Abstract

To create successful Autonomous Driving Systems (ADS), researchers use Data-Driven Models (DDM). Data-Driven Models link input and output data, building relationships between the two. The development of machine learning algorithms and architectures have expanded the possibilities for data-driven modelling. Environment perception tasks such as Traffic Sign Recognition (TSR), have improved considerably. For TSR, Convolutional Neural Networks (CNN) and other supervised deep learning techniques have produced up to 99.7% recognition accuracy on German traffic sign datasets (Stallkamp et al., 2012).

Despite recent progress, data-driven results still generate a degree of uncertainty. Questions remain, including whether these models work under all conditions such as extreme weather or blocking objects. Quality Assurance engineers cannot guarantee that Data-Driven Model's outcomes are always correct. Respectively, this uncertainty directly decreases the reliability of the Autonomous Driving System.

Supported by data mining, statistical modelling, and deep learning algorithms, we aim to achieve a better understanding of Data-Driven Model-based uncertainty. We examine uncertainty through three major sources: model-fit, data quality and scope compliance. We use the German Traffic Sign Benchmarks (GTSRB) dataset to evaluate the feasibility and usefulness of this approach. We test how the recognition model functions under realistic quality factors. These are conditions which an autonomous vehicle would encounter. With attention to data-quality and scope compliance, this holistic framework is a powerful tool for safety engineers.