENDED STEERING:
RECOMMENDED SPEED: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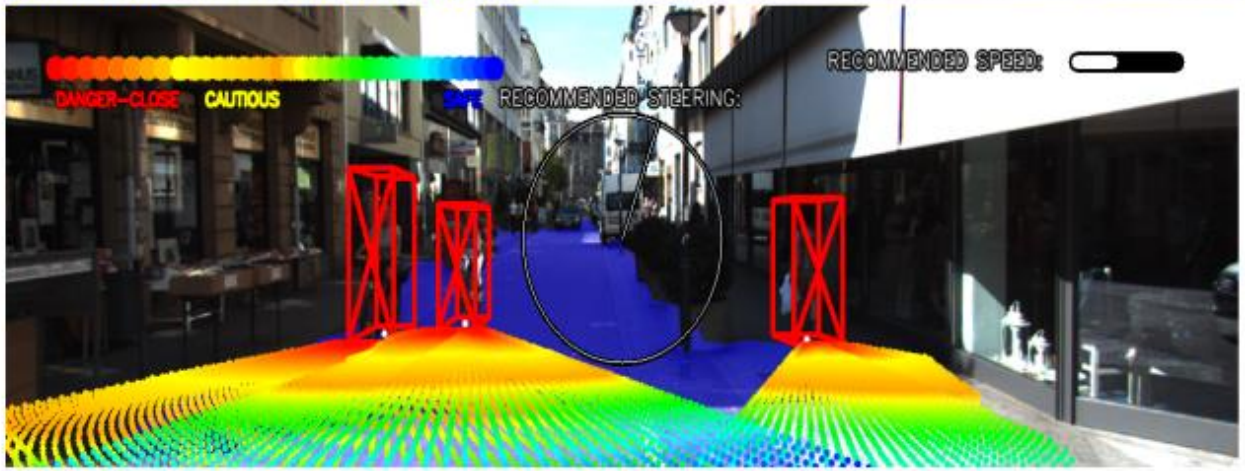
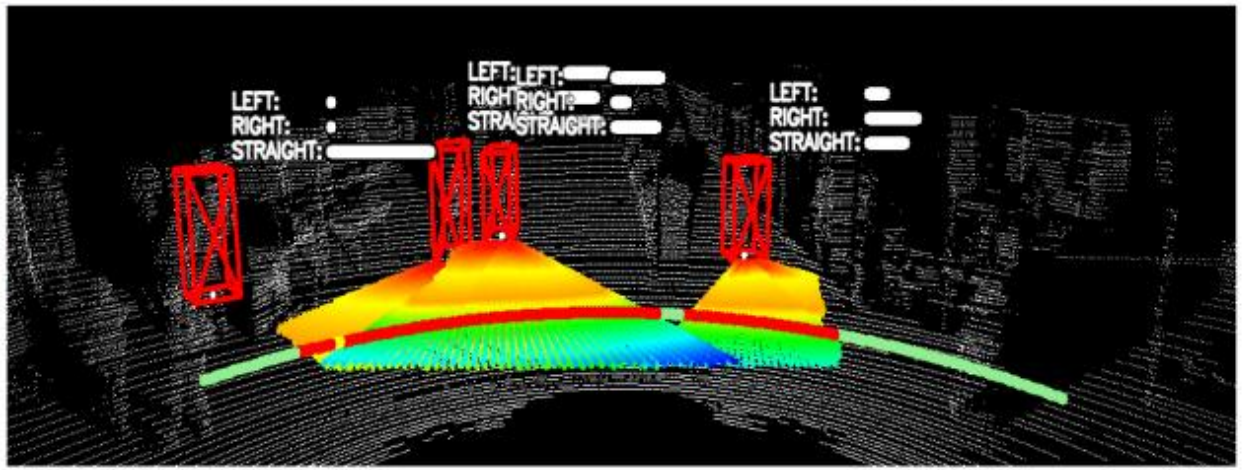

DANGER--CLOSE
CAUTIOUS
SAFE
RECOMMENDED STEERING:
RECOMMENDED SPEED:


LEFT:
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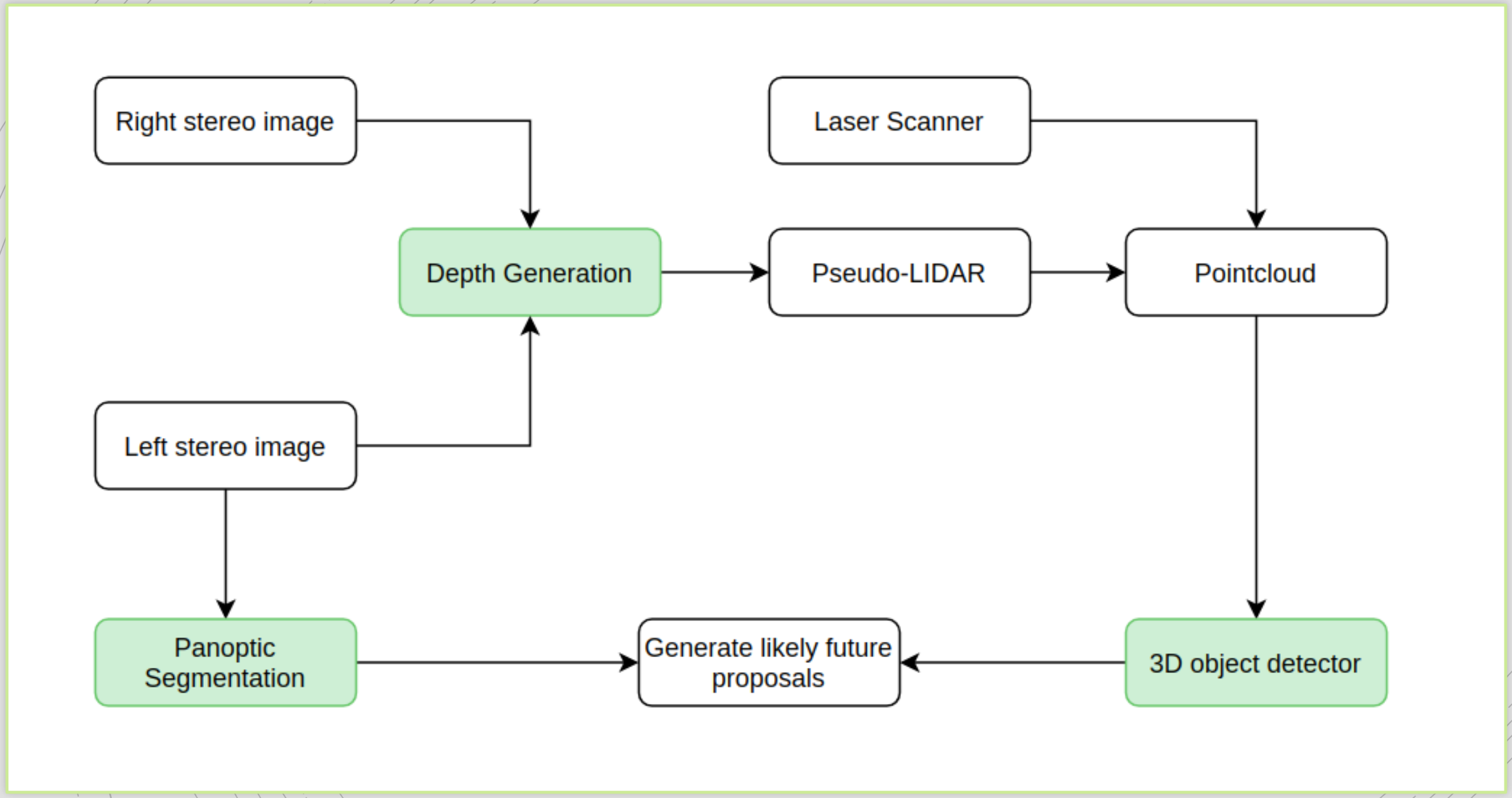
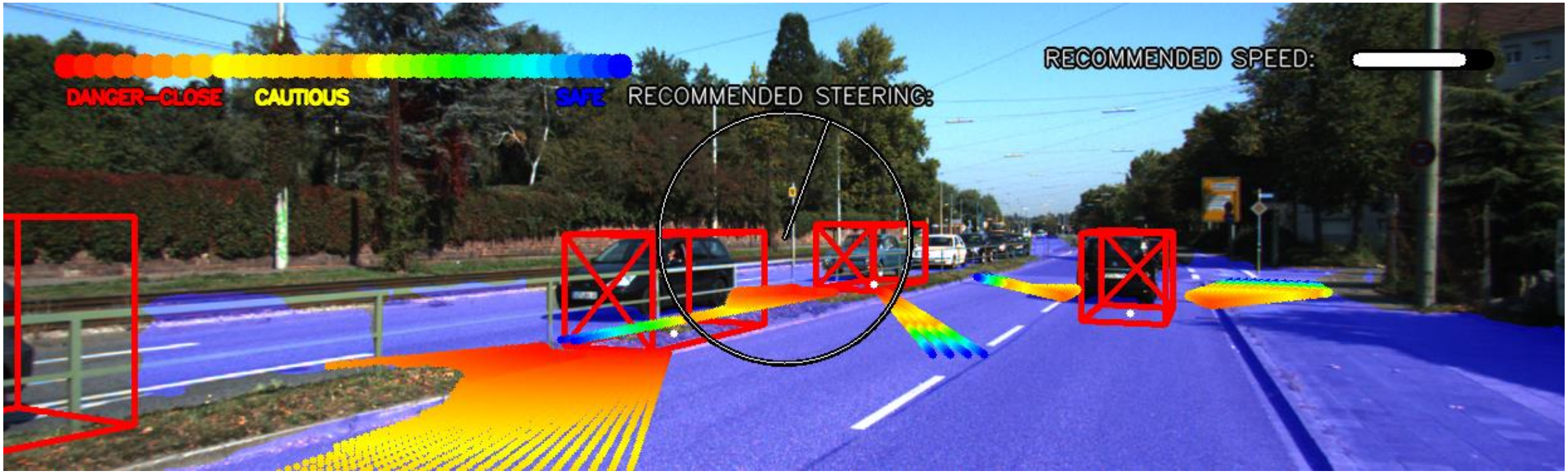

Right stereo image
Laser Scanner
Depth Generation
Pseudo-LIDAR
Pointcloud
Left stereo image
Panoptic Segmentation
Generate likely future proposals
3D object detector



Inaccurate 3D object detector

Inaccurate Panoptic Segmentation

Future Work

Use this method in conjunction with a reinforcement learning agent