Edge Case Hunting

in Scenario Based Virtual Validation of AVs

atlatec

Regulations discourage virtual testing

Today, the software of AV companies is the real product. The hardware and physical components — lidar, sensors, etc. — of AV vehicles have become so uniform, they're practically off-the-shelf. The real component that is being tested is software. It's well-known that software bugs are best found by running the software as often as possible; road testing simply can't reach the sheer numbers necessary to find all the bugs. What can reach those numbers is virtual testing.

However, the regulations discourage virtual testing as the lower reported road miles would seem to imply that a company is not road-ready.

Jack Stewart of **NPR's** Marketplace expressed a similiar point of view:

"There are things that can be relatively bought off-the-shelf and, more so these days, there are just a few companies that you can go to and pick up the hardware that you need. It's the software, and it's how many miles that software has driven both in simulation and on the real roads without any incident."

So, where can we find the real data we need to compare AV companies? One company runs over 30,000 instances daily through its end-to-end, three-dimensional simulation environment. Another company runs millions of off-road tests a day through its internal simulation tool, running driving models that include scenarios that it can't test on roads involving pedestrians, lane merging and parked cars. Waymo drives 20 million miles a day in its **Carcraft** simulation platform — the equivalent of over 100 years of real-world driving on public roads.

One CEO estimated that a single virtual mile can be just as insightful as 1,000 miles collected on the open road.

Jonathan Karmel, Waymo's product lead for simulation and automation, similarly explained that Carcraft provides "the most interesting miles and useful information."

Where we go from here

Clearly there are issues with disengagement reports — both in relying on the data therein and in the negative incentives they create for AV companies. However, there are *voluntary* steps that the AV industry can take to combat some of these issues:

1. **Prioritize and invest in virtual testing**. Developing and operating a robust system of virtual testing may present a high expense to AV companies, but it also presents the opportunity to dramatically shorten the pathway to commercial deployment through the ability to test more complex, higher risk and higher number scenarios.
2. **Share data from virtual testing**. Voluntary disclosure of virtual testing data will reduce reliance on disengagement reports by the public. Commercial readiness will be pointless unless AV companies have provided the public with reliable data on AV readiness for a sustained period.
3. **Seek the greatest value from on-road miles**. AV companies should continue using on-road testing in California, but they should use those miles to fill in the gaps from virtual testing. They should seek the greatest value possible out of those slower miles, accept the higher percentage of disengagements they will be required to report, and when reporting on those miles, describe their context in particularity.

With these steps, AV companies can lessen the pain of California's disengagement reporting data and advance more quickly to an AV-ready future.

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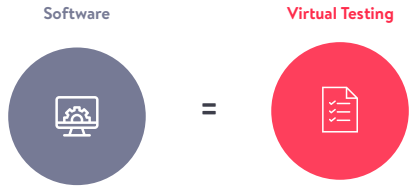

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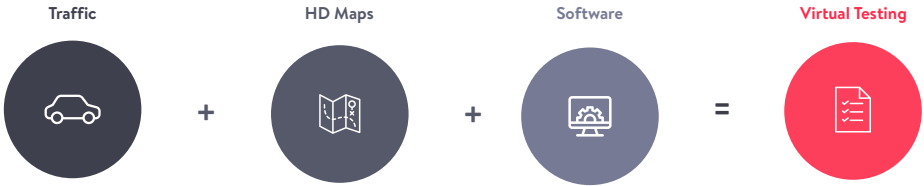

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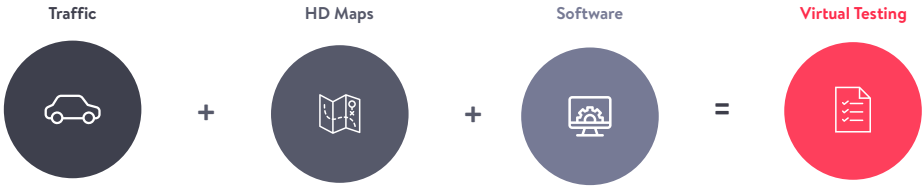

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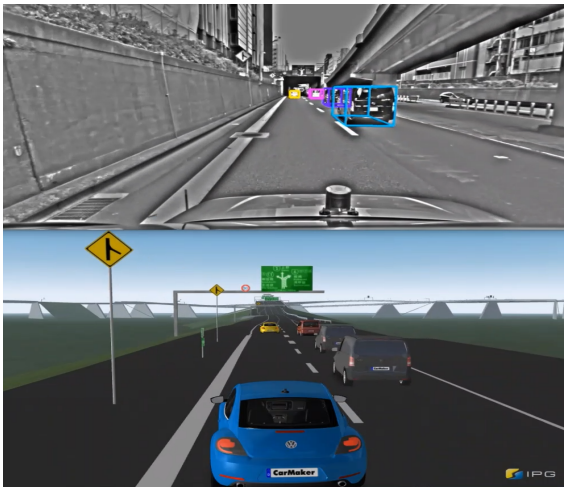
3D Map + Traffic



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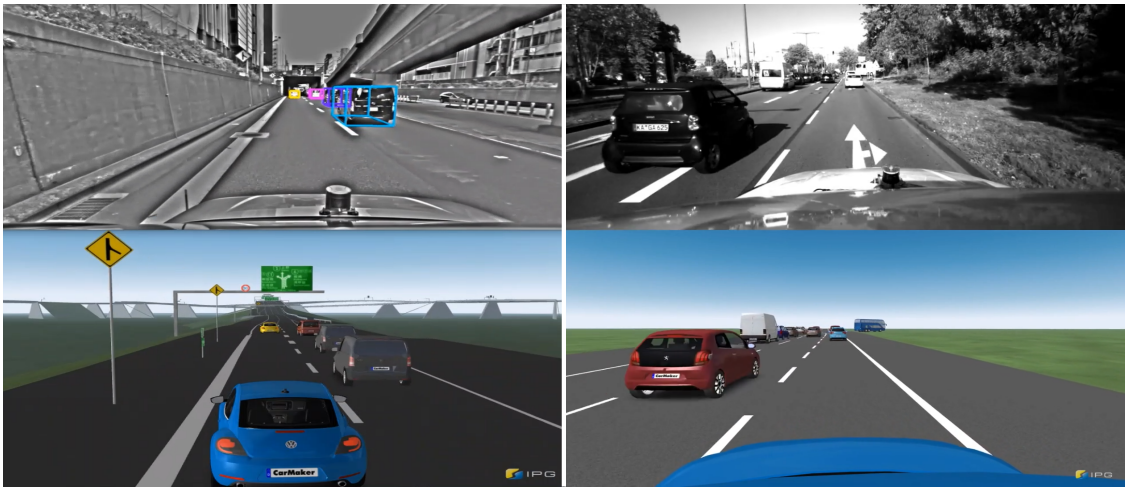


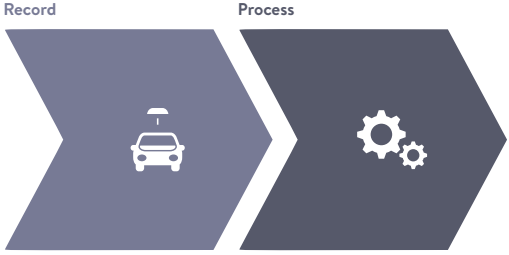
Workflow

Workflow

Record

Road data is captured with
the atlatec mapping system.

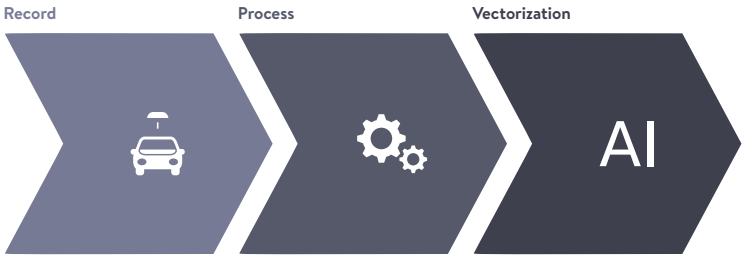
Workflow



Road data is captured with the atlatec mapping system.

Sensor data is translated into a 3D representation.

Workflow



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Sensor data is translated into a 3D representation.

AI is run on the raw data to create the 3D map and traffic.

The thus created scenario can be used for simulations.

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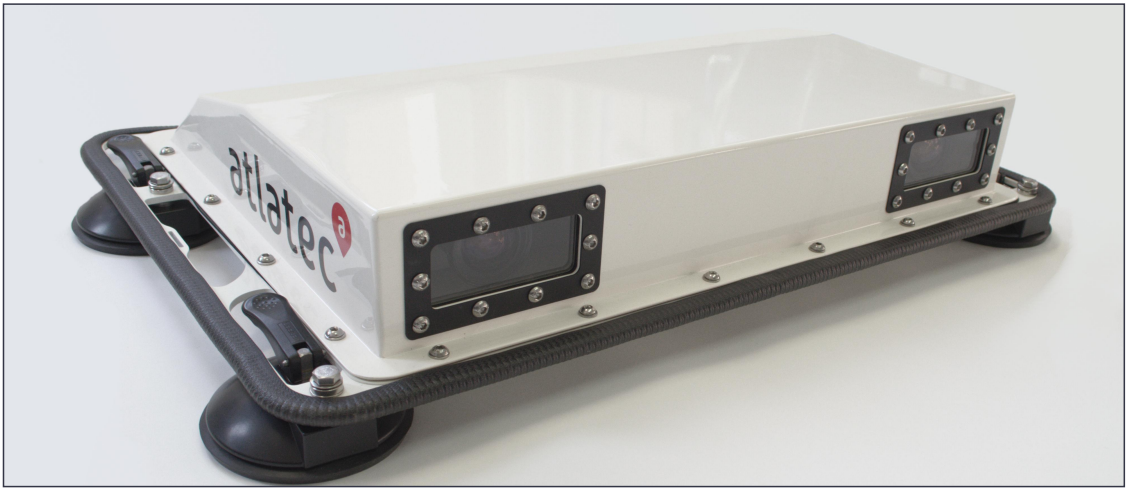

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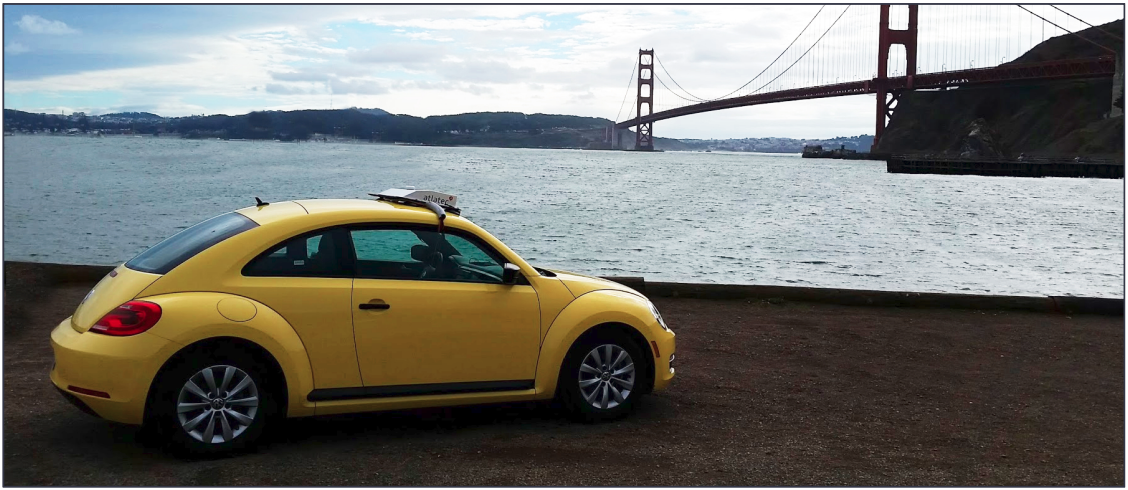

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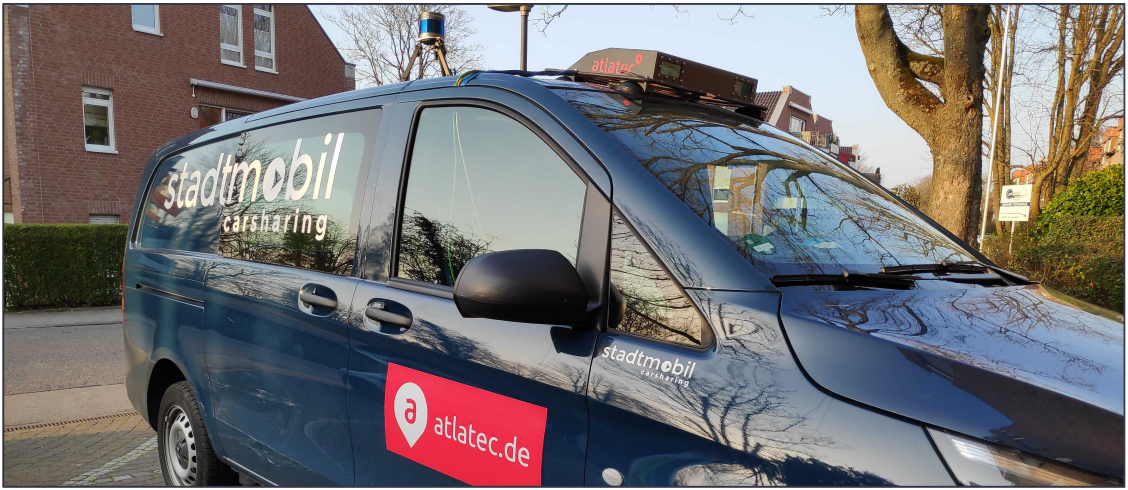

Data Processing

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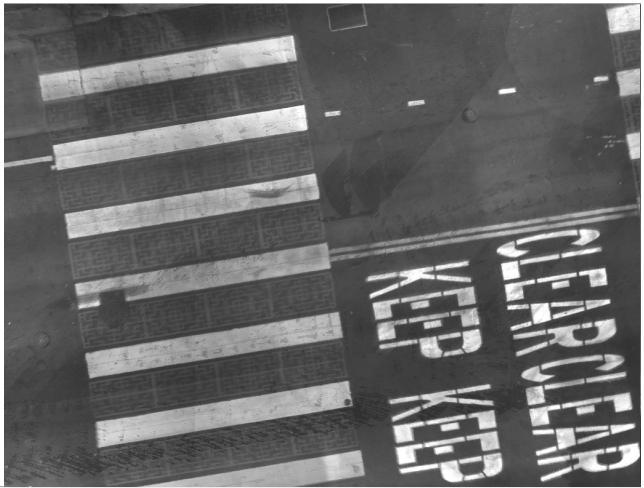
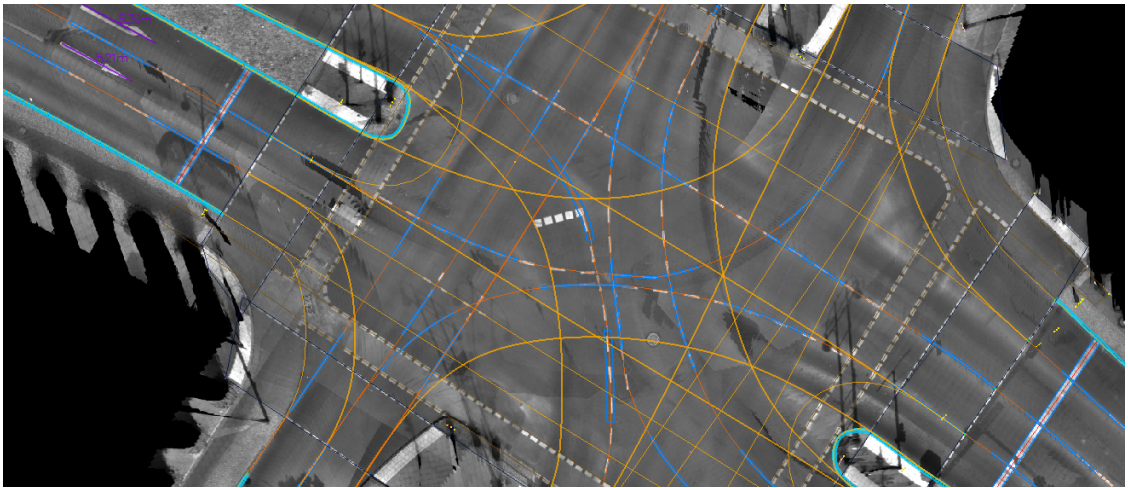


Human-Guided AI



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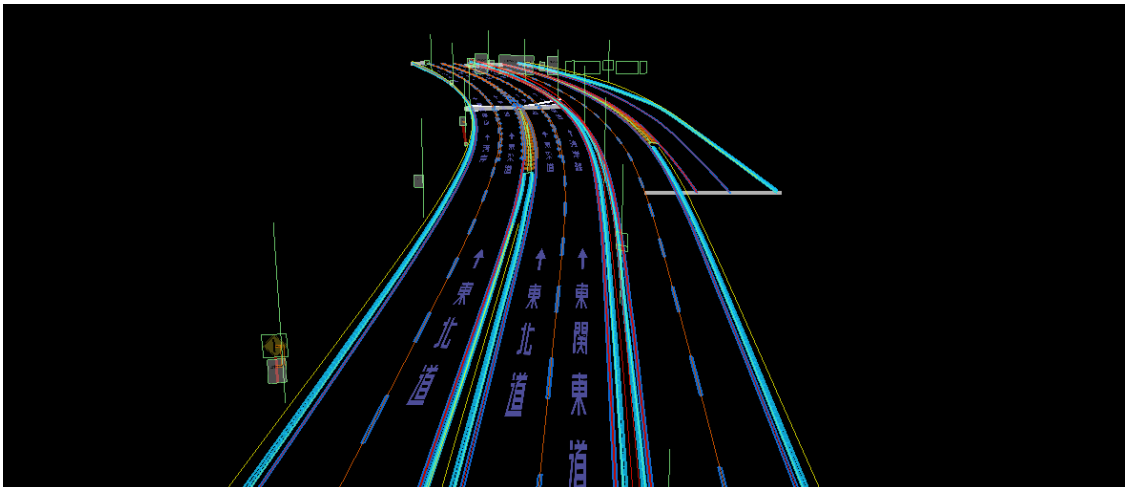
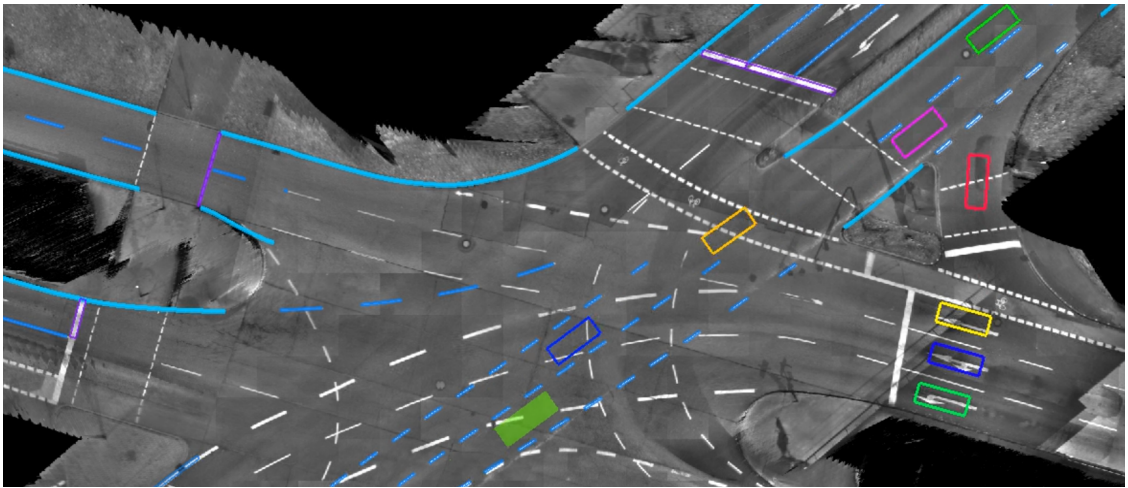


atlatec scenarios



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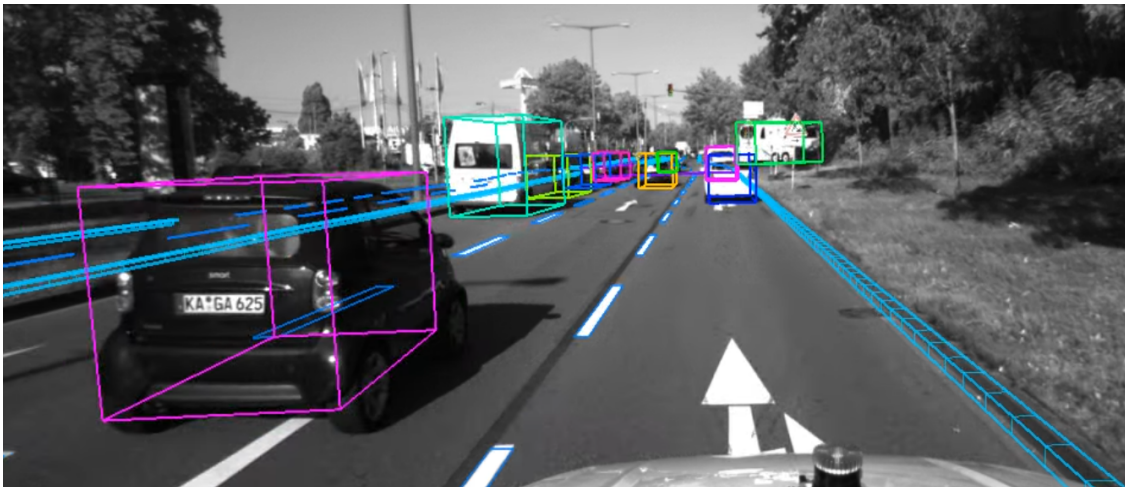

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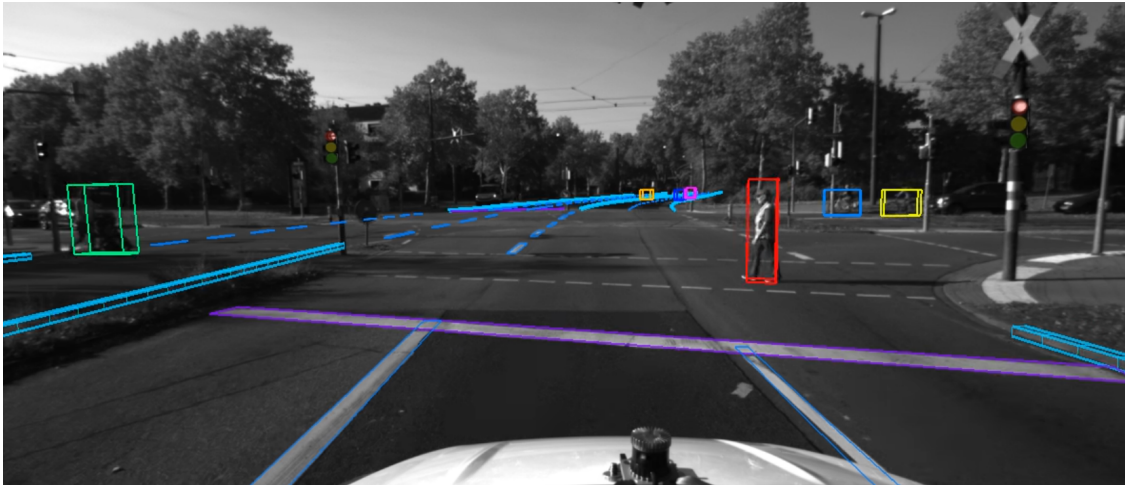

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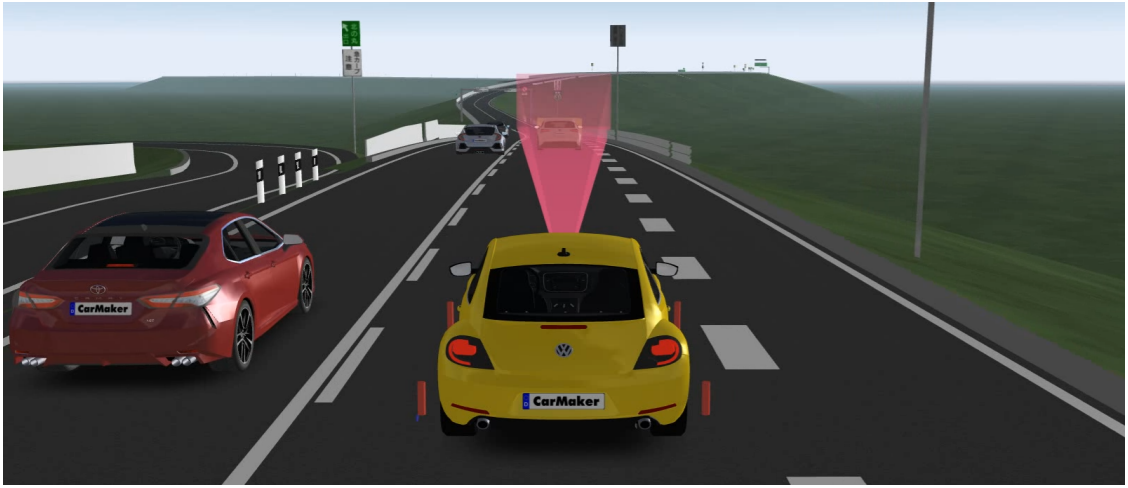

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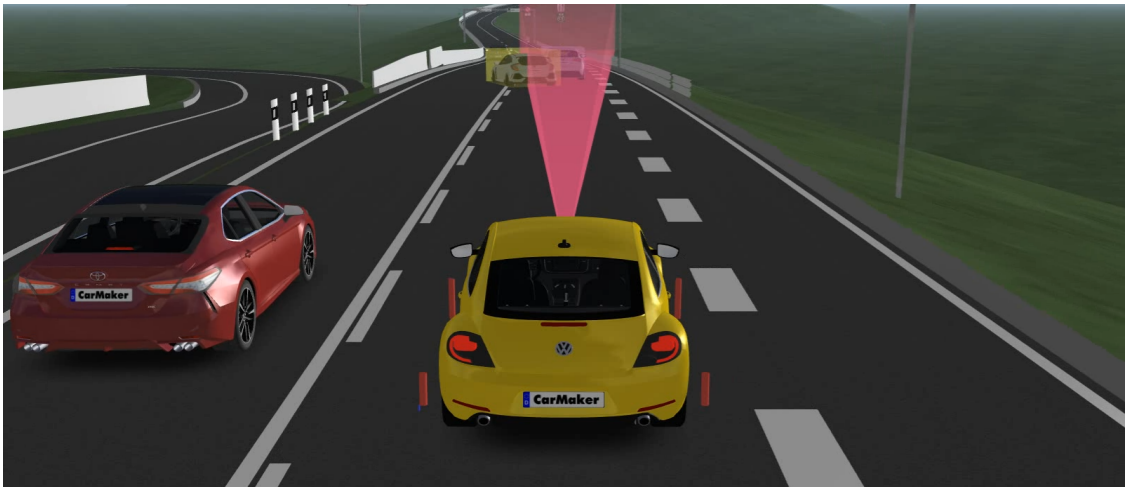

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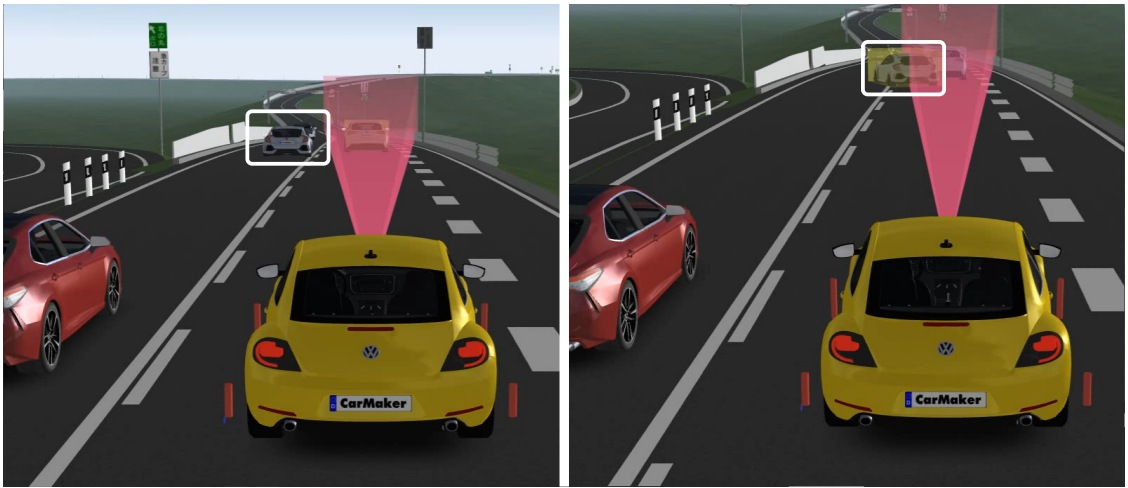
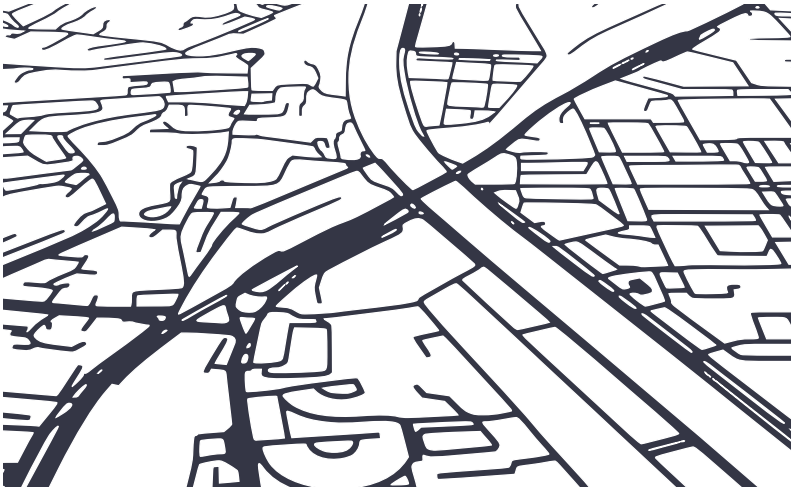


Fill your Own Scenario Treasure Chest



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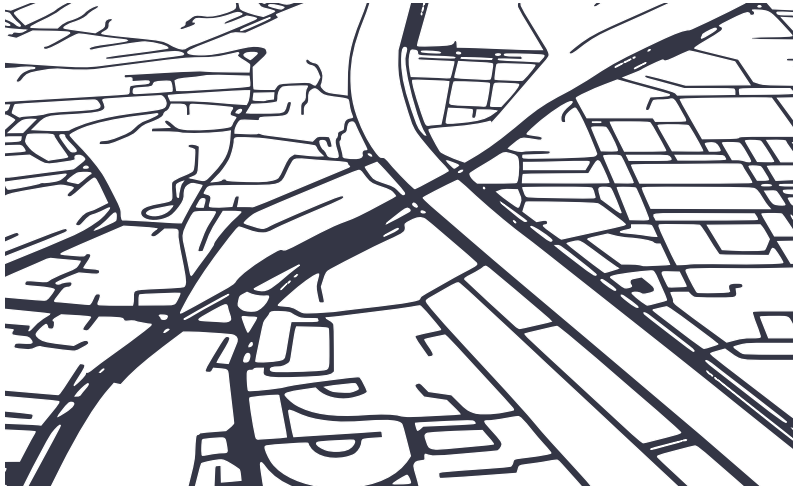

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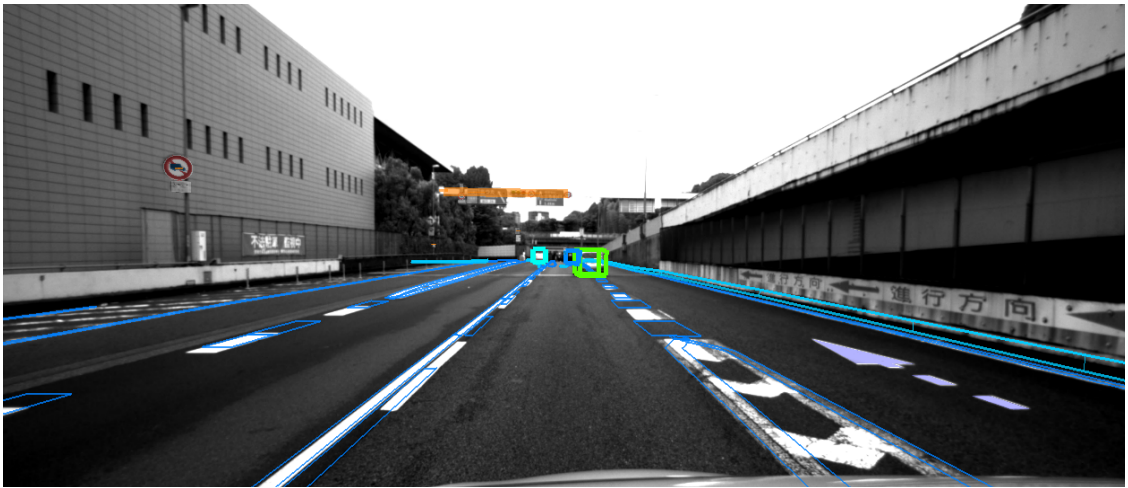
Test, Test, Test
Use CarMaker to test and validate your ADAS and AV features virtually.

Summary



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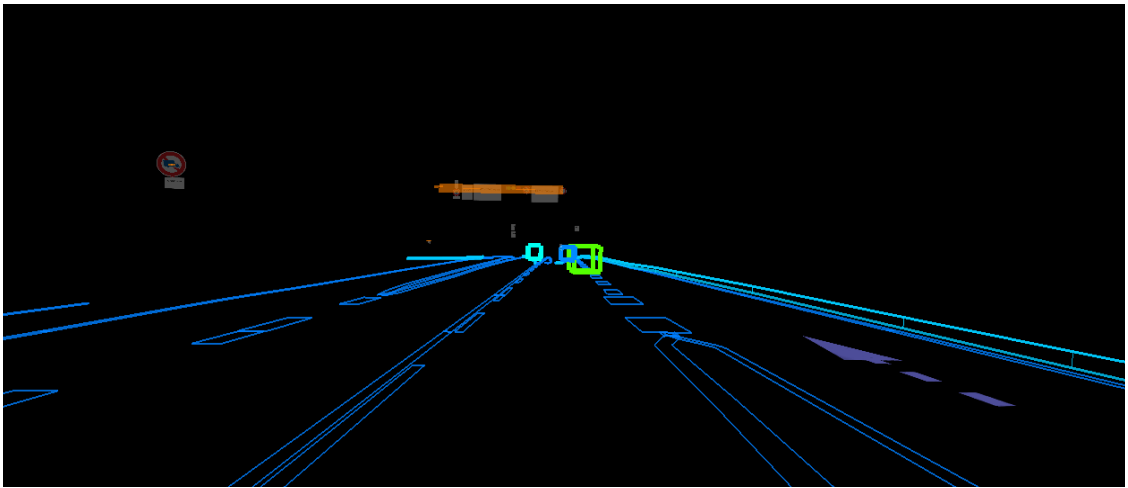

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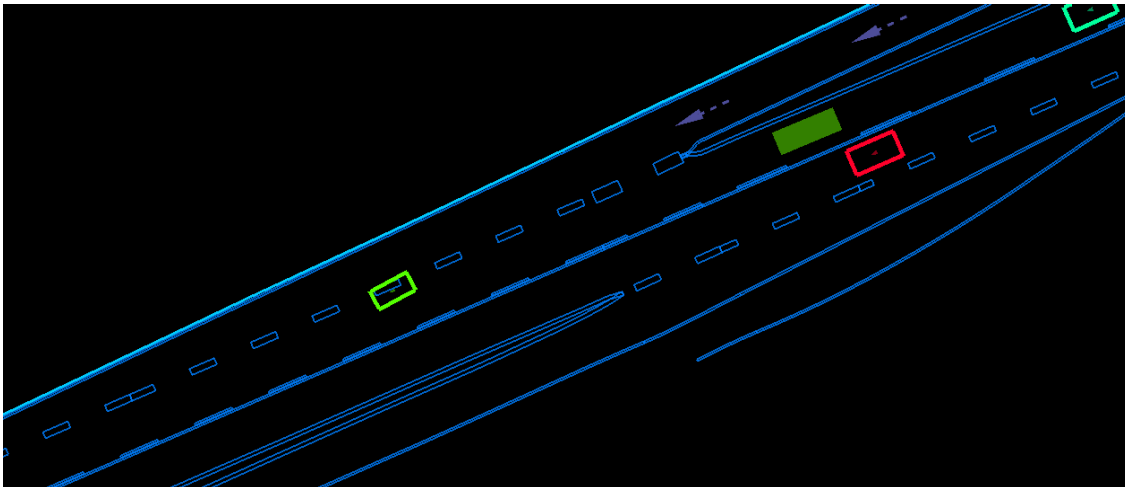

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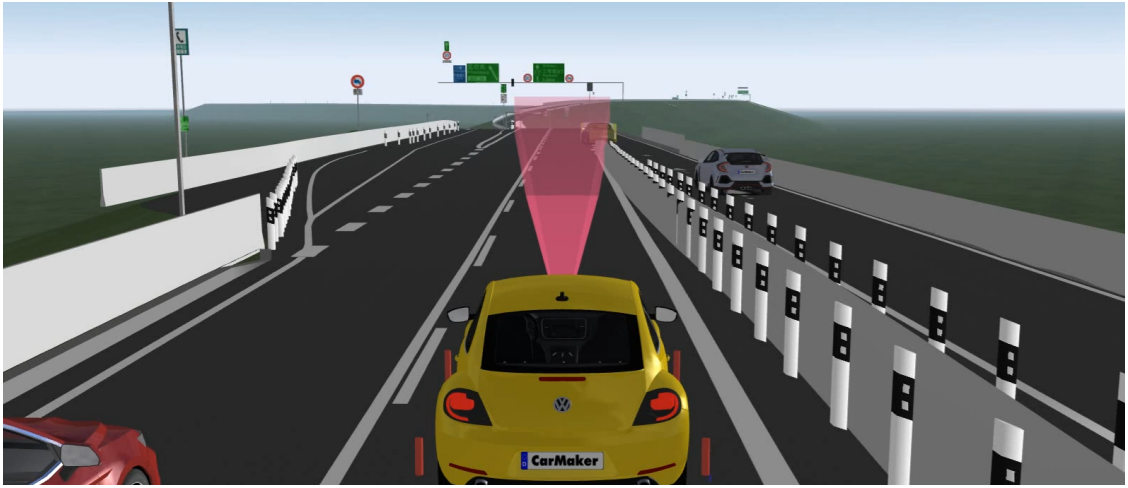

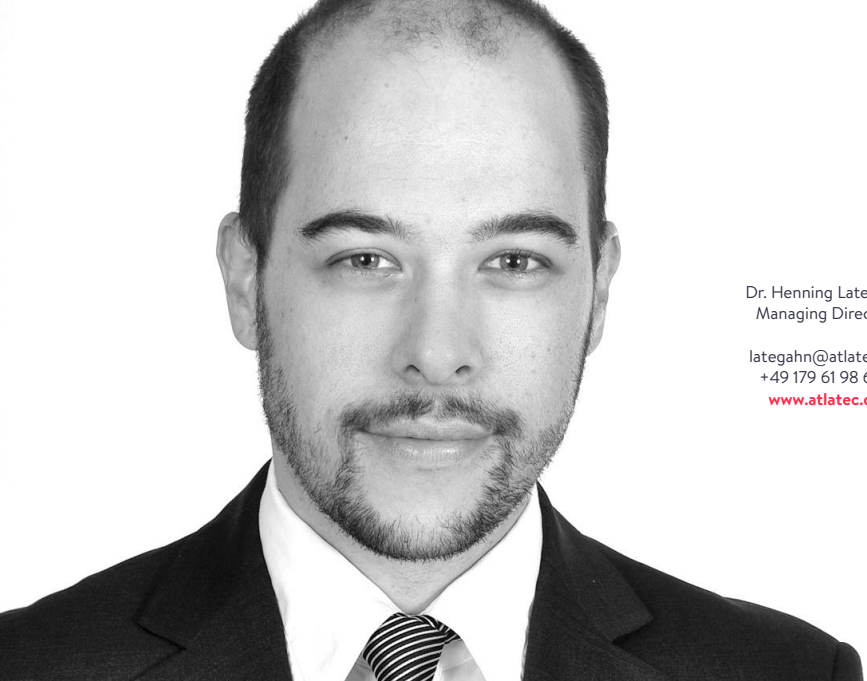

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