



如何实现无人驾驶？

并 MIL 智能体组无人驾驶汽车项目介绍

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Intelligent Agent Group @ HDU

环境感知

360 度全方位

地理定位

高精度 (10cm)

路径规划

安全与路权

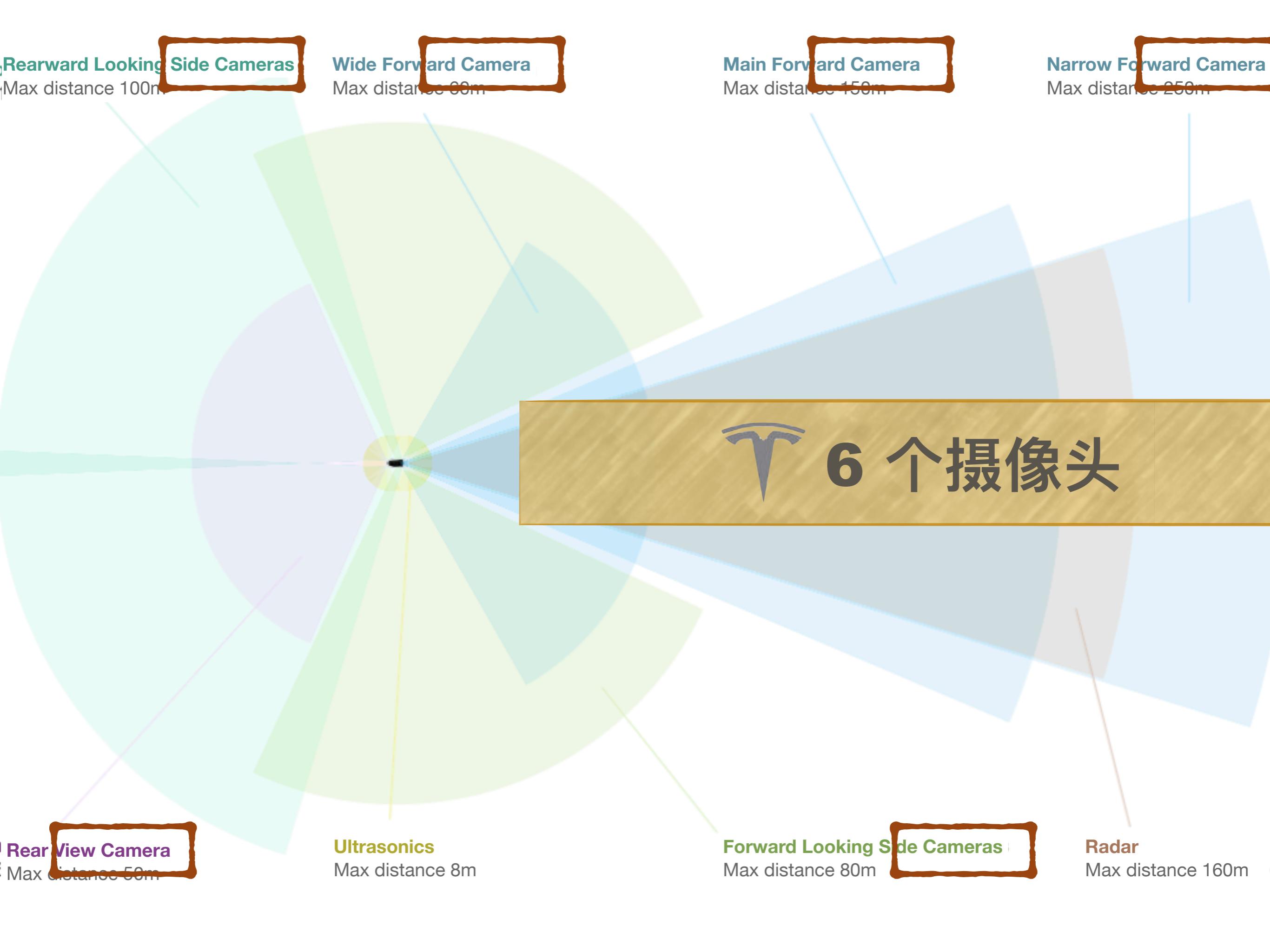
环境感知

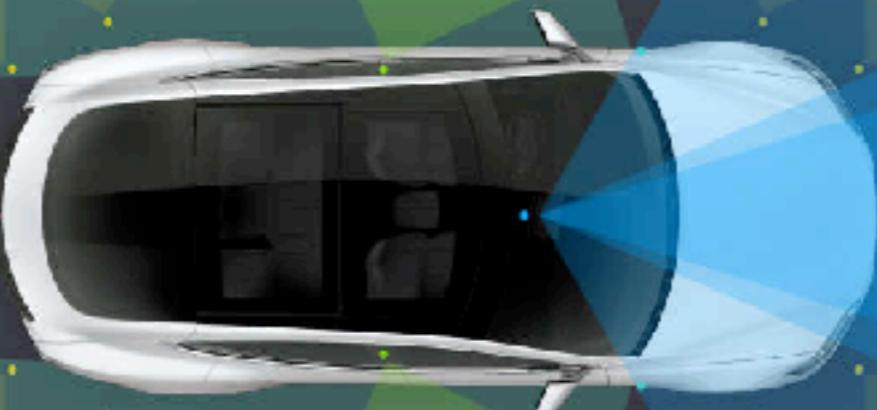
为什么使用摄像头？

	摄像头	激光雷达	毫米波雷达
分辨率	好	一般	差
抗噪能力	好	差	差
处理速度	差	差	好
气候鲁棒性	差	差	好
硬件大小	好	差	好

VIDEO





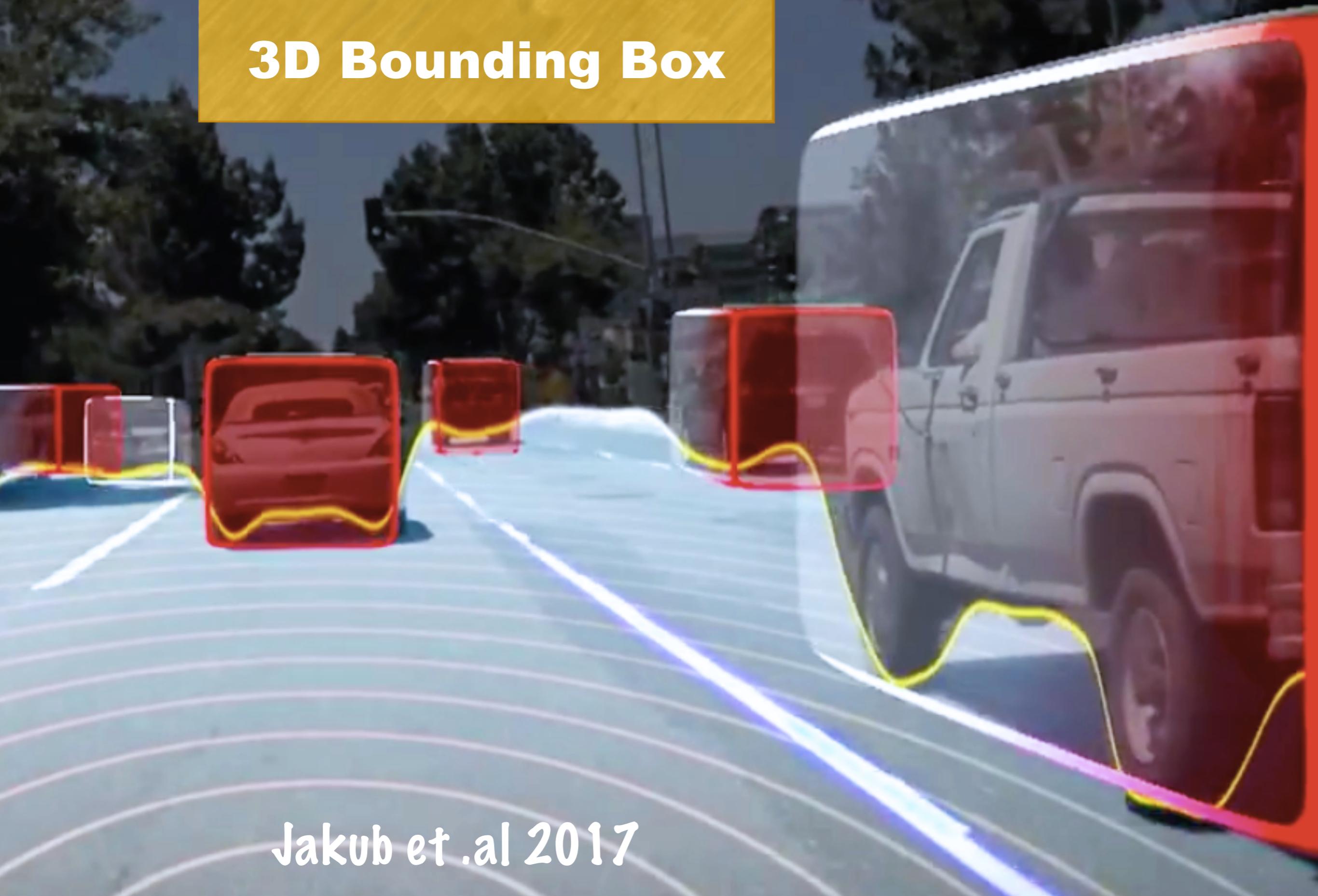


为什么每个方向都需要摄像头？

环境感知

Tasks

3D Bounding Box



Jakub et.al 2017

3D Bounding Box

Jakub et.al 2017

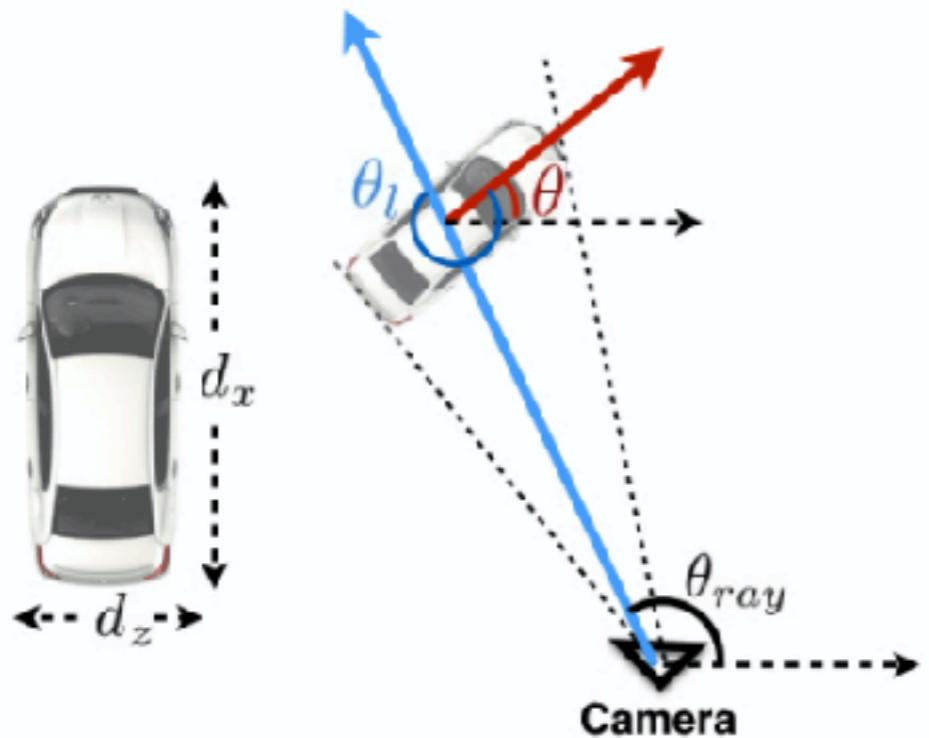
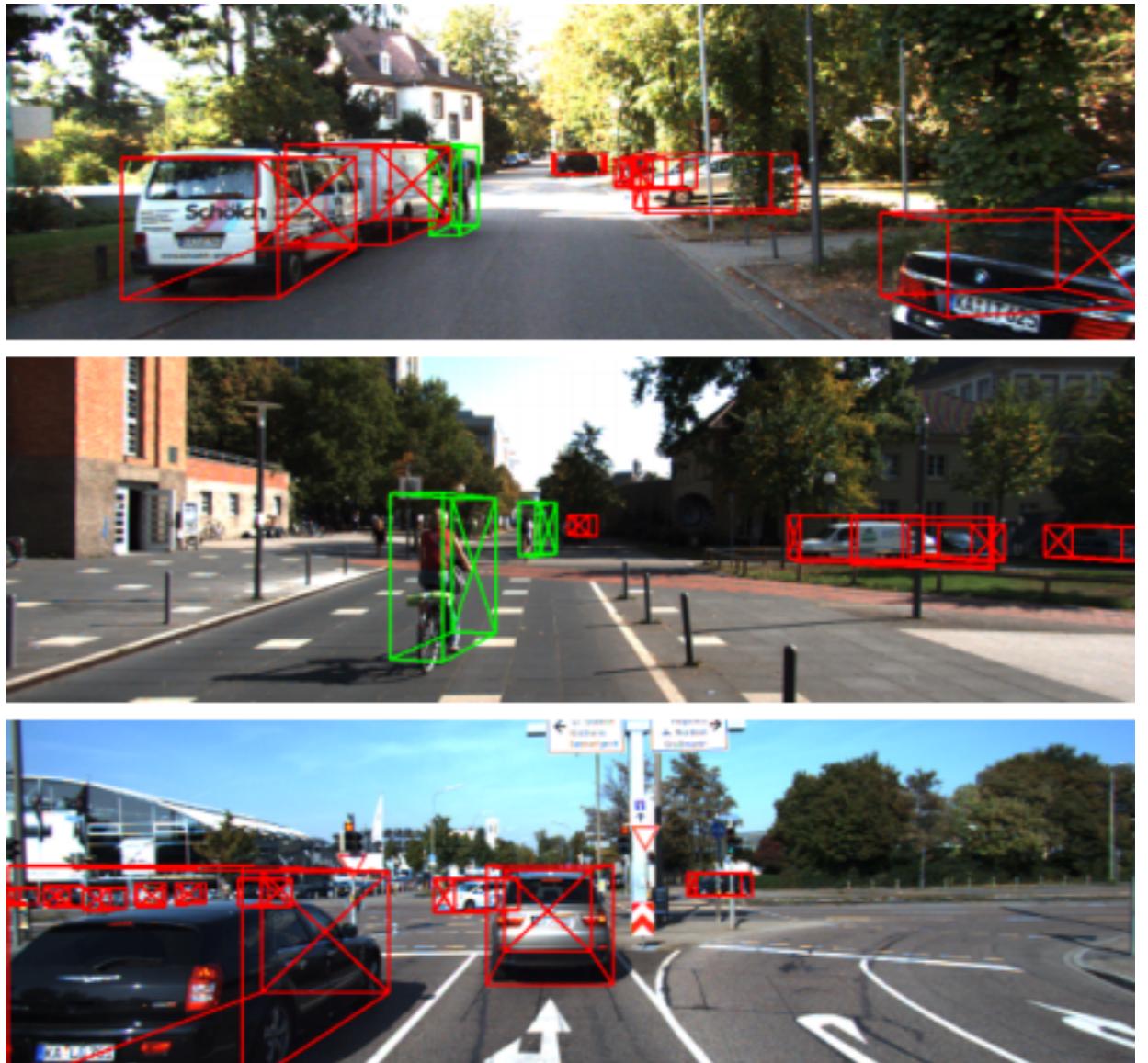


Figure 3. Left: Car dimensions, the height of the car equals d_y . Right: Illustration of local orientation θ_l , and global orientation of a car θ . The local orientation is computed with respect to the ray that goes through the center of the crop. The center ray of the crop is indicated by the blue arrow. Note that the center of crop may not go through the actual center of the object. Orientation of the car θ is equal to $\theta_{ray} + \theta_l$. The network is trained to estimate the local orientation θ_l .

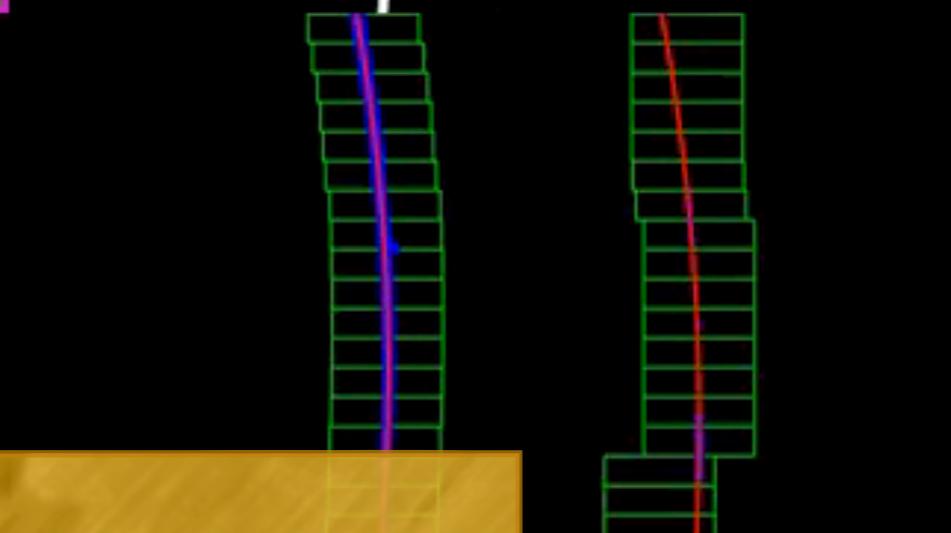


ure = 49.997(m)

in left of center

dark

dark (balanced)



Lane Detection

Driveable Area



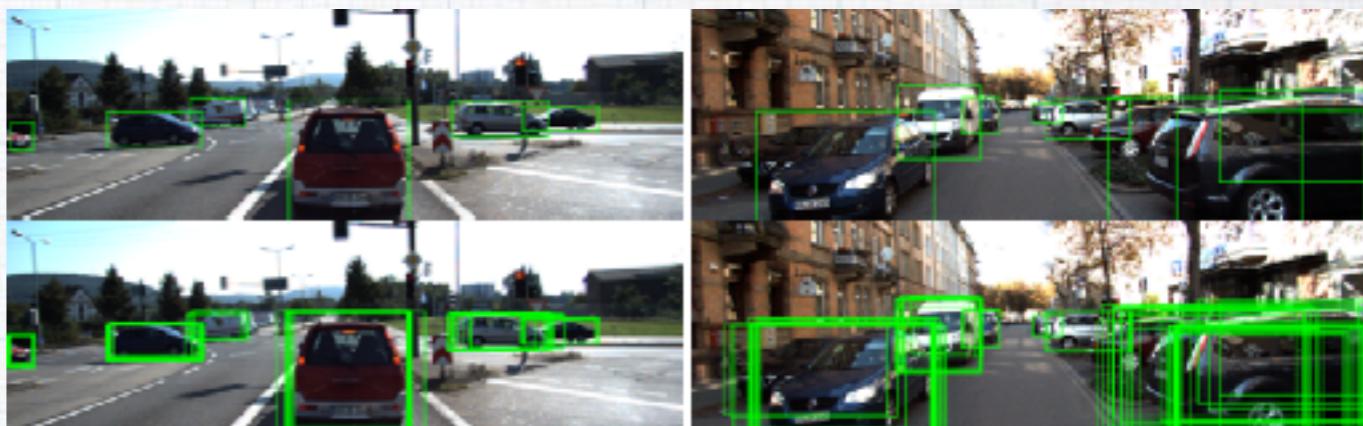
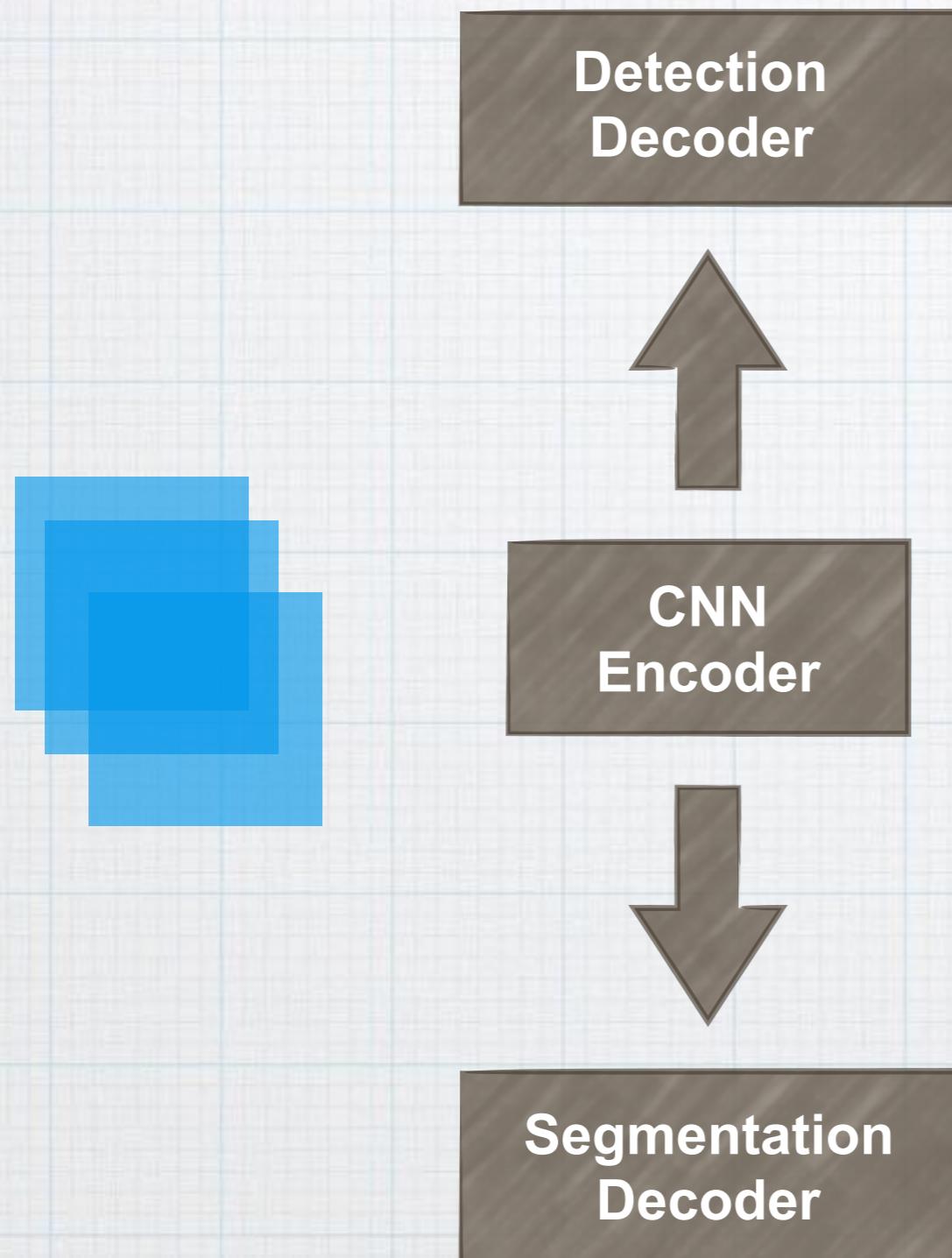
MultiNet

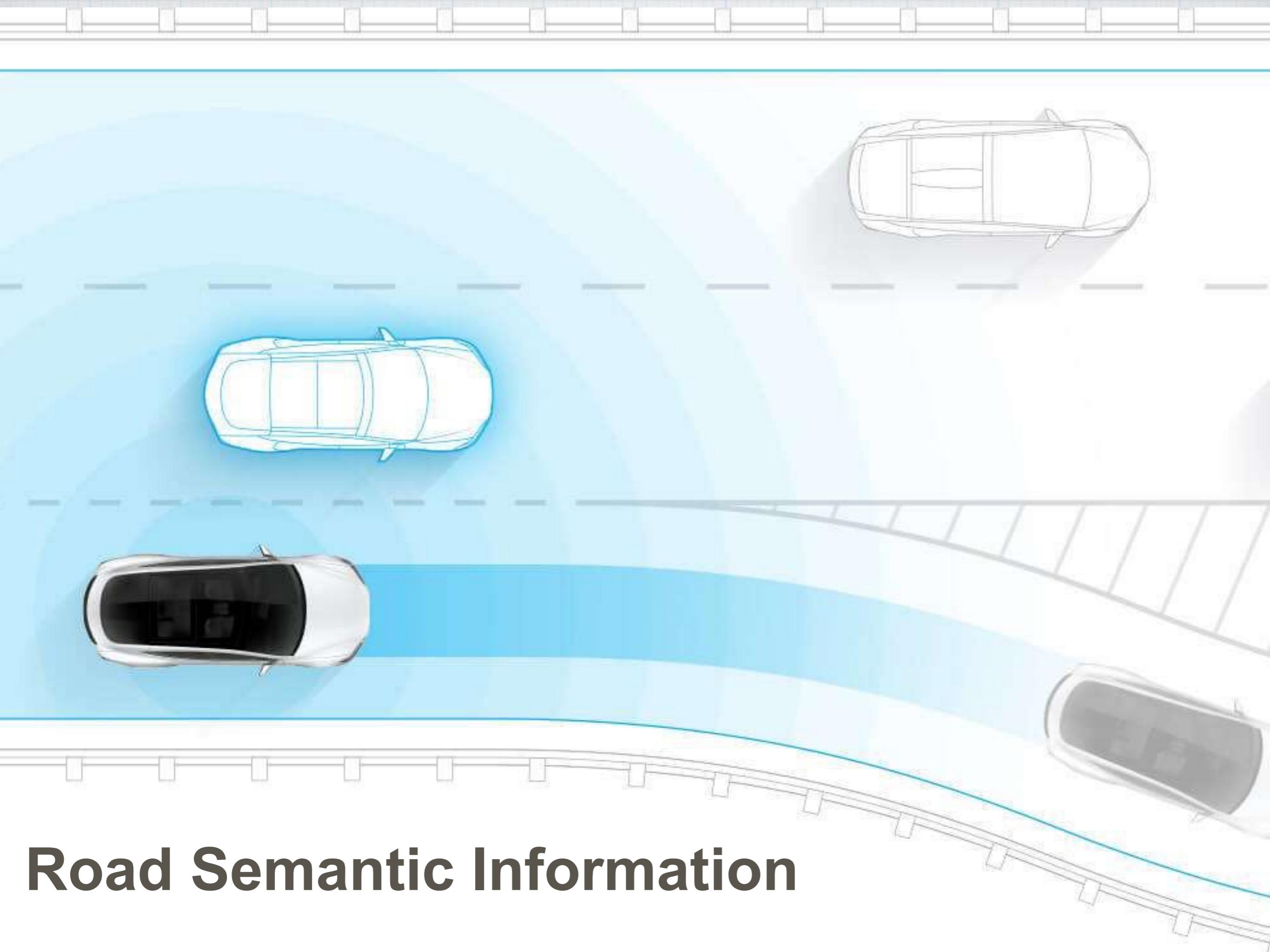
Marvin et.al 2016

street classification
vehicle detection
road segmentation

MultiNet

Marvin et.al 2016





Road Semantic Information

路径规划（控制）

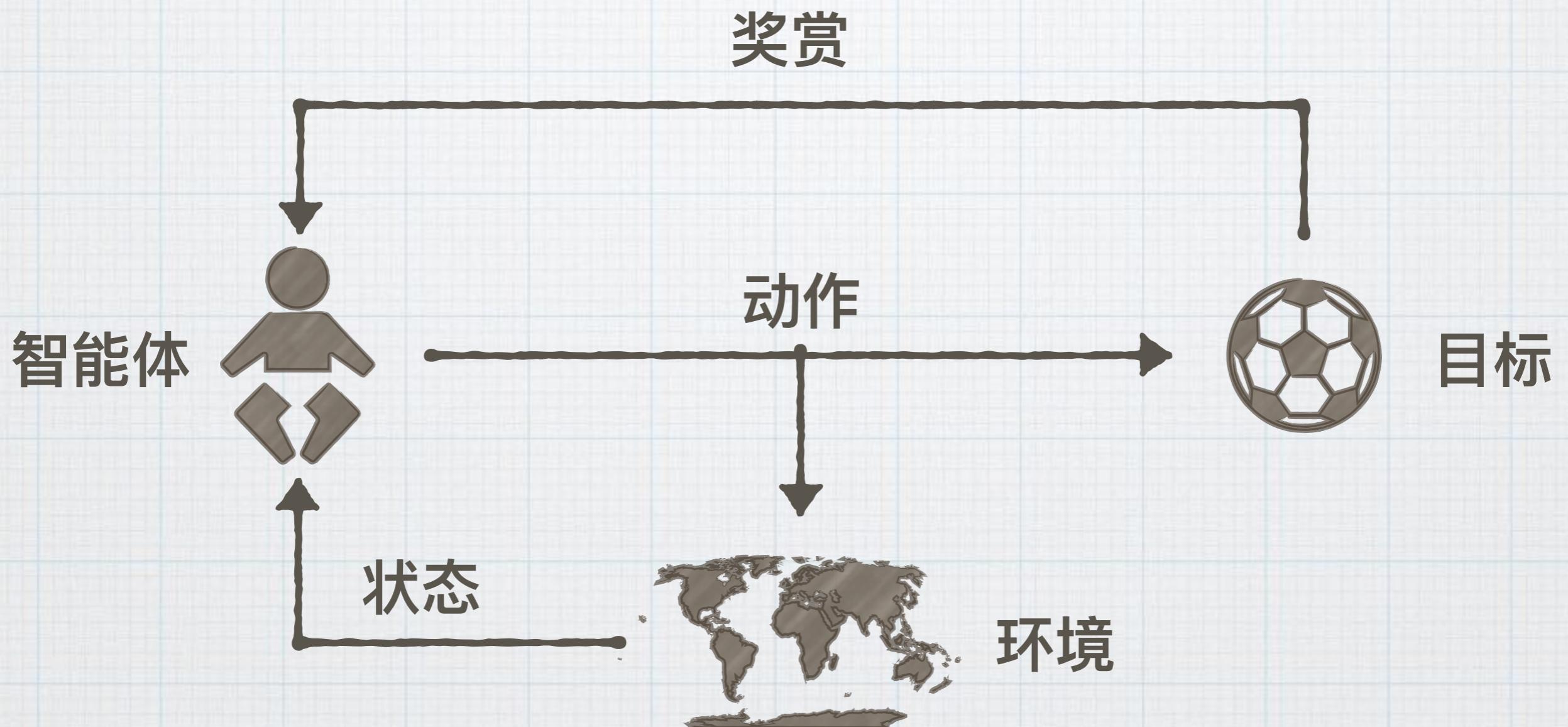
感知

- 对当下情况的判断
- 个体行动
- 理想的可预测性

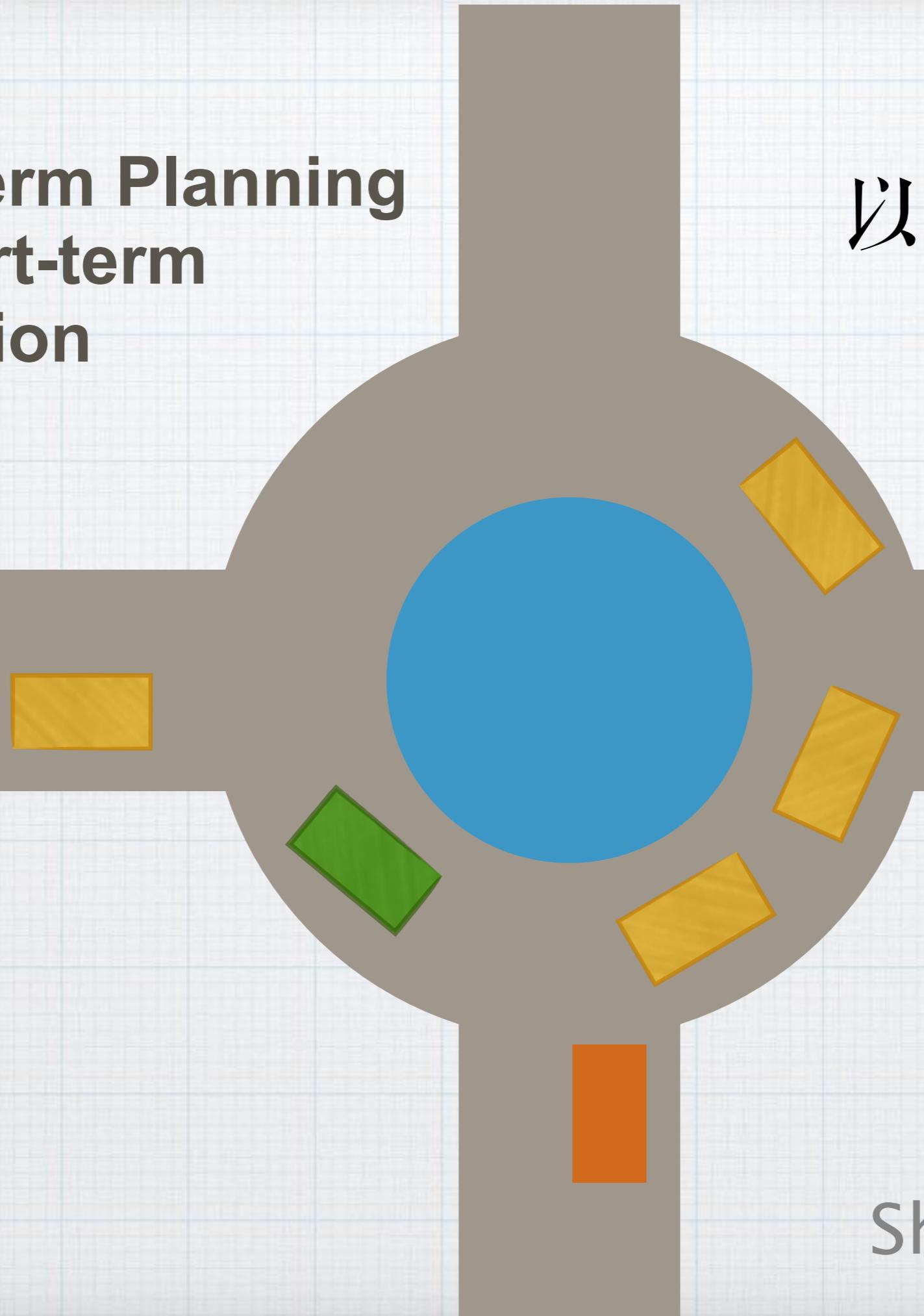
规划

- 对未来行动的计划
- 多人博弈
- 对未来的推测
- 不稳定的可预测性

Reinforcement Learning

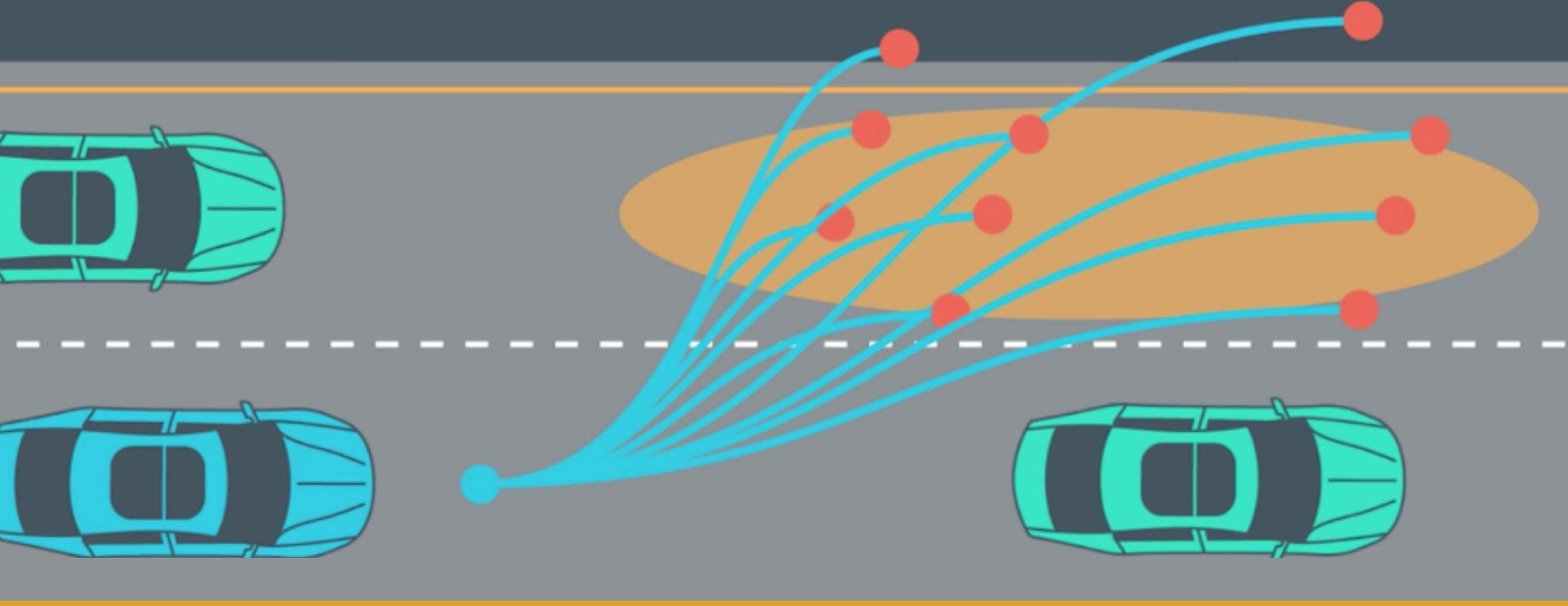


Long-term Planning by Short-term Prediction



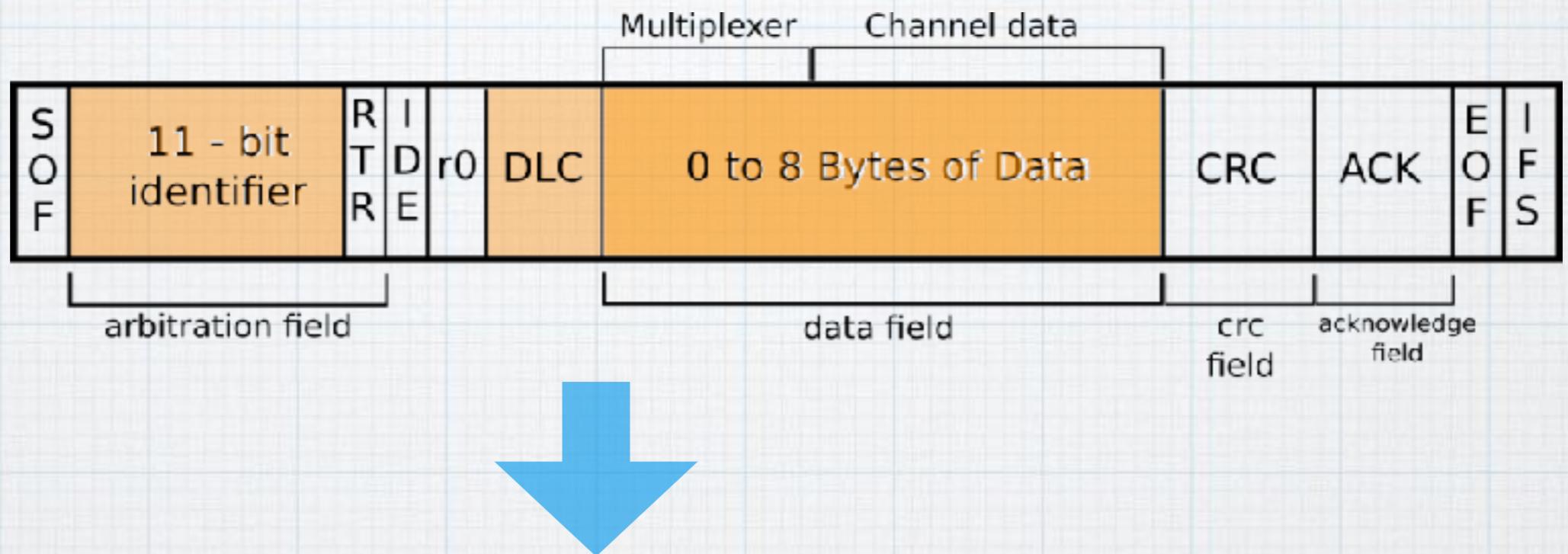
以安全为前提的
路权争夺

Shai et .al 2016



如何与车通信

CAN-Bus 协议



BO_ 228 STEERING_CONTROL: 5 ADAS

SG_ **STEER_TORQUE** : 7|16@0- (1,0) [-3840|3840] "" EPS

SG_ STEER_TORQUE_REQUEST : 23|1@0+ (1,0) [0|1] "" EPS

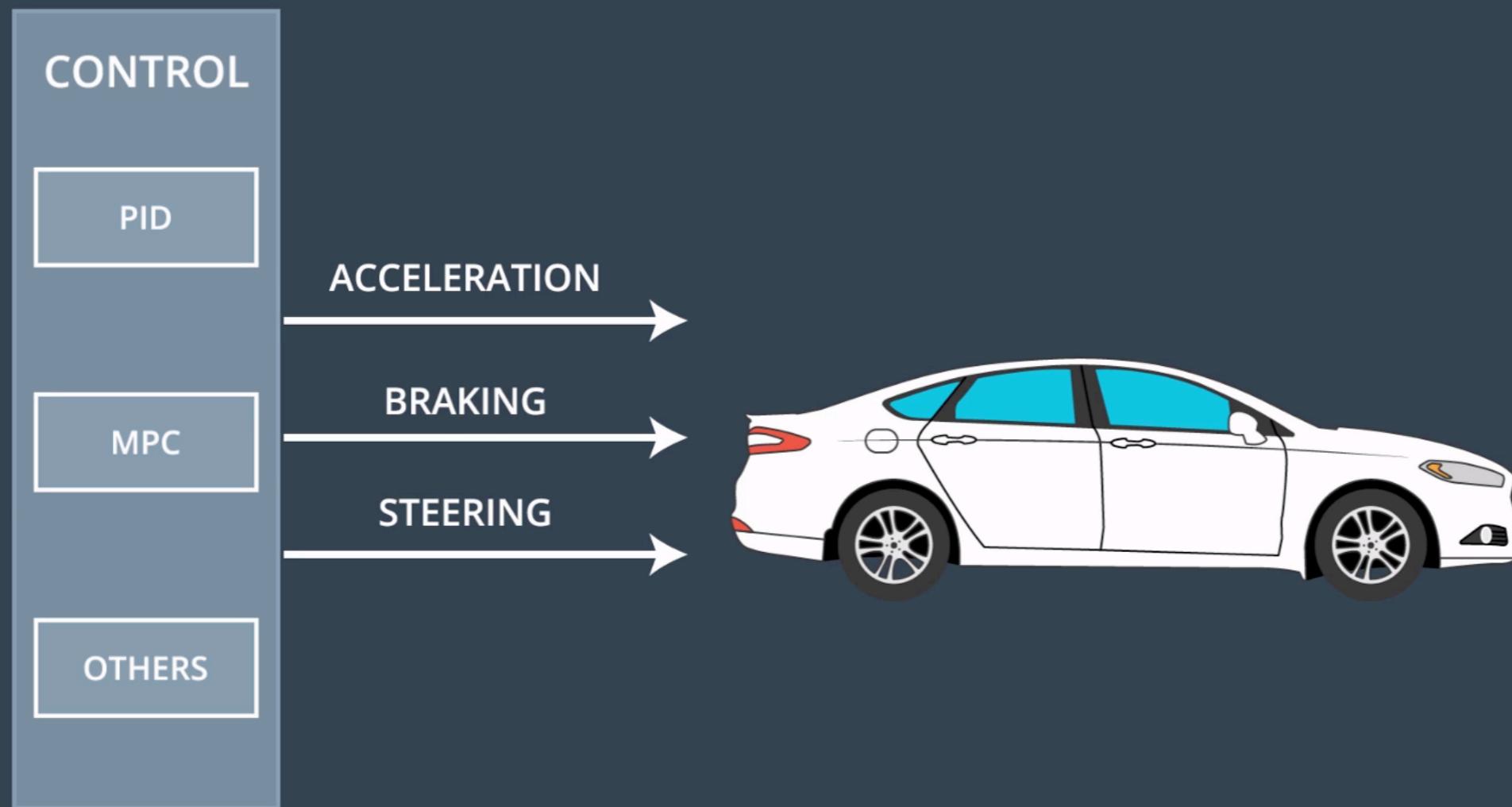
SG_ CHECKSUM : 39|4@0+ (1,0) [0|15] "" EPS

SG_ COUNTER : 33|2@0+ (1,0) [0|3] "" EPS

如何控制车到达指定位置？

BO_330 STEERING_SENSORS: 8 EPS

SG_STEER_ANGLE : 7|16@0- (-0.1,0) [-500|500] "deg" NEO



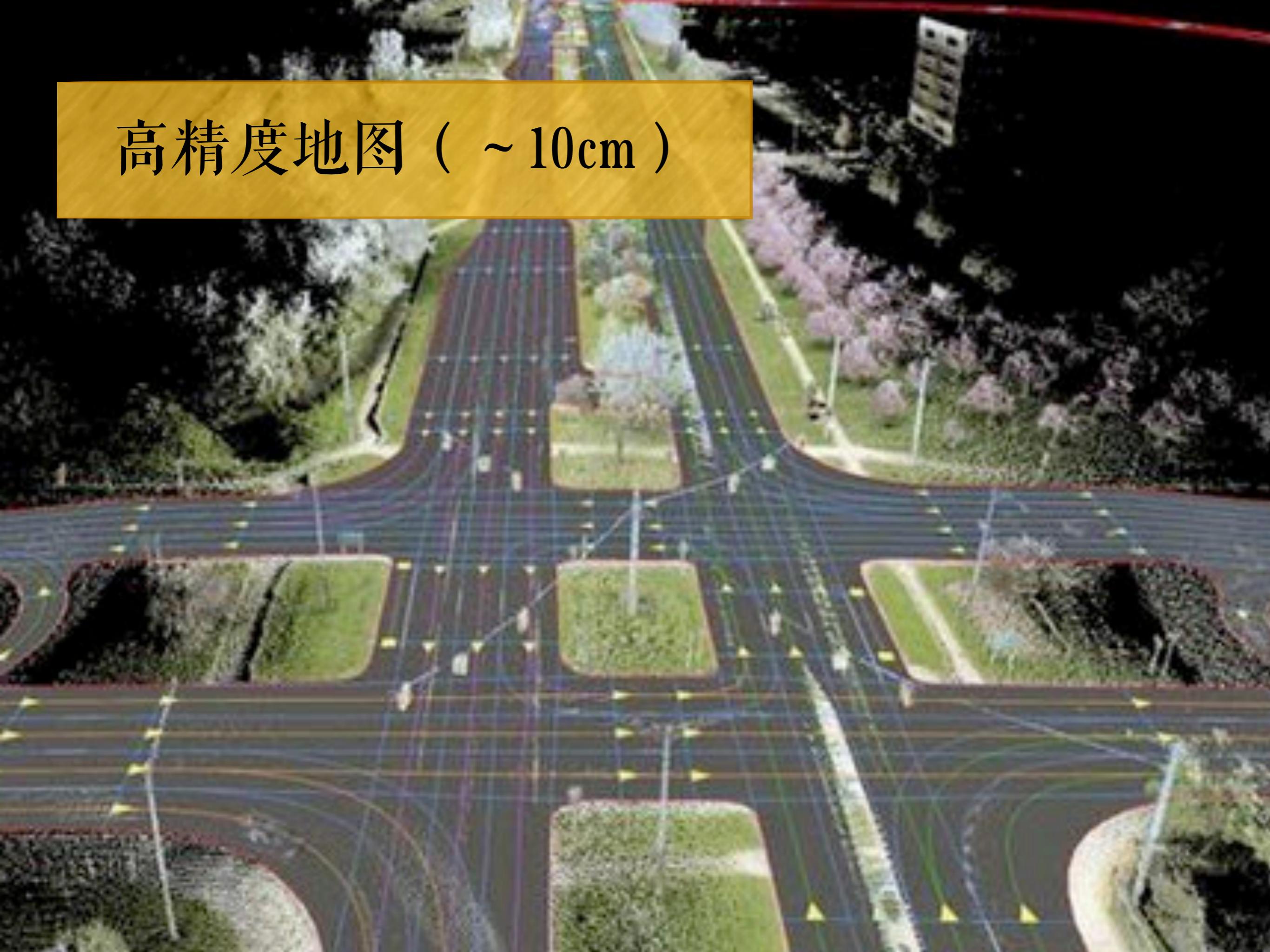
地理定位

Localization

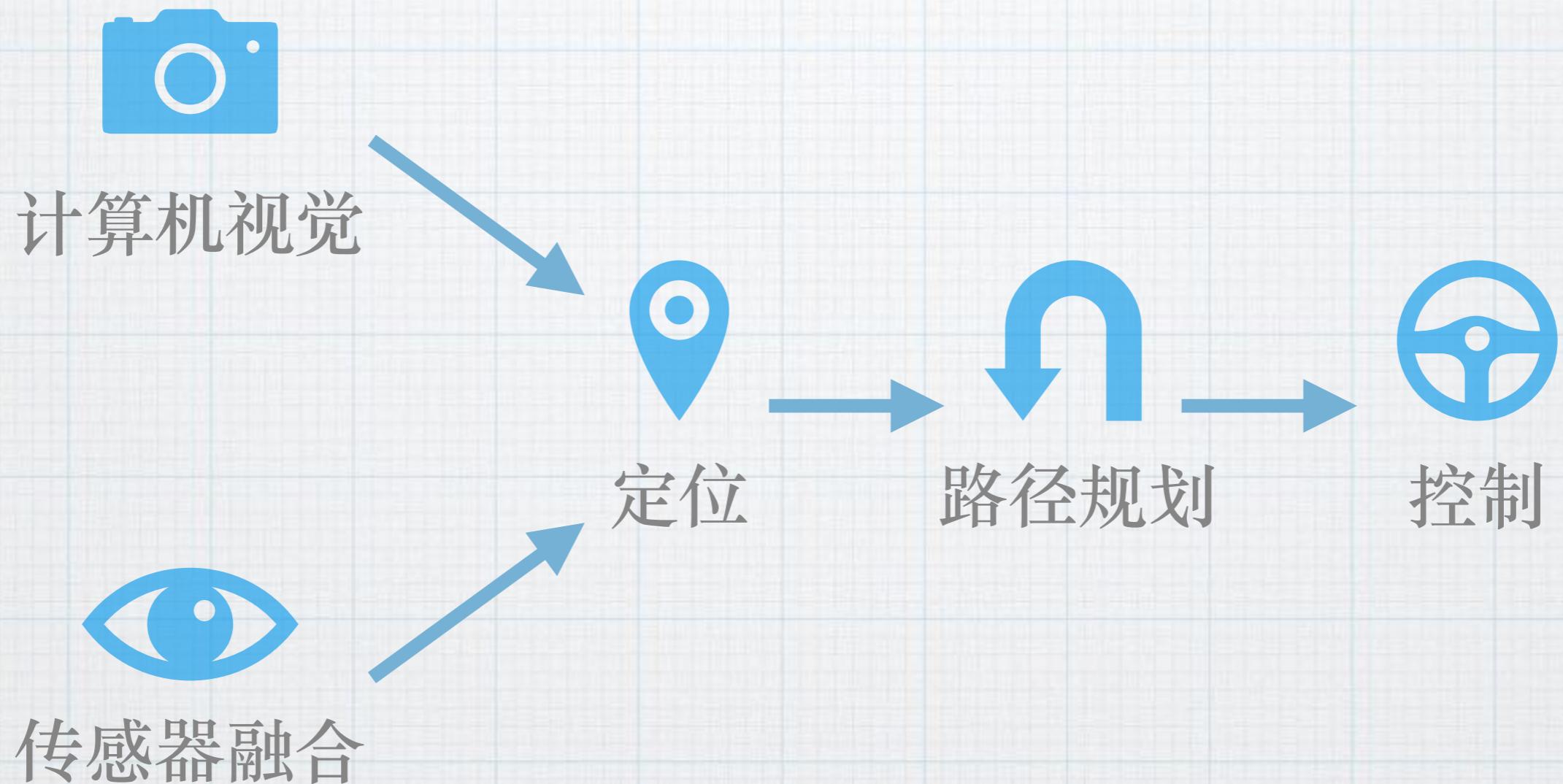
普通导航地图 (~10m)



高精度地图（~10cm）



无人车的运行机制



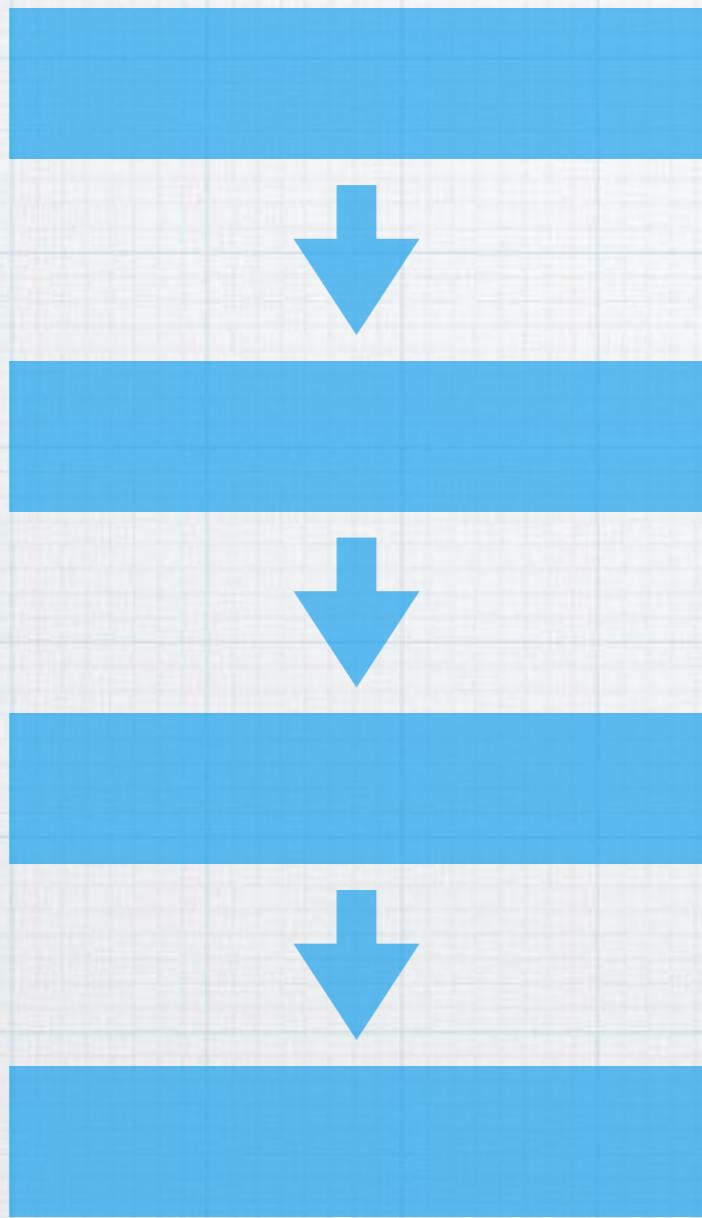
挑战：多模块的集成

系统安全

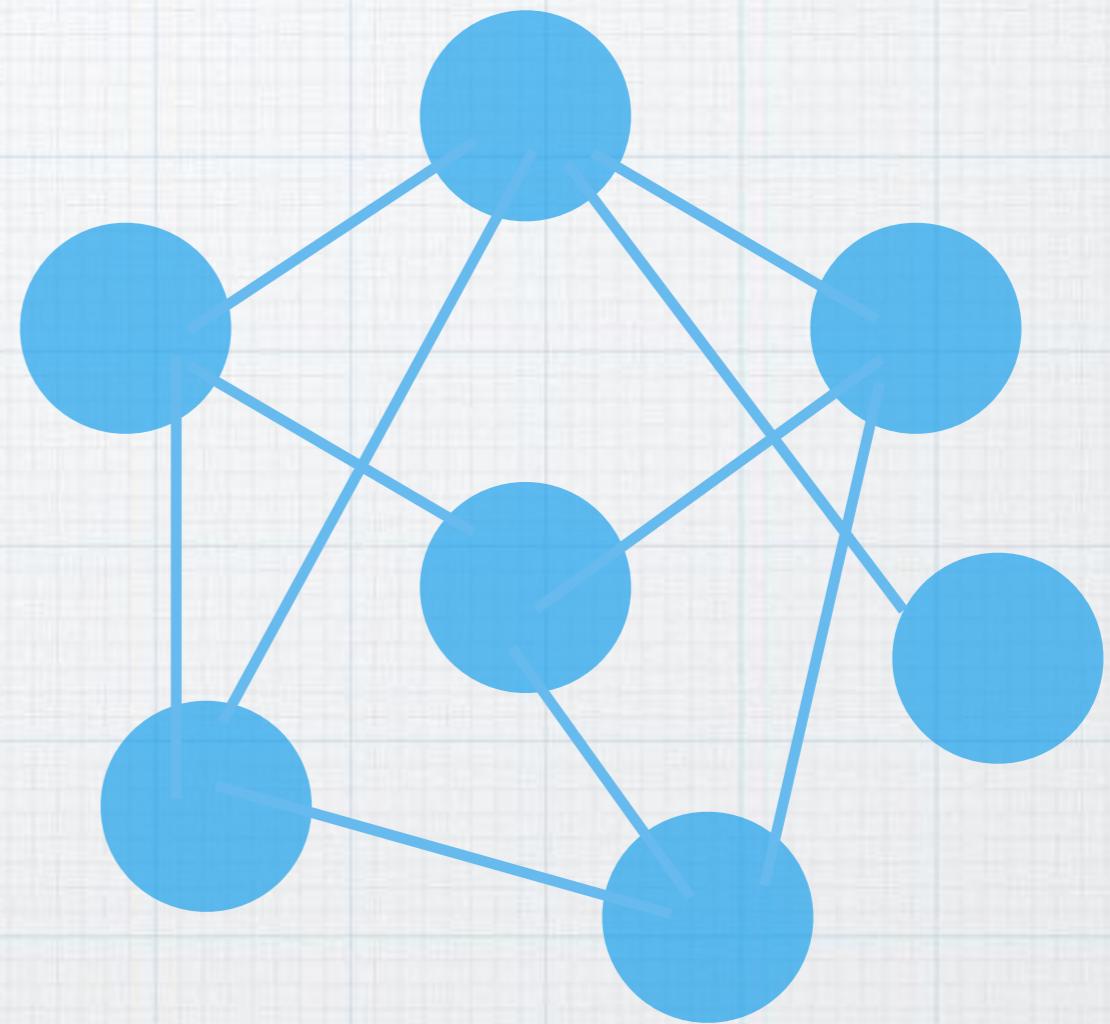
模块通信

资源分配

顺序式结构



分布式结构
(去中心化)

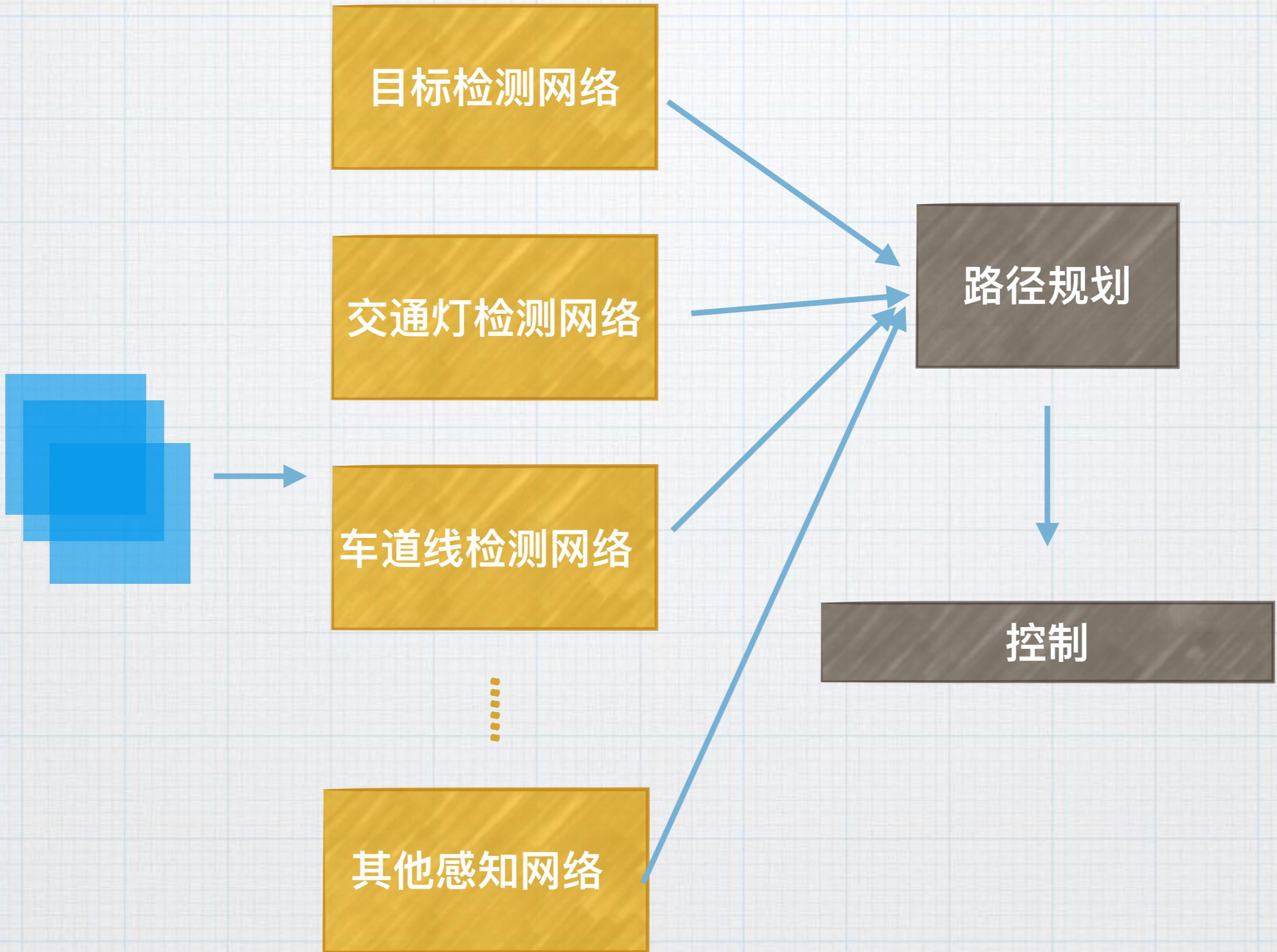


The ROS logo consists of a dark blue square containing a 3x3 grid of white dots. To its right, the letters "ROS" are written in a bold, dark blue sans-serif font.

ROS

The ØMQ logo consists of the letters "ØMQ" in a bold, red sans-serif font. A large, red circle with a diagonal slash through it is positioned to the left of the letter "Ø".

ØMQ



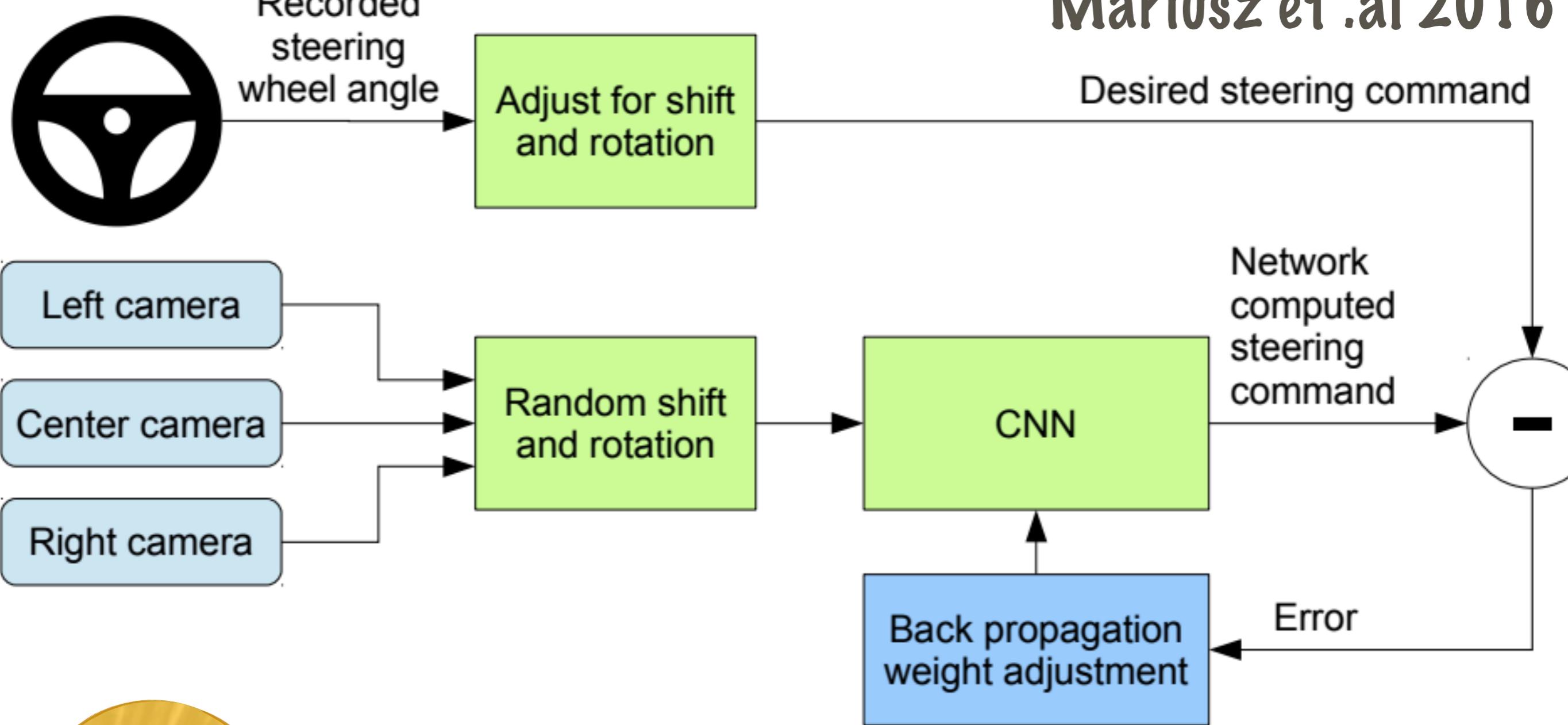
End-to-End 模型



不聪明

不灵活

难理解



效果好

仿真实验中，90% 的情况下 CNN 可以自动驾驶
路测表明，不同路况自动驾驶的概率为 98%

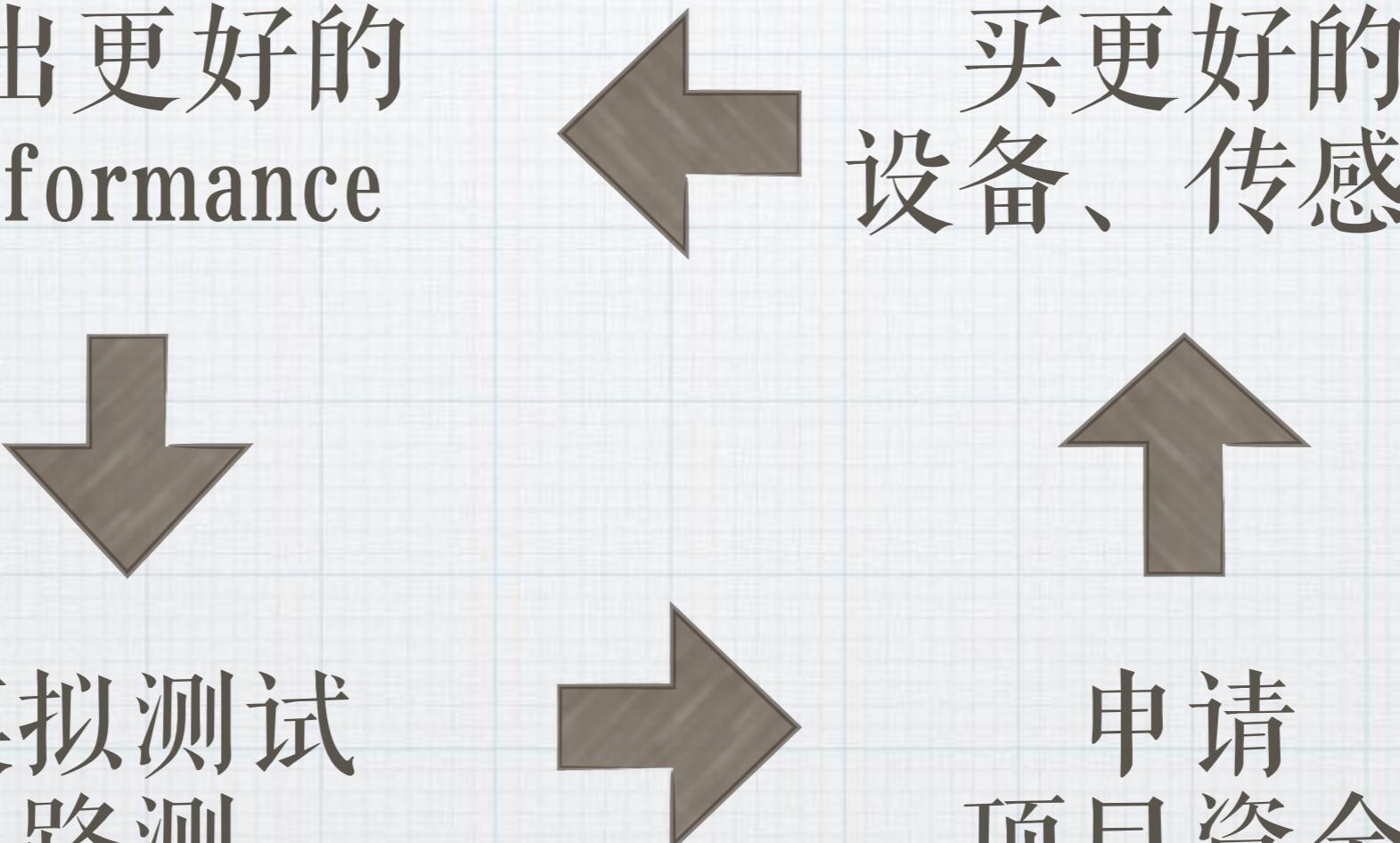
项目运转

做出更好的
performance

买更好的
设备、传感器

模拟测试
路测

申请
项目资金



技术贡献至上



QA