SELF-DRIVING CARS.

Markov Vladislav
417

The process

1

Sensing

Lidar, camera,
Radar, GPS, IMU

2

Perception

Classification,
Detection,
Segmentation

3

Mapping

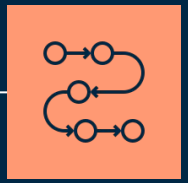
Create 2D, 3D
environment maps

The process

4

Localization

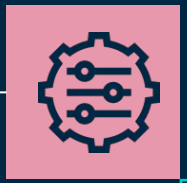
Where am I?



5

Planning

Motion planning,
Route planning



6

Control

Path tracking,
Light control,
Doors control

Hardware

01

Sensors

1

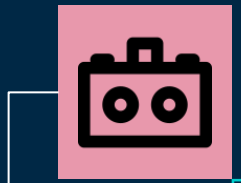
Lidar

Light reflection method

2

Camera

Photoelectric method



3

Stereo camera

Camera with two or more lenses

Sensors

4

GPS

Localization

5

IMU

Stabilization

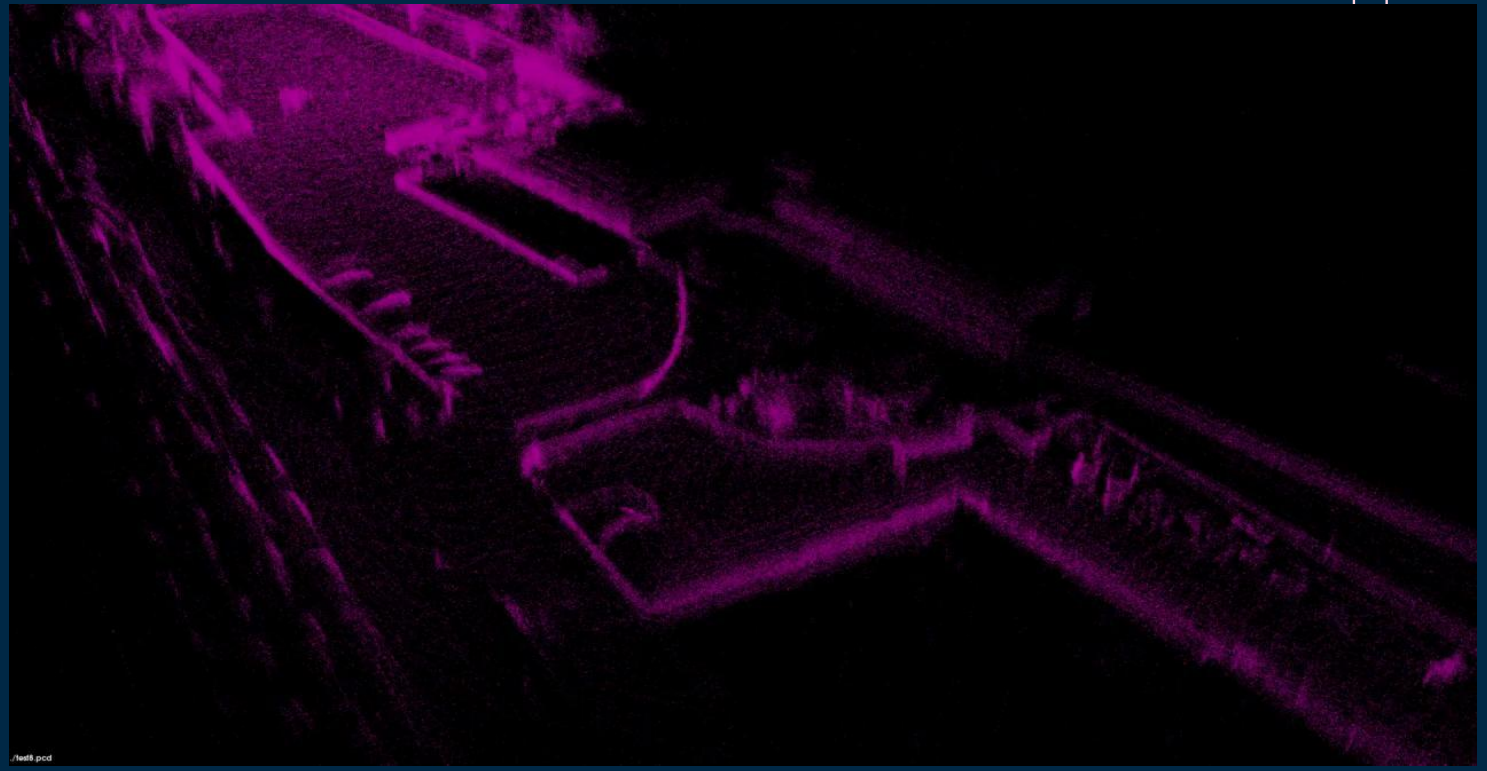
6

Radar

Radio wave method

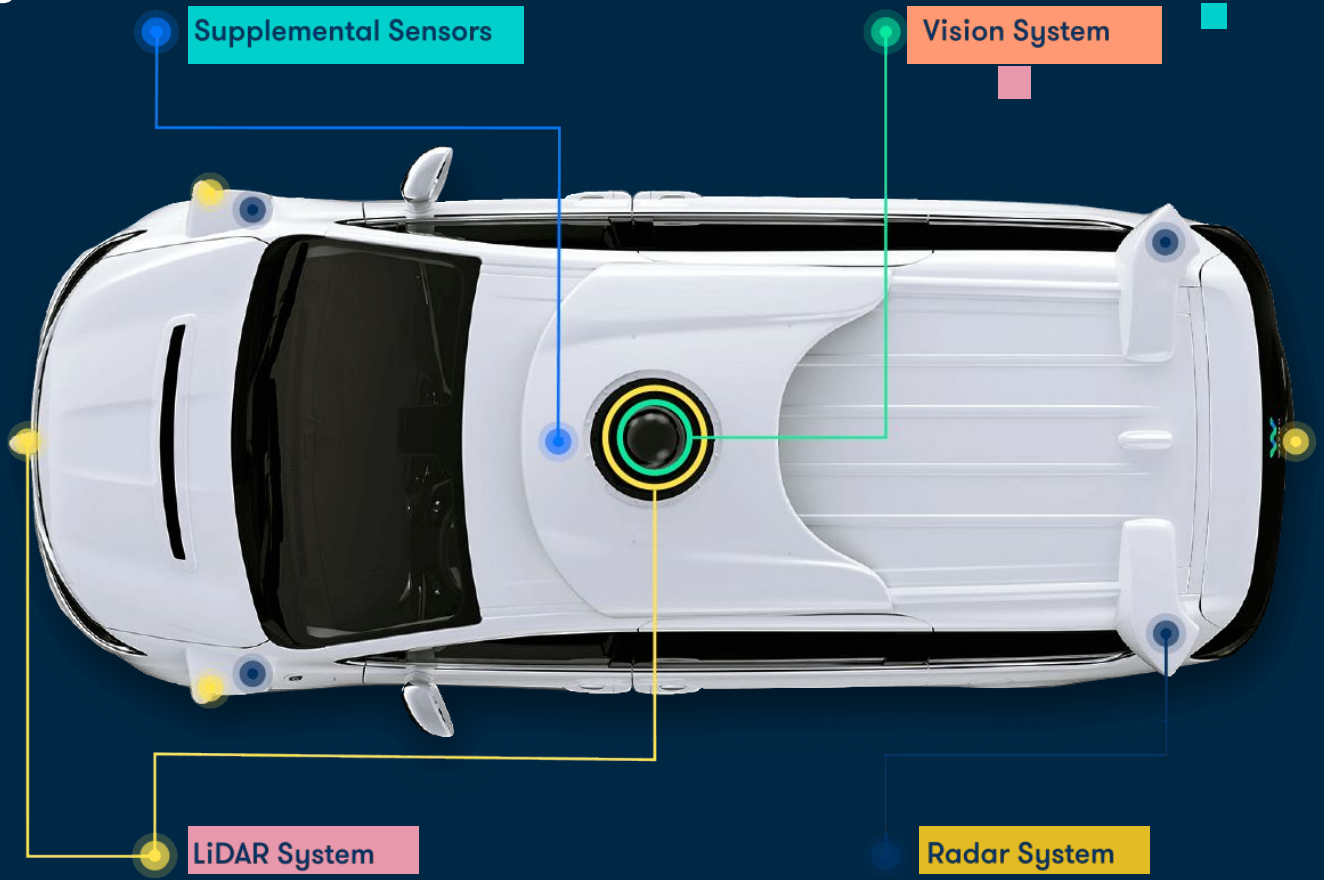
Velodyne lidar 16(100m range)

3D map based on Lidar



Localization based on Lidar

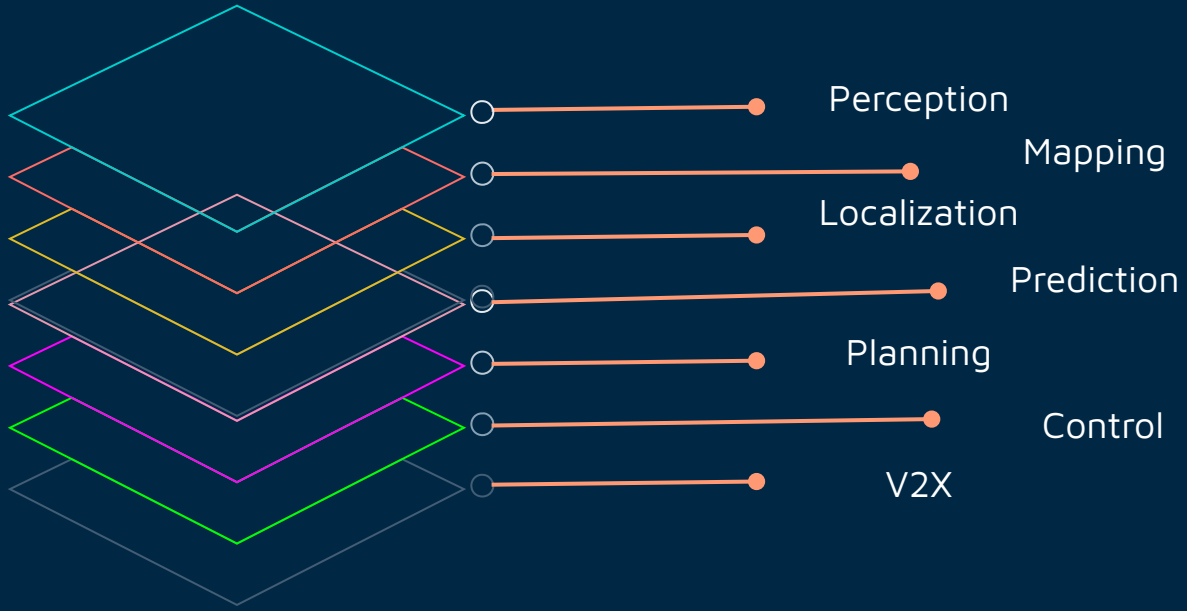
Sensors


Supplemental Sensors
Vision System
LiDAR System
Radar System

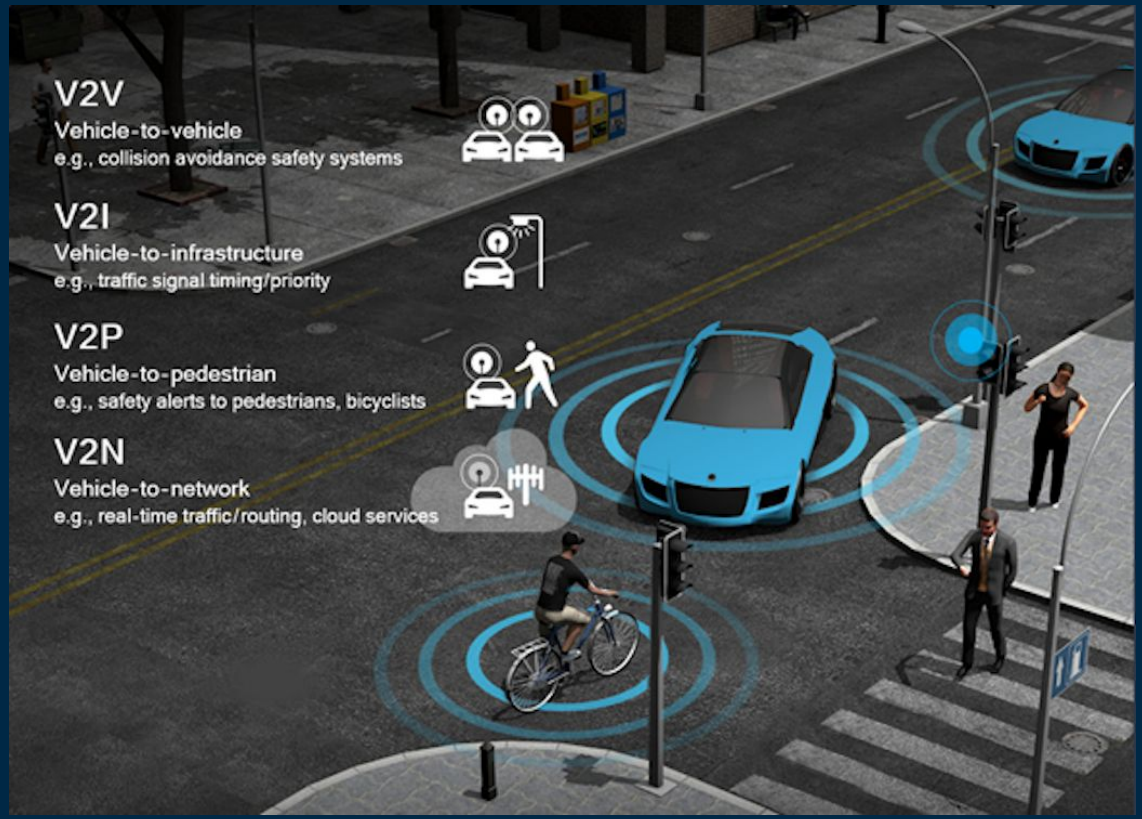
Software

02

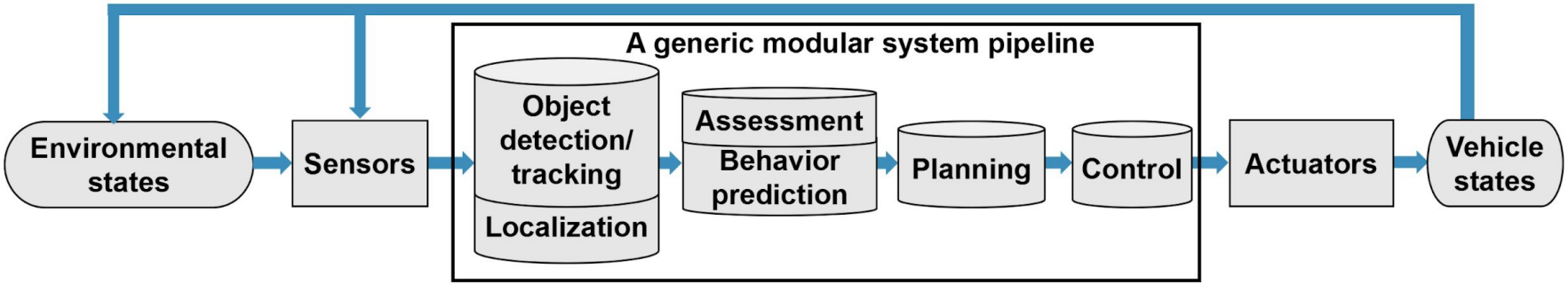
Modular system



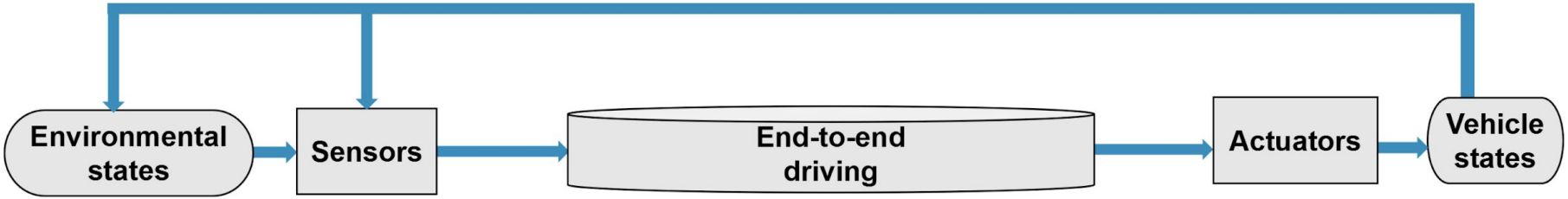
V2X


V2V
Vehicle-to-vehicle
e.g., collision avoidance safety systems
V2I
Vehicle-to-infrastructure
e.g., traffic signal timing/priority
V2P
Vehicle-to-pedestrian
e.g., safety alerts to pedestrians, bicyclists
V2N
Vehicle-to-network
e.g., real-time traffic/routing, cloud services

Modular system



End-to-end system



End-to-end system

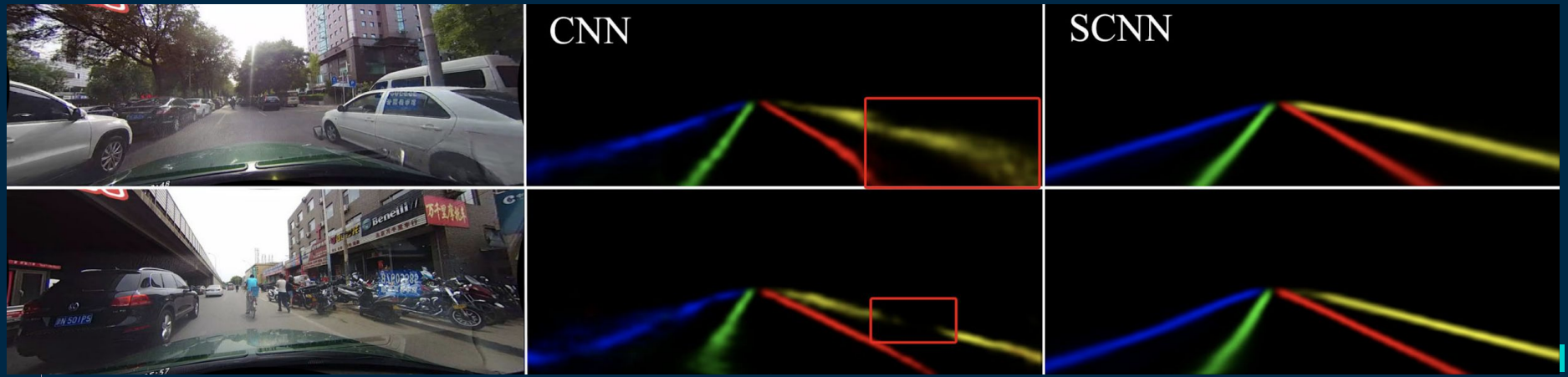
Learning/training strategy	+-
Direct supervised deep learning	Imitates the target data: usually a human driver. Can be trained offline. Poor generalization performance.
Deep reinforcement learning	Learns the optimum way of driving. Requires online interaction.
Neuroevolution	No backpropagation. Requires online interaction.

Detection

03

2-D detection

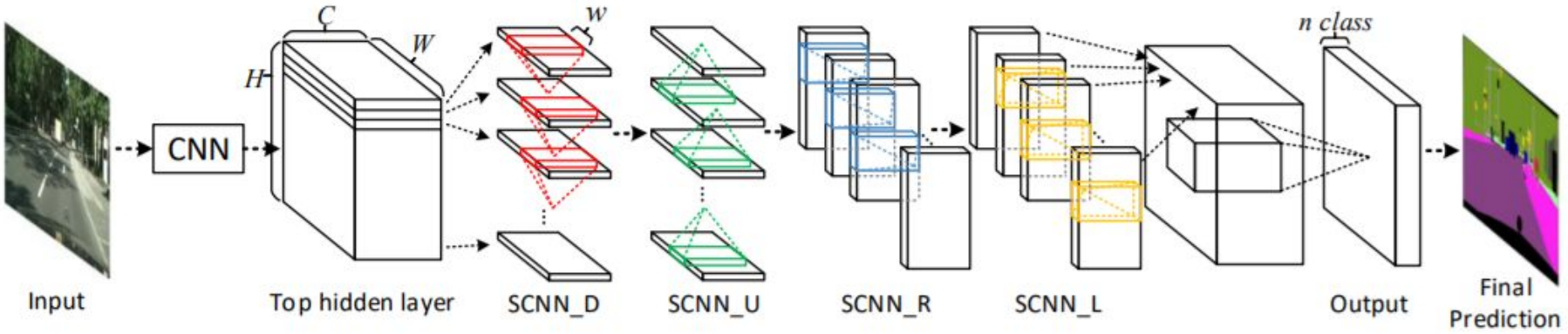
Spatial CNN



2-D detection

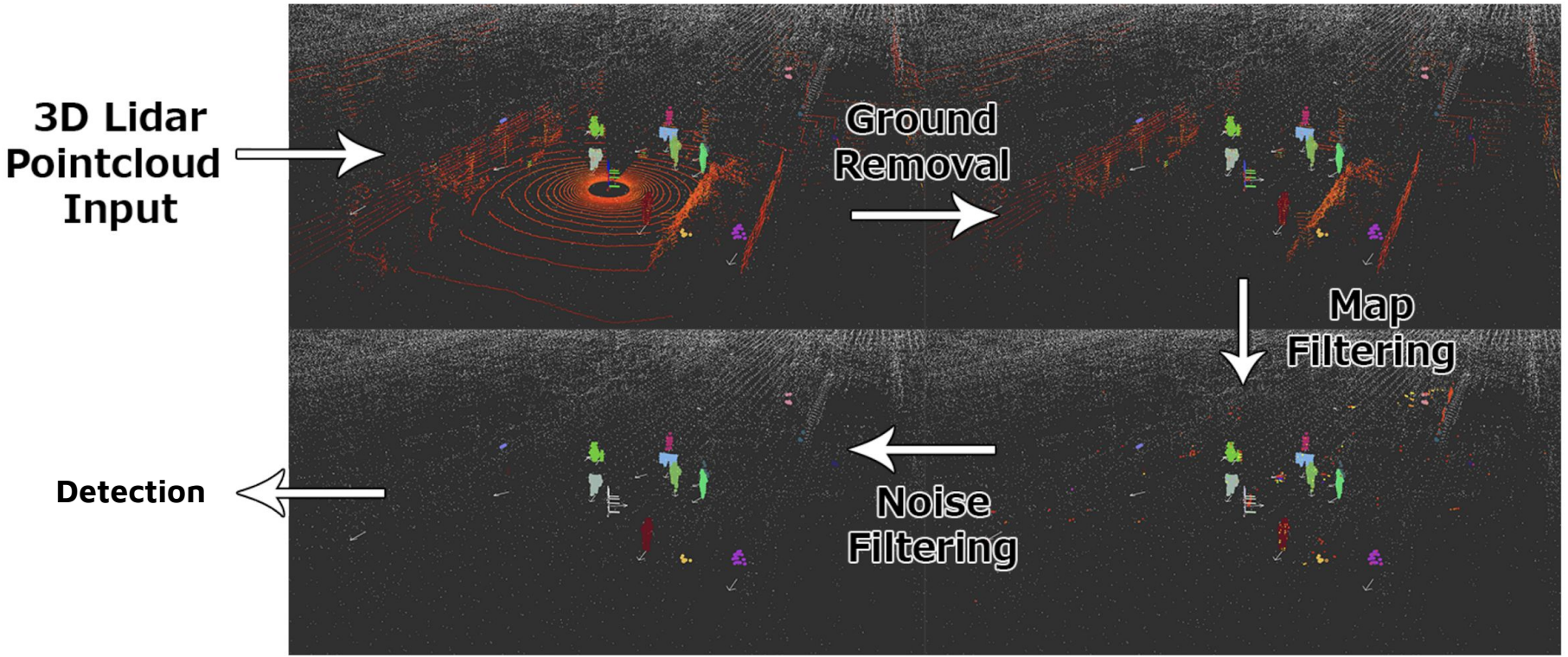
Tesla

2-D detection
Spatial CNN



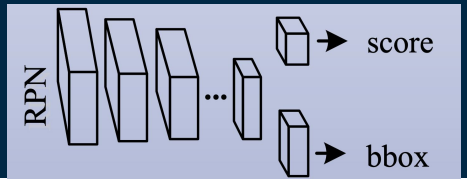
Paper

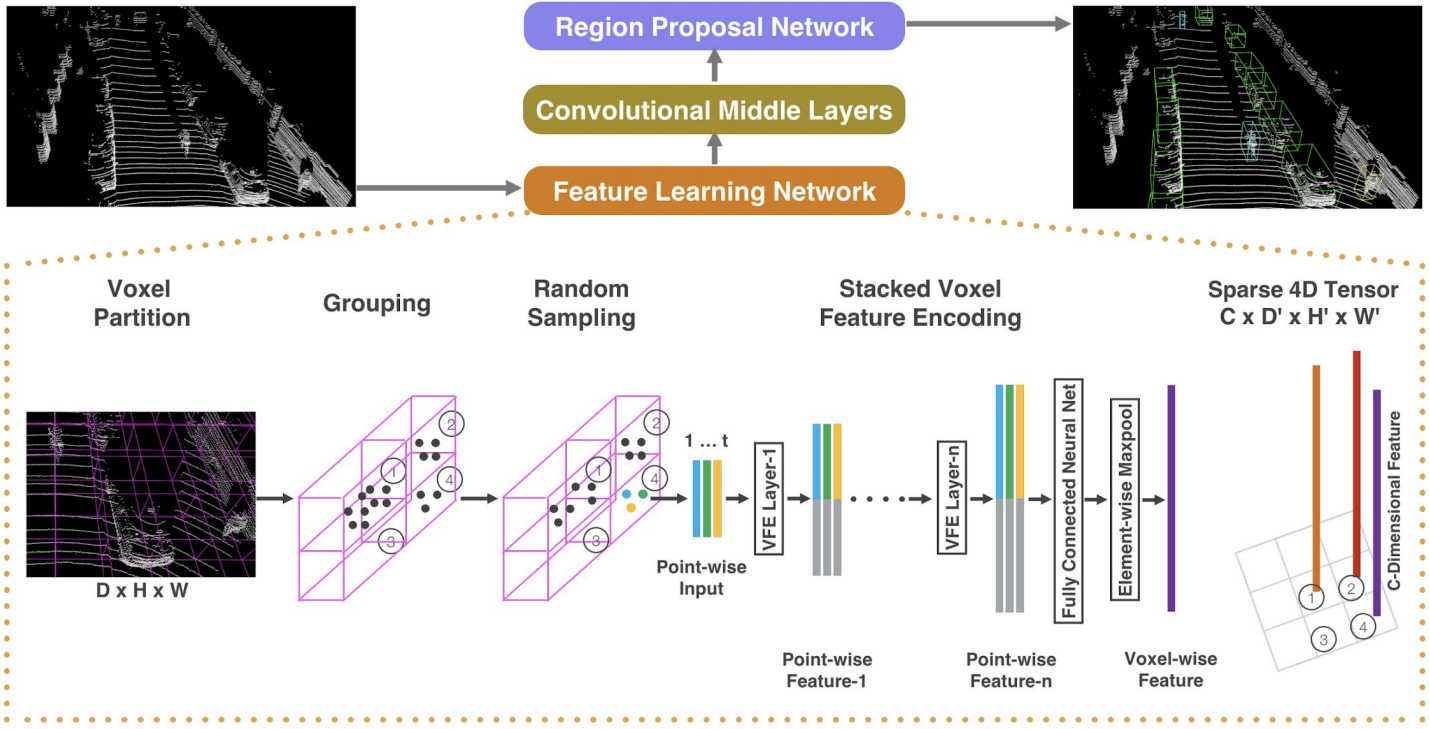
3-D detection



3-D detection

VoxelNet

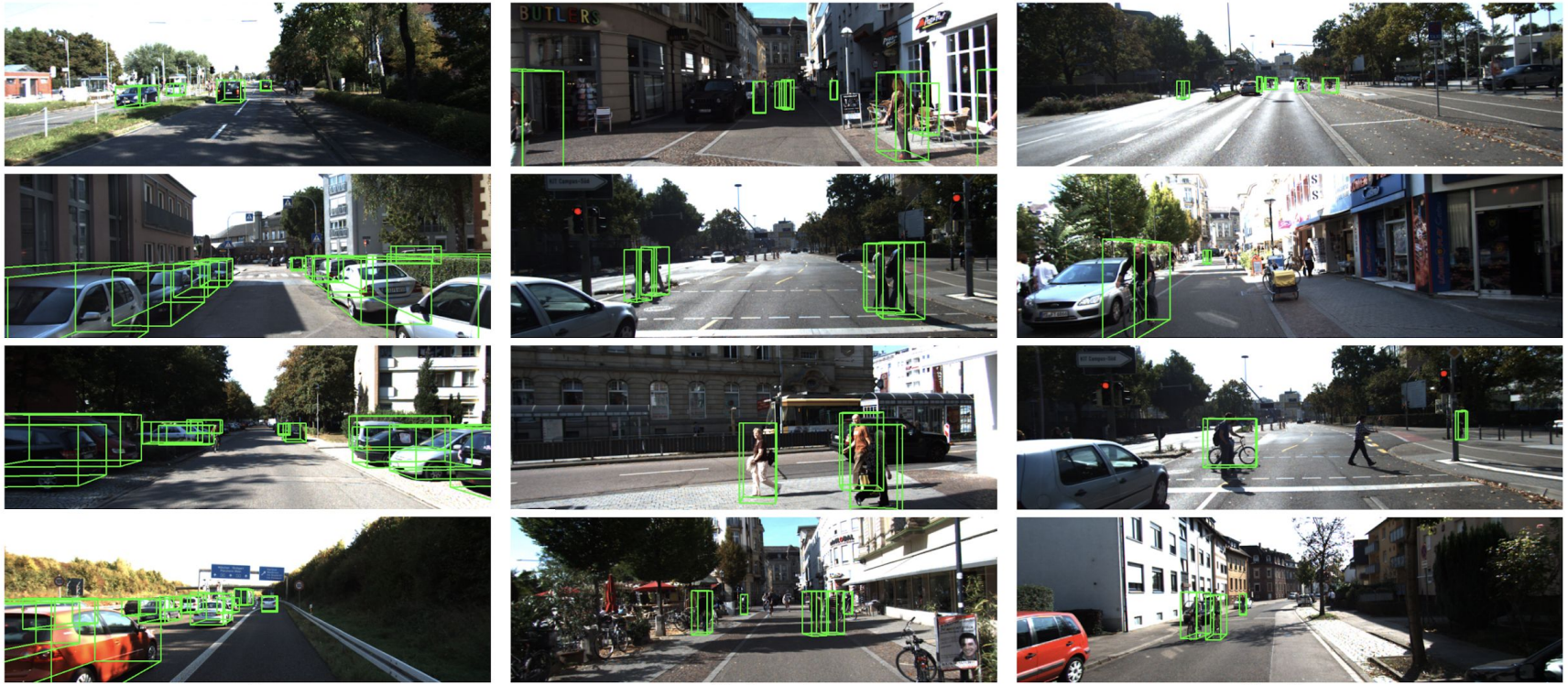




Paper

3-D detection

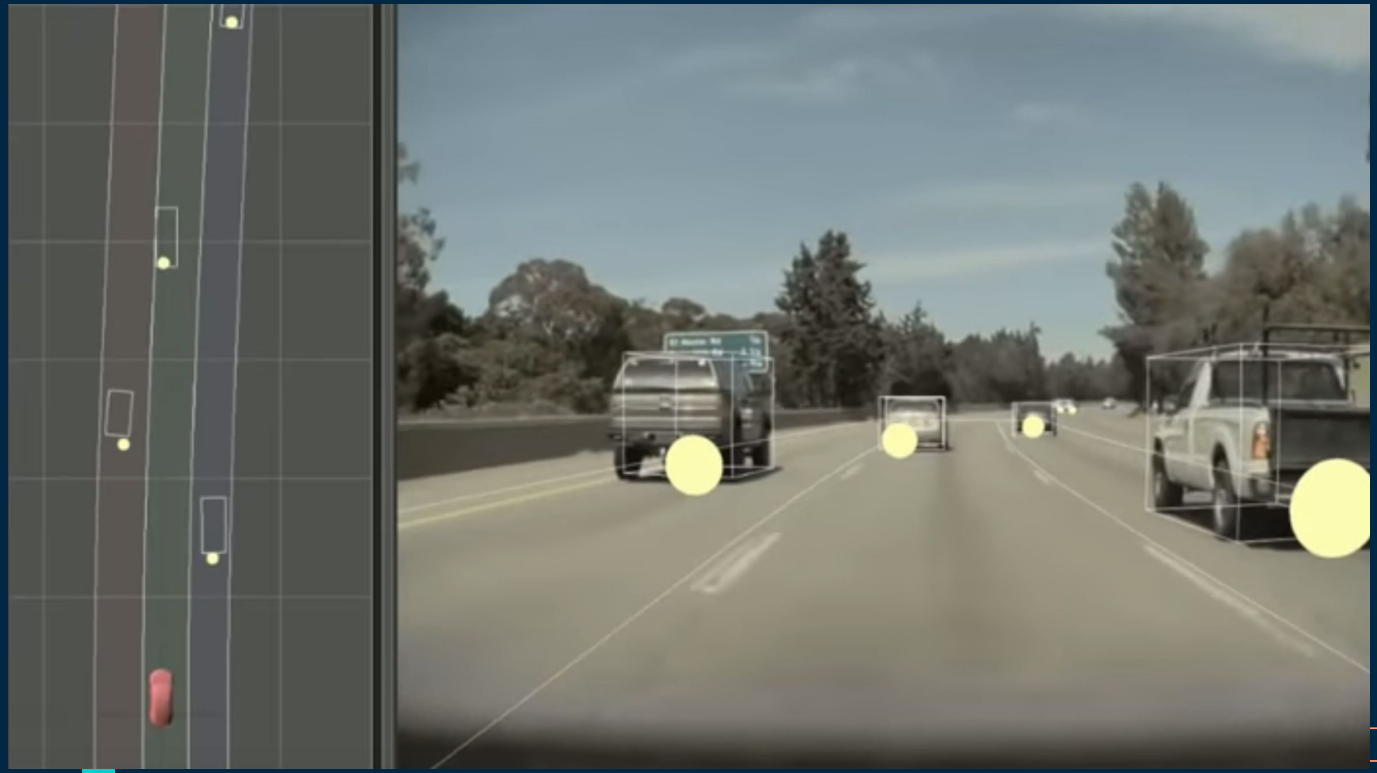
VoxelNet



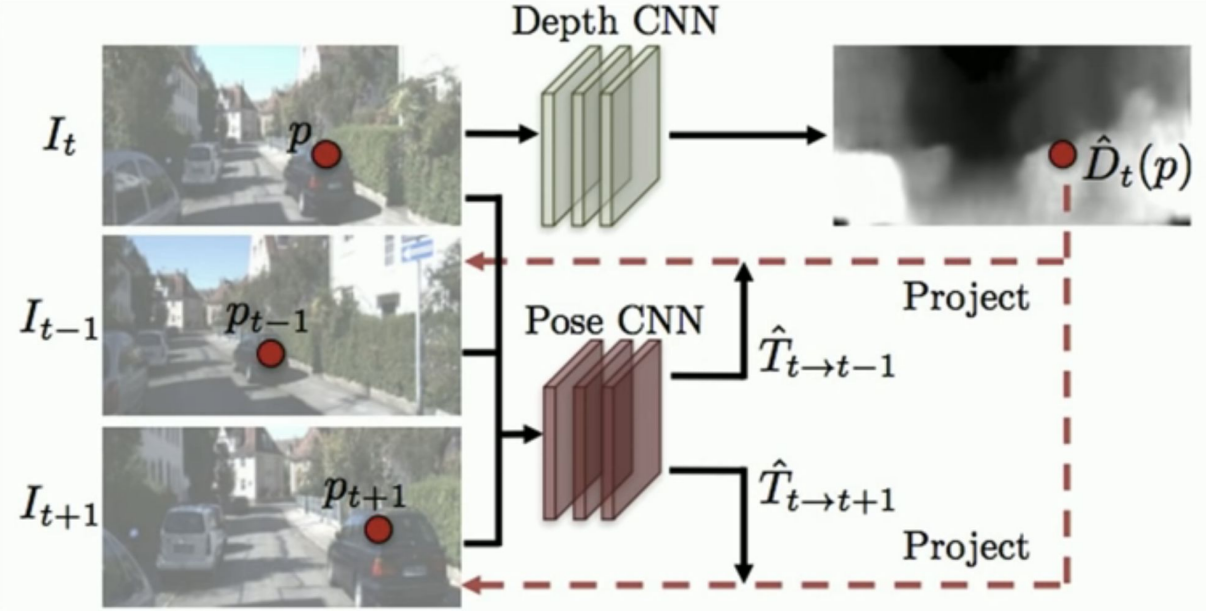
Distance

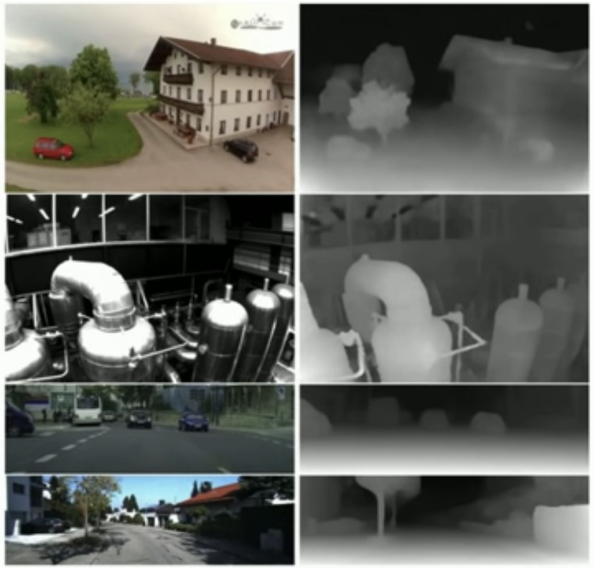
04

Radar



Self-supervision





Paper 1 Paper 2

THE END