A combined model-and learning-based framework for interaction-aware maneuver prediction

Abstract:
This paper presents a novel online-capable interaction-aware intention and maneuver prediction framework for dynamic environments. The main contribution is the combination of model-based interaction-aware intention estimation with maneuver-based motion prediction based on supervised learning. The advantages of this framework are twofold. On one hand, expert knowledge in the form of heuristics is integrated, which simplifies the modeling of the interaction. On the other hand, the difficulties associated with the scalability and data sparsity of the algorithm due to the so-called curse of dimensionality can be reduced, as a reduced feature space is sufficient for supervised learning. The proposed algorithm can be used for highly automated driving or as a prediction module for advanced driver assistance systems without the need of intervehicle communication. At the start of the algorithm, the motion intention of each driver in a traffic scene is predicted in an iterative manner using the game-theoretic idea of stochastic multiagent simulation. This approach provides an interpretation of
what other drivers intend to do and how they interact with surrounding traffic. By incorporating this information into a Bayesian network classifier, the developed framework achieves a significant improvement in terms of reliable prediction time and precision compared with other state-of-the-art approaches. By means of experimental results in real traffic on highways, the validity of the proposed concept and its online capability is demonstrated. Furthermore, its performance is quantitatively evaluated using appropriate statistical measures.