Smart System Technologies

Band 3

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A Comprehensive Knowledge Base for Context-Aware Tactical Driver Assistance Systems

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Abstract

An ongoing research project at the Transportation Informatics Group at Klagenfurt University is concerned with the development of the advanced driver assistance system MIDCO – a "Machine-vision based context-aware Intelligent Driver Co-Pilot". MIDCO will be an intelligent co-driver who will support the human driver and give advice in potentially dangerous and difficult situations.
This thesis is embedded within the project and is mainly concerned with the development of a comprehensive knowledge base for the planned context-aware driver support system. Most of the active research in driver assistance is still concerned with the gathering of environment information. Much less attention is given to the question what shall be done with the information once it is available. The presented work will focus on this by trying to give an answer to the three major questions:

- What is the context for driving assistance on a tactical level and how can it be represented?
- How can traffic rules be integrated in a driver assistance system?
- How can imperfect sensed context-information be handled?

An approach for knowledge representation and processing of driving context and traffic rules will be developed and validated within the thesis which is also able to cope with imperfect context information.
The thesis starts with an overview of state-of-the-art driver assistance systems and involved methods from artificial intelligence. Afterwards, a thorough analysis is conducted about what "context" means within the driving task on a tactical level. While this so-called context-model is implicitly hidden in every driver assistance system, no general model is available so far. Therefore, an appropriate context-model for representing and exchanging domain information about a driving scene is developed. The model provides a generic scene description, regardless of the specific driving task.
Although traffic law actually regulates the legal behavior of drivers, it is often not yet considered in driving assistance. The presented work pays tribute to this fact by integrating the context-model with a logic programming environment, where the complex traffic rules are kept in the form of static and dynamic constraints. This enables intelligent reasoning and decision deduction on the available information in real-time. An overtake assistant is used as a showcase to simulate and demonstrate the feasibility of the presented approach.
Safety is always the first and foremost aspect for driver assistance. Since the available context-information in a driver assistance system cannot be expected to be fully reliable, a support system should be able to know its own limitations and admit ignorance when necessary. Therefore, the thesis is completed with an analysis of the major types of imprecision of information, which are likely to occur in a driver assistance system, and an overview of suitable methods to cope with them in the knowledge base, in order to provide useful driver support nonetheless.