Advances in Vehicle Safety and Mobility Leading to Autonomous Driving

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Abstract

While autonomous or driverless driving has received a lot of public attention recently, the majority of the driving for the foreseeable future remains without automation, or with a mixed environment of no and partial automation. The full automation will include only a small percentage of vehicles. In all of these mixed modes of traffic, the significant persisting challenge is the safety of driving, which causes about 35,000 fatalities and 2.2 million injuries annually in the United States. Traffic crashes also result in an estimated economic loss of over $230 billion annually. Integrated vehicle passive and active safety systems are required to mitigate crashes or avoid collisions. This talk reviews some timely areas of research on vehicle control systems, signal processing, and communication enabled connectivity to address the pervasive vehicle safety problem.

Researchers use advanced methods in vehicle mechanics/dynamics, controls, communications, man-machine interface, human factors, AI and machine learning, as well as cognitive science to design and develop active safety and advanced driver assistance systems (ADAS). Based on sensory feedback and situational awareness, these systems can warn/alert the driver to take action, partially support the driver’s control tasks, or intervene by full control to automatically avoid collisions. In this talk, first, we discuss a holistic approach to vehicular safety and its advanced research challenges. We review advances in vehicular systems, ranging from partial to full autonomy and their collision avoidance implications. Next, we briefly discuss a critical perspective on personal mobility and the impact of current directions in the automotive industry. The latter presents a view of the future of driving that ensures functional mobility, safety, and congestion mitigation while minimizing energy consumption.