The invention of the automobile has transformed how people live, work, and interact in society. Today, with an ever-increasing number of in-vehicle options/activities, as well as the increasing demands being placed on the driver, vehicle platform, and transportation infrastructure, more is being asked of engineers, designers, scientists, and transportation specialists. Signal processing is playing an increasingly substantial role in this domain, including such general topics as monitoring driver distraction, vehicle lane/control detection/tracking, driver assistance through autonomous platforms, and vehicle infrastructure support and planning/monitoring. The diversity of these problems requires a more collaborative effort from engineers and scientists in a diverse set of specialties. The impact to society is massive, including such broad aspects as 1) safety, 2) commerce (i.e., sales and support/maintenance of vehicles), 3) energy costs (i.e., fossil fuel consumption, etc.), and 4) population mobility for effective traffic management. How will signal processing advance today’s vehicles into “smart” cars that are able to think and contribute to the task of operating a vehicle? What safety concerns are there in moving from a 100% driver-controlled vehicle, to driver assistive technologies (e.g., cruise control, assistive braking, lane-departure monitoring, etc.), to full autonomous driving? Many new and emerging challenges arise and need to be addressed in collaborative ways.

This special issue provides a venue for summarizing, educating, and sharing the state of the art in signal processing applied to the domain of automotive systems. Due to the significance of this topic from both an engineering/technology as well as a global society perspective, this special issue of IEEE Signal Processing Magazine will appear in two parts (part 1 is the current issue, and part 2 is scheduled to be published in the spring of 2017). Highlighted below is the scope of topics addressed in varying degrees by the articles that are explored in both parts:

- digital signal processing technologies in adaptive automobiles, diagnosis, and maintenance
- speech, hands-free, and in-car communication algorithms and evaluation
- in-vehicle dialog systems and human-machine interfaces
- driver-status monitoring and distraction/stress detection
- computer vision methods for vehicle recognition and assisted driving
- multisensor fusion for driver identification and robust driver monitoring
- signal processing for position and velocity estimation and control
- signal processing for green vehicle-related energy management
- vehicle-to-vehicle and vehicle-to-infrastructure communications and networking
- autonomous, semiautonomous, and networked vehicular control
- human factors and cognitive science in enhancing vehicle and driver safety
- machine learning and data analytics associated with automotive systems
- issues regarding security and privacy aspects for smart vehicle systems.

In planning this special issue, we worked extensively to ensure a wide representation of the field. A large number of white papers were received, and the authors of a select set of white papers were invited to submit full papers that were then peer reviewed.


This special issue provides a venue for summarizing, educating, and sharing the state of the art in signal processing.
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