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SECOND PRIZE

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Autonomous Vehicle Learning-based Model Predictive Controller

Safety issues are still a very serious challenge for autonomous vehicles, which require a higher degree of autonomy and reliability. Vehicle dynamic models are important for the implementation of model-based predictive control for motion planning and tracking control of autonomous vehicles. If the vehicle's dynamics, handling performance and actuator constraints can be fully considered in the path tracking process, the accuracy of the path tracking results can be effectively improved, and the occurrence of road traffic accidents can be reduced, or even avoided. Notably, model predictive controllers are a widely implemented strategy for path tracking controllers, they can improve the tracking performance significantly and with better control performance. In this research, an Adaptive Neuro-Fuzzy Inference System (ANFIS) is proposed and implemented to a traditional model predictive controller for vehicle lateral control. The main goal of this combination is to provide a prediction horizon required for use in an arbitrary autonomous vehicle's path tracking controller. Data is collected from a custom unity platform, while the performance is compared to a designed linear model predictive controller in the real time simulation. The performance of ANFIS model predictive controller is evaluated and compared with a linear model predictive controller to validate the applicability and accuracy of this learning-based model predictive controller, in addition to comparisons with the reference states from various testing scenarios with real road conditions.