Measuring the World: Designing Robust Vehicle Localization for Autonomous Driving

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Autonomous vehicles rely on map data for trajectory planning. Map data can be seen as memory of what sensors have seen before, thus extending the knowledge of the environment beyond the actual sensor range. Localization algorithms are the essential key to localize the vehicle within a given map. This task has to be accomplished under different environmental conditions. It turns out that a key aspect of localization is to find a suitable representation of the world surrounding a vehicle. Such representation has to be aligned to the chosen data association between map and sensor measurements. Besides choosing a suitable sensor setup and map representation, the mapping algorithms are equally important to maintain accuracy and reliability of maps. Different challenges have to be addressed by mapping algorithm. The consideration of environmental changes and their integration in large scale datasets such as provided by mapping companies is one aspect. Another aspect is that mapping algorithms have to handle data from multiple sensors resulting from different vehicles to unleash the full potential of the map.