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Probabilistic threat assessment with environment description and rule-based multi-traffic prediction for automated driving

With a significant progress in sensors, actuators and other technologies for automotive vehicle, numerous safety systems have been active topics of automotive research area. And, in particular, the main challenges lie in active safety systems which are expected to reduce the risk of accidents, improve safety and enhance comfort and performance for drivers. Some of these active safety systems have been already commercialized include Adaptive Cruise Control (ACC), Electronic Stability Control (ESC), LaneDeparture Warning (LDW), Lane Keeping Support (LKS), Lane Change Assist (LCA) and Collision Mitigation Systems (CMS). Current automotive safety systems can be grouped by in which driving state it occurs. Vehicle driving states can be described by following sequential five states: normal driving state, warning state, crash avoidable state, crash unavoidable state, and post event state. The first three states focus on accident avoidance, while the last three states focus on damage mitigation (with an overlap of the third state). Using the above sequential driving state flow, it is apparent that automotive safety concerns should be addressed with an integrated system approach. Accordingly, as the next generation of the active safety systems, current safety systems on vehicles are becoming integrated and merging so that each system interacts with the other. Therefore, the core of the integrated automotive safety system can be summarized as a threat assessment and decision making method which defines the current driving state of safety and makes the control decision. Various situation assessment methods have been studied previously by many researchers . Generally, the driving situation assessment consists of the following three steps: an estimation of current driving states, a prediction of future driving states and an evaluation of collision risk or their collision type. The current stages of risk metrics are mainly based on the predicted time at which some predefined risky event occurs. The typical predicted time based indices include the time to collision (TTC) or time to impact. Polychronopoulos et al. proposed the predicted time to minimum distance with sensor fusion method. Time to react which means the last point to decelerate or accelerate or steer to avoid the predicted collision has been proposed and analyzed . Berthelot et al. presented an algorithm to compute the probability distribution of TTC induced by an uncertain system input and thus allows to use TTC as a more robust and reliable probabilistic activation condition. Brannstorm et al. estimated perimeter of the object and the set of maneuvers that the host driver can use to avoid a collision. This set of maneuvers is then assessed to determine if the driver needs immediate assistance to avoid or mitigate an accident.

Biography

Koungsu Yi received his BS and MS degrees in Mechanical Engineering from Seoul National University, Korea, in 1985 and 1987, respectively, and PhD degree in Mechanical Engineering from the University of California, Berkeley, in 1992. He is a Professor at the School of Mechanical and Aerospace Engineering at Seoul National University, Korea. He currently serves as a member of the editorial boards of the *KSME, IJAT, and ICROS* journals. His research interests include Control Systems, Driver Assistant Systems and Active Safety Systems of ground vehicles.

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