OVERVIEW: The evolution towards autonomous vehicles and intelligent transportation systems will be revolutionizing the mobility of people and goods. The main objectives are the improvement of:

- Safety (today, 1.25-Million people are killed each year in vehicle accidents, mostly caused by human errors)
- Inclusivity (mobility for all, including elderly and disabled people)
- Efficiency (avoiding waste of energy/time due to traffic congestion)
- Human-machine interfacing

At the core of this evolution resides the development of advanced wireless imaging technologies such as radar, lidar, and array of video cameras to ensure vehicle context-awareness. Since assisted/autonomous vehicles have stringent latency constraints, the real-time processing of 2D and 3D images acquired from the above wireless sensors is a key issue to be addressed. All acquisition, communication and processing tasks related to complex autonomous driving functionalities have to be solved in less than 100 ms, to be negligible vs. the driver’s reaction time and to minimize the distance travelled by a high-speed vehicle.

Radar is an electromagnetic active-imaging technology, with a RF front-end operating from few GHz to about 80 GHz, and is extensively used for obstacle detection, and distance/speed measurements in harsh operating environments. In continuous wave radars, real-time image processing is needed to extract information about the obstacles, their relative distance, speed and motion direction through spectral analysis (FFT, wavelet,...). Instead, lidar is a light active-imaging technology, which is used for 2D and 3D mapping, with distance measurement accuracies of few cm. Accurate 3D mapping will require the development of new algorithms and architectures for map rendering, distance recalculation, critical decision taking, etc. and all these tasks have to be implemented in real-time. Video cameras are extensively used for classification and scene understanding. They are passive, low-cost and widely available sensors (operating in the visible spectrum or near infrared-spectrum for enhanced night vision), which see colors, shapes, textures. By using real-time image processing algorithms, advanced functions can be achieved such as traffic/road sign recognition, blind spot detection, all-around view, lane change assist/departure warning, obstacle classification, to name just a few. Managing arrays of imaging sensors poses also several challenges in terms of phase synchronization and beamforming, since complex waveforms have to be synthesized within stringent time constraints. Processing all these many and heterogeneous sources of information in real-time will require exploiting deep artificial intelligence and deep learning techniques. The issue is not only in terms of algorithms, but also in terms of computing architectures. Beside classic Very Large Scale Integration (VLSI) architectures for real-time processing new parallel architectures, including Field Programmable System-on-Chip (FPSoC) and Graphics Processing Units (GPUs) need to be explored.

Since most accidents are caused by drunk or fatigue or inattentive drivers, other important issues are the real-time acquisition and processing of driver biometric data and a natural and easy-to-use human-machine interface. For biometric measurements, the research is focusing on wireless technologies such as using a biometric radar to measure heart-rate and breath-rate or using image processing techniques to monitor the eye level opening status. Autonomous vehicles will also be interconnected among each or at least many of them, with the people (driver, passengers, pedestrians) and with the infrastructure, through V2X (Vehicle to Everything) wireless technologies. To this aim the fusion in real-time of information from on-board sensors (radar, video camera, lidar, ...) and from wireless networking acquired data can further improve the context awareness of vehicles.
**Topics of Interest:** This special issue is soliciting contributions that report on the most recent progress in real-time processing and acquisition for radar, lidar and video camera wireless imaging systems in smart vehicles and intelligent transportations. The list of possible topics includes, but are not limited to, the following:

- Real-time acquisition and processing of radar images for distance/motion measures in autonomous vehicles
- Real-time acquisition and processing of lidar images for accurate 2D/3D mapping in autonomous vehicles
- Real-time processing of images from array of video cameras for traffic/road sign recognition, all-around view, line change assist/departure warning, blind spot detection and obstacle classification
- Real-time fusion of many and heterogeneous imaging data sources (lidar, radar, IR or visible video camera)
- Latency-constrained wireless communications for Vehicle to Everything (V2X) networking
- Real-time fusion of on-board sensors and wireless acquired data for autonomous/assisted vehicles
- VLSI architectures for real-time processing in autonomous vehicles, including FPSoC, GPUs, and embedded systems
- Artificial intelligence (AI), deep learning and data mining algorithms and computing platforms for autonomous vehicles
- Real-time Human-Machine-Interface based on visual technologies and head-up display projectors
- Real-time processing of biometric sensors to monitor the driver’s attention, fatigue or his/her health status
- Algorithms and computing architecture for real-time predictive diagnostic on-board vehicles
- Phase synchronization and beamforming with real-time constraints for array of imaging sensors (multi-channel lidars, radars and video cameras)

**Submission Guidelines:** Authors from academia and industry working in the above research areas are invited to submit original manuscripts that have not been published and are not currently under review by other journals or conferences. All potential authors are requested to volunteer as reviewers in the peer-review process for manuscripts submitted for this special issue. Manuscripts are requested according to the Guidelines for Authors available from the online submission page of JRTIP at https://www.editorialmanager.com/rtip/default.aspx. All the manuscripts will be peer-reviewed following the JRTIP reviewing process. Notes: when submitting your manuscript, at the step of “Choose Article Type”, please choose this special issue: **"SI: Real-time Radar, Lidar and Video Camera Imaging in Smart Vehicles and ITS"**. Prior to sending full manuscript submissions, it is highly recommended to query the appropriateness of submissions with a 100-200 word abstract by contacting the Guest Editors.

**Guest Editors:**

Prof. Bruno Neri, Department of Information Engineering, University of Pisa, bruno.neri@iet.unipi.it

Prof. Sergio Saponara, Department of Information Engineering, University of Pisa, sergio.saponara@unipi.it

**Important Dates:**
Manuscripts submission deadline: November 30, 2017

Completion of first round of reviews: March 31, 2018

Submission of revised manuscripts deadline: June 30, 2018

Completion of second round of reviews: Sept 1, 2018 – Note: accepted papers are made available online as Online First Articles soon after acceptance; such papers can be downloaded and cited once they appear online.