Navigation and Localization for Intelligent Transportation Systems

Daniel Medina, Student Member, IEEE, Jordi Vilà-Valls, Senior Member, IEEE, Pau Closas, Senior Member, IEEE

Abstract—As contemporary applications such as driverless cars or autonomous shipping are called to revolutionize Intelligent Transportation Systems (ITS), there is a growing need on the provision of precise, continuous and reliable navigation information. The Special Session on “Navigation and Localization for ITS” addresses the latest research on positioning solutions, Global Navigation Satellite Systems (GNSS), multi-sensor data fusion and localization/tracking methods, to enable both seamless navigation information, and next-generation localization/tracking systems for ITS. This Special Session will be held at the IEEE ITSC’19 Conference in Auckland in New Zealand.


I. INTRODUCTION

RELIABLE positioning and navigation are becoming crucial in safety-critical applications within the ITS. The first edition of the “Navigation and Localization for Intelligent Transportation Systems” Special Session aims to provide with the latest algorithms and solutions based on satellite, inertial, 5G and other means of navigation to comply with the stringent navigation requirements of autonomous vehicles. In addition, the Special Session also targets the latest research on localization and tracking methods, which can provide enhanced performance for ITS monitoring and can represent an invaluable source of information delivered to autonomous vehicles. This special session will take place on the 22nd Edition of the Intelligent Transportation System Conference (ITSC) in Auckland, New Zealand.

II. SCOPE AND GOALS

Location-based services, alongside with the modern applications on Intelligent Transportation Systems require reliable, continuous and precise navigation, positioning and timing information for their successful operation and implantation in the market. GNSS has become the cornerstone source of positioning data, and this dependence can only but grow in the future. The goal of the Navigation and Localization on ITS Special Session is gathering the most relevant advances on algorithms and solutions to comply with the navigation requirements of safety-critical applications: automated landing on aviation, driverless autos, small autonomous robots, or unmanned air vehicles (UAVs).

GNSS technology has been under substantial development over the last years, especially with the deployment and release of the operative services of the European Galileo, Chinese BeiDou and Indian IRNSS constellations besides the modernization of GPS and GLONASS. Studies addressing the combination of multiple constellations and/or the performance of new constellations and frequencies are key to characterize the navigation possibilities into ITS. Moreover, the proliferation of radio threats, namely jamming and spoofing, evidence the vulnerabilities of satellite-based navigation. For this reason, augmenting conventional navigation systems to include other sensing modalities and exploit signals of opportunity has become a necessity. Articles on new strategies for multi-sensor data fusion, innovative solutions for Kalman and particle filtering, mechanisms for outlier detection and exclusion, and countermeasures to radio interference are invited into this Special Session.

Furthermore, the use of signals or opportunity, e.g. LTE or 5G cellular networks, for navigation is of fundamental importance to assure reliable and seamless navigation in GNSS challenging scenarios, such as urban canyons or indoors. Contributions on opportunistic navigation are welcomed for the participation on this Special Session. In addition to stand-alone navigation, the use of cooperative positioning methods, or feedback from external localization and tracking systems, can improve the overall navigation capabilities, thus being a cutting-edge research field of interest in this Special Session.

III. TOPICS OF INTERESTS

The scientific community, as well as experts in the navigation and signal processing fields are being contacted and invited to submit their contributions to this Special Session. The organizing team encourages submissions on the following (non-exhaustive) list of topics:

- Use of new GNSS constellations and frequencies.
- Robust GNSS receivers.
- Positioning based on signals of opportunity.
- Cooperative localization and navigation methods.
- Countermeasures to radio threats (from detection to mitigation): jamming and spoofing.
- Indoor positioning and GNSS-denied environments.
- Multi-sensor data fusion strategies.
- Single/Multiple target localization and tracking.
- Algorithms for fault detection and exclusion.
- Positioning for autonomous systems (UAVs, land vehicles, robots, etc.)
IV. DISSEMINATION PLAN

Based on the declared interests of invited authors, it is expected a minimum number of 10-12 manuscripts submitted for the proposed Special Session.

Upon approval, the organizers will disseminate the CfP among their peers from diverse international institutions, encouraging the submission of contributions. Moreover, the CfP will be also distributed through standard dissemination channels for the navigation, robotics and signal processing communities. Particularly, the following is a list of committed authors: Javier Arribas (Centre Tecnològic de Telecomunicacions de Catalunya, Spain); Zak Kassas (University of California, Irvine, CA); Robert Odolinski (University of Otago, New Zealand); Lars Grundhöfer (German Aerospace Center, Germany); as well as a contributed paper by the Special Session organizers.

V. ABOUT THE PROPOSERS

Daniel Medina (daniel.ariasmedina@dlr.de) is a research fellow at the Institute of Communications and Navigation of the German Aerospace Center (DLR). He received the B.Eng in Electrical Engineering from the University of Malaga and the M.Eng in Computer Science from Charles III University of Madrid in 2014 and 2016 respectively. Currently, he is on the verge of completing his PhD on sensor fusion for robust navigation under signal-degraded scenarios. His research interests include GNSS carrier-phase attitude determination, high accuracy applications and robust estimation.

Dr. Jordi Vilà-Valls (jordi.vila-valls@isae-supaero.fr) is Associate Professor at the Institut Supérieur de l’Aéronautique et de l’Espace (ISAE-SUPAERO), University of Toulouse, France. He received the M.Sc. in Electrical Engineering from both Universitat Politècnica de Catalunya (UPC), Spain, and Grenoble Institute of Technology (INPG), France, in 2006, and the PhD in Signal Processing from INPG in 2010. His primary areas of interest include statistical signal processing, nonlinear Bayesian inference, robust filtering, computational and robust statistics; with applications to positioning/localization/tracking systems, sensor data fusion, and intelligent transportation systems. He is Senior Member of the IEEE, EURASIP and ION, and currently serves as Students Activities Co-Chair for the EUSIPCO’19, and Finance Co-Chair for the IEEE CAMSAP’19.

Dr. Pau Closas (closas@northeastern.edu) is Assistant Professor in Electrical and Computer Engineering at Northeastern University, Boston MA. He received the M.Sc. and Ph.D. in Electrical Engineering from UPC in 2003 and 2009, respectively. He also holds a M.Sc. in Advanced Maths and Mathematical Engineering from UPC since 2014. He is the recipient of the EURASIP Best PhD Thesis Award 2014, the 9th Duran Farell Award for Technology Research, and the 2016 ION’s Early Achievements Award, for contributions to signal processing for GNSS. His primary areas of interest include statistical signal processing, stochastic filtering, robustness analysis, and game theory, with applications to positioning systems, wireless communications, and mathematical biology. Pau Closas is Senior Member of the IEEE, the EURASIP and the ION. He has been involved in the organizing committees of a number of conference such as EUSIPCO’11, IEEE SSP’16, EUSIPCO’19, or IEEE ICASSP’20.