

GUEST EDITORIAL PREFACE

Special Issue on New Applications and Advanced Methodologies for Road Safety and Simulation

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Safety and in particular road safety have become major concerns worldwide, due to the rapid growth in the number of vehicles and traffic accidents. Road fatalities are the result of several joint factors: they can be caused by drivers' errors, by vehicles' malfunctions and by issues related to roads environment. In the U.S., in 2010 there were an estimated 5.419.000 crashes (30.296 fatal crashes), killing 32.999 and injuring 2.239.000. The European Commission has defined road safety as the major societal issue: in 2011, more than 30,000 people died on the roads of the European Union, i.e. the equivalent of a medium town. In addition, for every death on Europe's roads there are an estimated 4 permanently disabling injuries such as damage to the brain or spinal cord, 8 serious injuries and 50 minor injuries. More recently, more than 180.000 road accidents

were reported in Italy in the 2013 with 3.400 deaths and 259.500 injured.

In order to enhance road safety, several researches have been recently carried out defining new strategies and approaches, exploiting new advanced methodologies. In particular, the technologies provided by Information and Communication Technologies (ICT) can be helpful in tackling road safety issues. Through the technologies provided by ICT, it is possible to find new and innovative solutions to road safety issues, developing new systems and tools, which can improve the investigation and analyses of roads problems. Throughout the past years, a great deal of research efforts have centered on this field. Furthermore, the focus of recent researches is the development of methodologies, tools and technologies to design innovative methods and algorithms

for wireless sensors networks applied to road safety and simulation. Some examples are the development of new technologies such as on-board software and hardware systems used to improve the efficiency and the control of mechanical components, such as hydraulic pump. Moreover, thanks to the new wireless sensors, it is now possible to update these on-board systems through the Over-The-Air (OTA) software system, which allows carmakers to update or exchange the software installed in automotive engine control units using wireless technologies. Recently, it has become customary to adopt driving simulation laboratories, in order to test these new algorithms and approaches for road safety.

In the last decade, a dedicated driving simulation laboratory has proved to be an advanced and valuable tool to generate improvements in the studies on transportation. Starting from 2007, driving simulation studies have increased and many researchers have approached this new tool in order to use it for their specific purposes. In addition, researchers in other fields have focused their attention on driving simulation and accepted it as a very promising and interesting tool for their investigations. Through driving simulations in the virtual world, users can naturally interact with the objects of virtual reality made vivid thanks to multimedia and simulation technologies. Moreover, the wireless sensors and software analysis tools provided by simulation systems allow researchers to process and analyze the data obtained in driving simulation sessions, in order to understand the reasons behind users' errors, such as lack of attention (for example caused by reading road signs or advertisements). Driving simulation system has become essential in order to: (i) test the on-board system identifying possible issues; (ii) identify the traffic safety risks of new roads' design improving accident black spots, which are important to establish long-term management mechanism and to reduce road traffic accidents.

This special issue aims at bringing together interdisciplinary researchers and professionals of both road safety and telecommunications and

networking in order to facilitate the exchange of know-how and progress in simulation techniques and their applications to safety analysis. This goal is achieved through the presentation of a set of stand-alone articles and advances in the emerging field of investigating and understanding the issues related to road safety, through new perspectives, applying the innovative signal processing advances in wireless networks design for road safety and simulation.

In the first paper, titled "*FDTD Simulation of the GPR Signal for Preventing the Risk of Accidents due to Pavement Damages*" by F. Tosti, and A. Umiliaco, investigates the benefits provided by ground-penetrating radar (GPR) as efficient technique to enable better management of pavement assets and better diagnosis of the causes of pavement failures. The authors provide an in-depth analysis of one of the main causes of surface damage through the GPR numerical simulator *GprMax2D* based on finite-difference time-domain (FDTD) method for the simulation of the GPR signal. The simulation results underline the high potential of the GPR technique: an effective tool able to detect the causes of road damages, allowing researchers to evaluate the evolution in time of road's degradation.

The second paper, titled "*Impact of Immersion and Realism in Driving Simulator Studies*" by M. Despina et al., presents a new 3D driving simulator based on 3D modelling tools in a module-based approach through a vivid 3D reality which allows users to interact with a virtual representation of road environment and vehicles. The driving simulator aims at testing both the different setups of the simulator and the environment's infrastructure parameters affecting the driver's performance.

The third paper of this Special Issue is "*Allocation Criteria for Increasing Electronic Toll Collection Gates on Freeways Determined Using Simulation Analysis*" by P.Y. Tseng et al., and depicts the electronic toll collection (ETC) system for freeway toll plazas in Taiwan in February 2006. Here, the authors highlights the usefulness of ETC, based on interdisciplinary technologies such as telecommunications and image processing techniques, in increasing the

capacity of toll station enhancing the safety and convenience of road use. The work ends analyzing the simulation results which show that the operation performance of toll stations depends on many factors such as traffic volume and ETC usage rate.

This journal issue also contains a regular paper, that is out of the contents of this special issue, paper number 4 and titled “*Broadband and e-Government Services in South East Europe: Comparative Analysis, Impact and Policy Recommendations*” by K. Antonis et al. The authors provide a comprehensive overview of the current state of affairs regarding broadband and e-Government services in seven South East Europe countries (Austria, Bulgaria, Greece, Italy, Slovenia, Former Yugoslav Republic of Macedonia, and Montenegro). The impact of broadband on the growth and employment in these countries is investigated by specifying the macroeconomic evidence required for the analysis. A detailed regression analysis is carried out on data collected by the respective countries in order to find the correlation between broadband, growth and employment. The paper ends providing useful and usable information that could lead to suggestions for improvements and joint actions for policy makers that will, in turn, help improve the related policies in these countries.

The fourth paper (that is the paper number 5 in this journal issue), “*Simulation of Pedestrians and Motorised Traffic: existing research and future challenges*” by E. Papadimitriou et al. illustrates a review of the state-of-art in pedestrian simulation models in order to identify the main issues in this field for further research. The authors focus on the modelling of pedestrians and motorized traffics underlining how, in recent years, pedestrian simulation models are used in the framework of wireless vehicular networks. Through the review of the pedestrian simulation

models also used in wireless networks as well, the authors show the popularity of this research topic and identify the main challenges for the simulation of pedestrians and motorized traffic in urban areas.

The last paper of this special issue (that is the paper number 6 in this journal issue) “*Protocol for Transferability of Driver Simulator Results to Real Traffic Conditions*” by M. Gemou et al., depicts a protocol allowing the transferability of the driver simulator’s results in real traffic condition. In order to define this new kind of protocol, the authors exploit six major research hypotheses, analyzing the weaknesses of driving simulators, as well as an experimental and methodology framework for the analysis of collected data and measurements (described in details in the paper in order to allow researchers to adopt it for driving simulators). The novelty of the proposed protocol is that it is based on the examination of the behavior of each single driver and in the context of a general population and it is flexible in order to be used in other type of driving simulators.

We would like to thank all of the authors who have submitted their papers to this Special Issue and the reviewers who have helped to evaluate the submissions with their invaluable work. The guest editors are really grateful to the Editor-in-Chief (EiC), Prof. Dr. M. Bartolacci, and also to the IGI Global staff for their kind help and support during the papers review and decision process. Finally, we hope the readers will be encouraged by the contents of this Special Issue to address many of the demanding and open problems in this field.

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