HD Map with RoadDNA

High definition map with sensor-agnostic localization

Overview

Automated vehicles require maps that are significantly different than the maps that are used in today's navigation systems. Drivers today mainly use digital maps to orientate themselves, to plan a journey and to navigate to their destination. However, as the driving task gradually shifts from the driver to in-vehicle automated systems, the role and scope of digital maps shifts accordingly. This means that the user of the map is no longer the driver, but rather a machine. As a result, a new generation of maps built purposely for machines is needed. The next generation of maps comes in the form of a highly accurate and realistic representation of the road, generally referred to as high-definition (HD) maps.

As carmakers race towards an autonomous future, the industry as a whole widely agrees on the need for HD maps to make autonomous driving possible. TomTom is a pioneer in HD maps, having launched the first commercial HD map in 2015.

The TomTom HD Map is a highly accurate representation of the road, featuring a myriad of attributes including lane models, traffic signs, road furniture and lane geometry, with accuracy down to a few centimeters. The TomTom HD Map can be used to help an automated vehicle precisely localize itself on the road, to support the vehicle sensors to understand its surroundings, and to plan maneuvers. Because of these characteristics, the TomTom HD Map can be used to enable and improve different driving automation functions, such as Autopilot and Highway Pilot, all the way to Level 5 automation.

Features	Benefits
Lane-level geometry	Helps improve the lateral and longitudinal control for automated driving applications
Lane-level speed limits	Helps improve the speed control function for automated driving applications
Lane markings	Helps ensure the vehicle adheres to the traffic rules
Traffic lights	Ensures safe stops and entrance to highway ramps
Road borders and guardrails	Improves lateral positioning and input for operational design domain
Lane connectivity	Helps determine a safe and smooth path for the vehicle
Complete on/off ramp coverage	Allows safe and comfortable merging onto highway and automated lane change

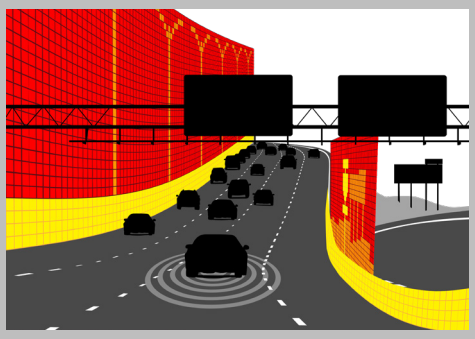
RoadDNA powers sensor-agnostic localization

Accurately determining the location of a vehicle in a robust and scalable manner is a key piece of the autonomous driving challenge. Because traditional GPS solutions fail to deliver the accuracy and robustness needed for autonomous driving, TomTom developed RoadDNA, an innovative product that addresses the localization challenge.

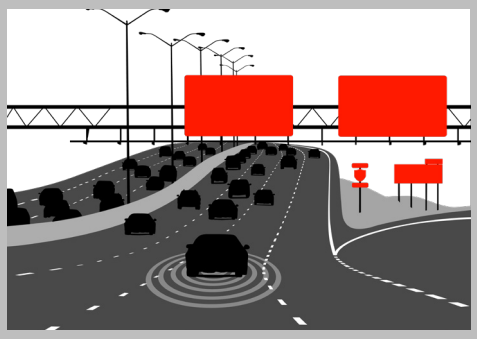
RoadDNA is a set of localization layers in the TomTom HD Map that enable accurate and precise localization for

autonomous vehicles. To precisely position itself on the road, an autonomous vehicle correlates RoadDNA data with the data obtained by its sensors in real-time, resulting in a highly precise lateral and longitudinal position.

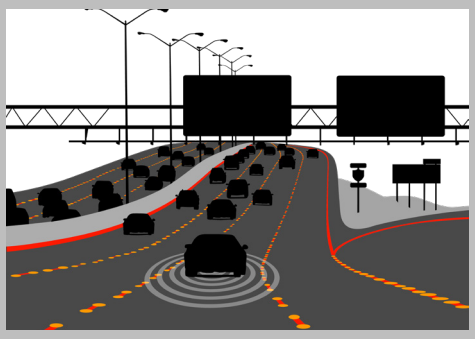
Automated vehicles today come equipped with a variety of sensors: cameras, radars, and even LiDARs, which can be used for localization. RoadDNA consists of multiple sets of data tailored to each type of sensor, delivered in a storage- friendly and processing-friendly format, illustrated below.



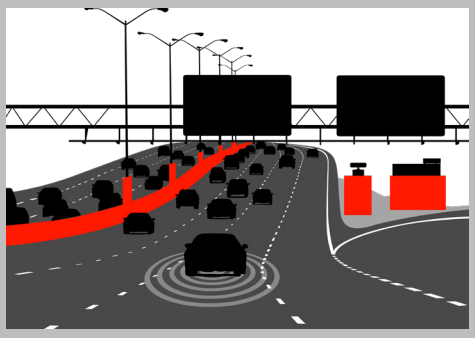
Roadside: A highly optimized LiDAR point cloud of roadside patterns, tailored for LiDAR-based localization



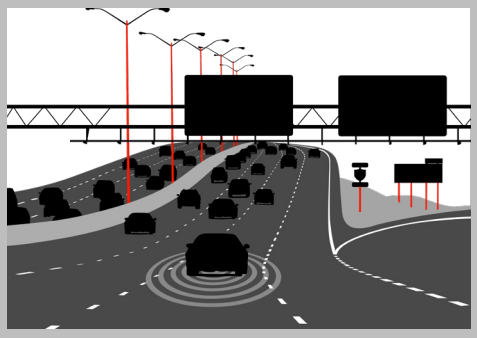
Signs: A collection of traffic signs along the road, mainly tailored for camera-based localization



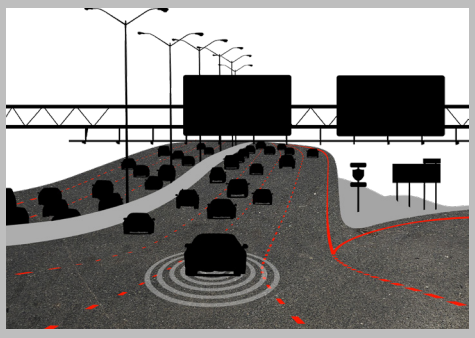
Markings: A model of lane markings along the roadway, mainly tailored for camera-based localization



Radar: A continuous view of roadway objects as perceived by radar sensors, mainly tailored for radar-based localization (partner data)



Poles: A collection of vertical poles along the side of the road, suitable for LiDAR, camera and radar-based localization



Reflectivity: Localization data that leverages the reflectivity of the road surface, mainly tailored for LiDAR-based localization