Usability of Local Traffic Density as Basis for Adaptive Driver Assistance Systems

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Abstract (300-500 words):

Driver assistance systems' objective is to support the driver in traffic. The spectrum varies from mere information systems to direct interventions in critical situations. State-of-the-art systems usually work applying a definite scheme. External factors retroacting on the behaviour of drivers in traffic are not factored in. One of the main external factors is the traffic density in the vicinity of the car which applies in particular for driving on multilane motorways. The main goal of the studies is the development of an estimation for traffic density adequate enough to allow traffic adaptive assistance functionality (e.g. for Adaptive Cruise Control).

Various parameters can be found in the literature describing the traffic phenomena. Usually, these are obtained based on stationary infrastructural facilities (e.g. inductive loops), merely allowing the reflection of a macroscopic view. Through this, there can be divergencies concerning the drivers' view of traffic conditions being non-stationary and based on their own range of acquisition. This motivates the development of a measure based on automotive onboard sensors being able to ensure a good estimation of the subjective view on traffic density. For this purpose, the so called Coverage Level was introduced at ITS 2007 conference [1]. The first outcomes based on data of a simulator study were presented. The target scenario consisted in a run on a multilane motorway, whereat the subjects had to rate continuously systematically modified traffic densities on a fifteen-point scale. This data was taken as reference for the fitting approaches of the objective measure. The analysis of the data showed that estimation is possible in principle. However, the performance is considerably affected by the used filter method and had to be improved. In addition, the outcomes were based on non-causal filters preventing an implementation for online systems.

In order to carry on the illustrated work, currently an in-depth analysis is carried out on the mentioned data including an appraisal of the respective test run videos. Various findings concerning the ratings and the applied measurement method can be unveiled through this. The comprehension of this knowledge leads to estimations based on causal filters which are suitable for taking as a basis of adaptive driver assistance systems. The following steps will concentrate on detecting reasonable parameters for the adaptation of ACC functionality in respect to traffic density.

The paper will contain a detailed discussion of the data analysis. The optimization procedure for improving estimations will be shown and the outcomes will be discussed

respecting the contradictory context of performance and robustness. This will include enhanced options of estimations comprising additional measurements like mean traffic velocity and the number of ascertainable cars. Furthermore, expedient ways of manipulating the mode of operation for standard ACC systems will be pointed out.

References

[1] S. Knake-Langhorst and C. Schießl, "Local Traffic Condition - Improvement of a Vehicle Based Measurement Approach," presented at 6th European Congress and Exhibition on Intelligent Transport Systems and Services, Aalborg (DK), 2007-06-18.