

Motion Planning and Tracking for Overtaking Vulnerable Road Users considering Individual Driving Style

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Interactions between pedestrian and vehicle lead to numerous accidents. Therefore, recent research studies extensively about the motion of vehicle considering vulnerable road user (i.e., bicycle riders, pedestrians). This paper presents a steering assisted system to overtake the vulnerable road user considering driving style of drivers.

Samples of driving data in overtaking a pedestrian are collected in a driving simulator. Three driving styles are identified with regard to the lateral distance between car and pedestrian. In order to find the optimal path for each driving style, a potential field map is created based on the infrastructure and pedestrian's information. The estimation of risk of collision with pedestrian is assumed as the main reason between maneuvers among driving styles. Hence, the specific parameters for potential functions are identified by genetic algorithm. Subsequently, the reference paths are generated by gradient descent method at the beginning of avoidance maneuver. For path tracking, car dynamic is considered by the "bicycle model" with two degrees of freedom: lateral position y and yaw angle ψ . This model can be described as a discrete linear time invariant system. The car's model's input is the front wheel steering angle. Car's states and reference path are the inputs for the model predictive controller. The controller minimized the error between reference signal and vehicle states for a finite period of time ahead to provide the suitable control input for vehicle. The controller output is the change of front wheel steering angle. Simulation results show that the car can follow the reference path successfully.

This method can be applied to ADAS system, such as Lane-keeping Assistance to navigate the car in overtaking process. The maneuver can be adapted to specific driving style. As a consequence, this ADAS system can improve mutual understandings and mutual control with drivers.

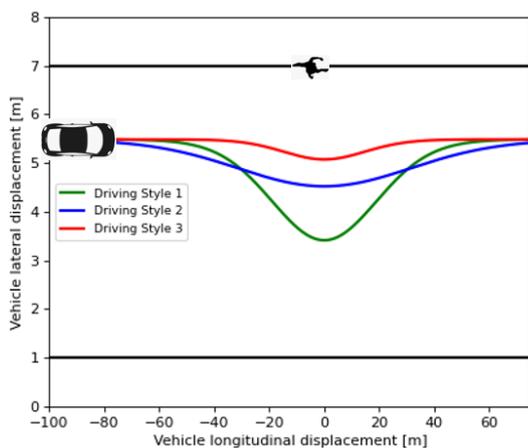


Fig. 1. Reference paths for a vehicle to approach and overtake a VRU considering driver's driving style.

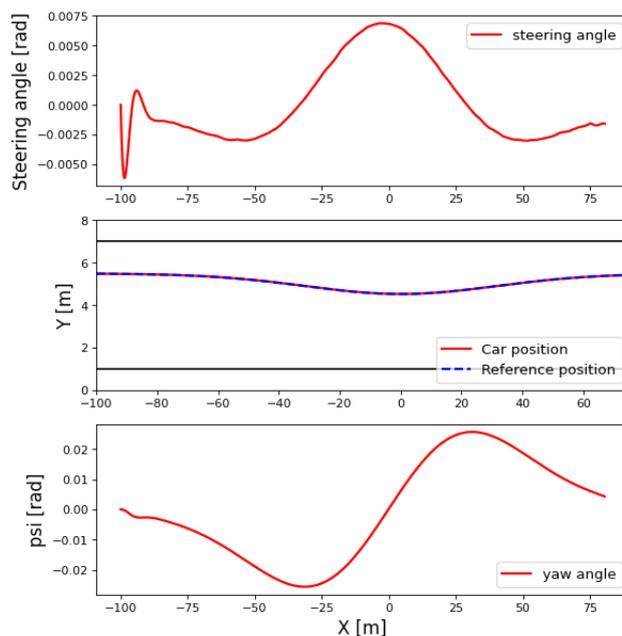


Fig. 2. Results of tracking for driving style 2.