SIP-adus Workshop 2022

Virtual validation methodology for AD safety assurance

Effectiveness verification of autonomous vehicle evaluation using simulation

In order to verify the effectiveness of the autonomous vehicle, the real autonomous vehicle developed by "Research on the recognition technology required for automated driving technology (Lv. 3 and 4)" (hereinafter called "AD-URBAN") is connected to the DIVP® simulation, and sensor recognition for performance and safety evaluation.

We are working on simulation reproduction and safety evaluation based on the sensing weakness conditions observed by AD-URBAN in the Tokyo waterfront area.

Real world; Autonomous Vehicle Systems ⇄ **Virtual world**; Space and Sensor Modeling

金沢大学 KANAZAWA UNIVERSITY AD-URBAN

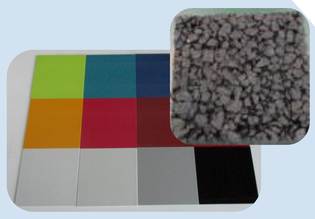
DIVP

① Sharing sensing weakness conditions observed in real world → ② Factor analysis and construction of simulation model

Traffic light undetected

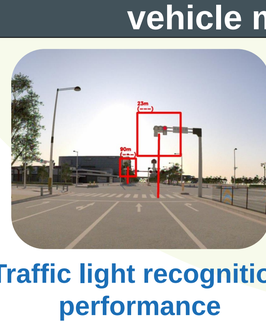
Self-position indeterminate

Traffic Participants/3D Map Model

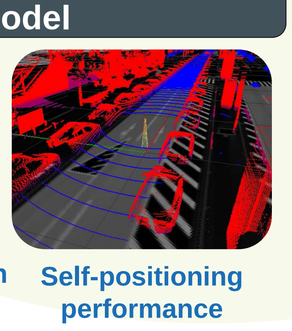


Material model (painting and asphalt)

⑤ Safety evaluation of autonomous vehicle model ← ④ Reproduction and provision of sensor weakness scenes ← ③ Consistency verification of simulation model

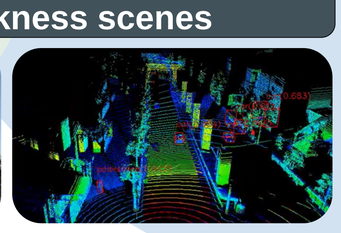


Traffic light recognition performance



Self-positioning performance

Backlight (traffic light)



Thermal barrier coating road surface

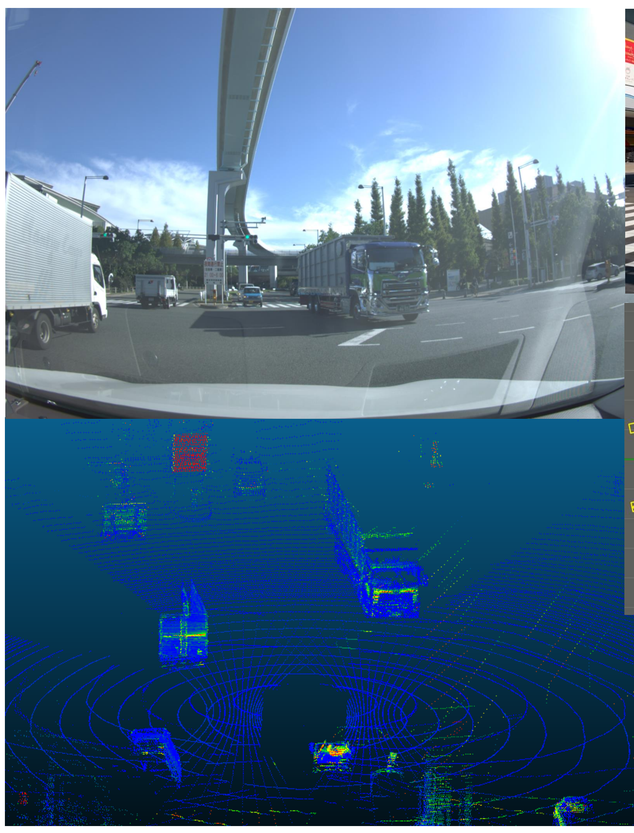
Camera model verification（Real / Virtual）

Case study：Reproduction and utilization of trajectory data obtained on public roads

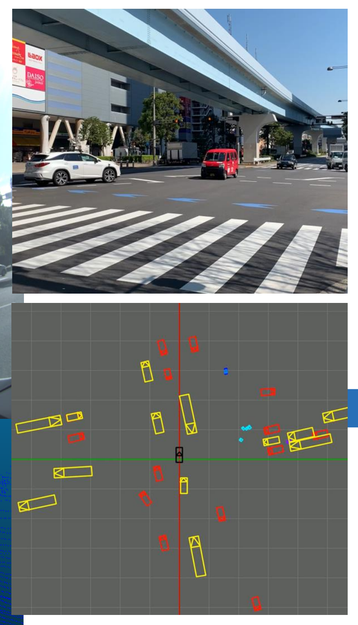
By reproducing the evaluation scene on the simulation from the trajectory data of ego-vehicle and surrounding vehicles obtained on public roads, it is possible to evaluate the recognition performance according to the change of the sensor position.

In this research, we are also verifying that multi-condition safety evaluation can be performed efficiently by adding more severe conditions for autonomous vehicle (e.g. rainy weather, additional vehicles in the vicinity and so on).

Trajectory data on public road

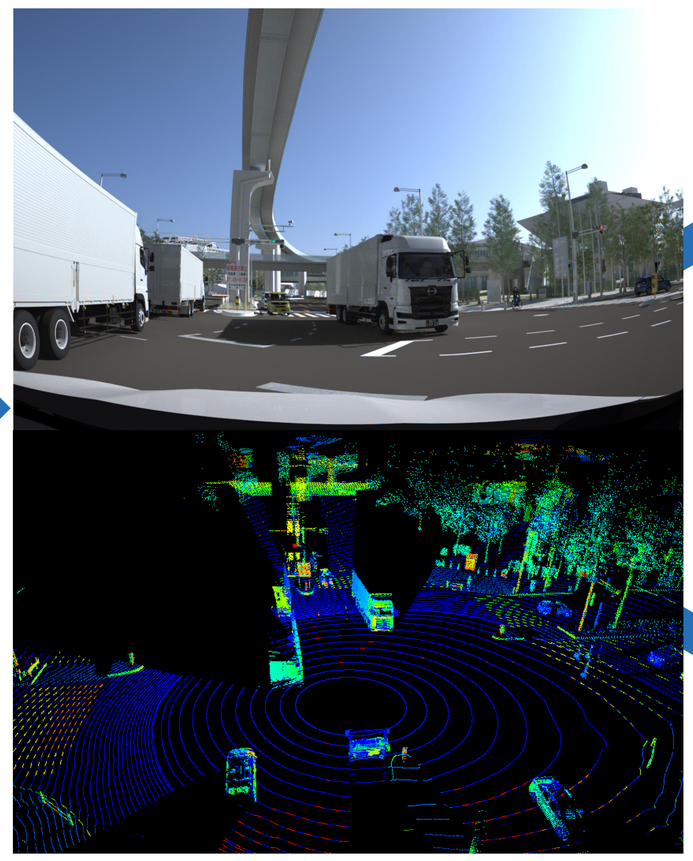


Real sensor data (Camera/LiDAR)



Trajectory data of ego-vehicle and surrounding vehicles

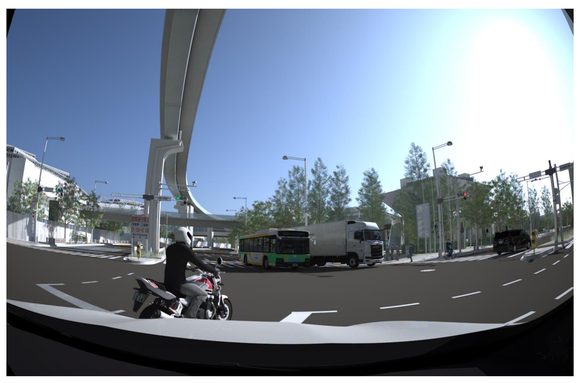
Simulation reproduction



Adding more severe conditions

Change to rainy condition

Additional vehicles in the vicinity



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