1st International Workshop on Safety/Reliability/Trustworthiness of Intelligent Transportation Systems (SRToITS 2023)

SRToITS2023 is in conjunction with SAFECOMP2023

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1   Introduction

A mix of intelligent transportation systems (ITSs, e.g., the automated car/bus/metro/train, etc.) and regular transportation systems (RTSs) in future traffic networks challenges the safety, reliability and trustworthiness of ITSs, as well as the holistic safety of traffic networks. Hence, it is crucial to understand the risks of such mixed traffic networks where ITSs and RTSs are both involved, with mutual interactions. The risks can be caused by the following aspects: the complexity of operational tasks that ITSs have to deal with has been grossly underestimated, the artificial intelligence (AI) technology-based decision making is not reliable enough, ITSs lack a thorough and correct understanding of human driver behaviors and intentions in mixed scenarios, etc. With this in mind, there are many important issues that need to be investigated to facilitate ITSs performing tasks safely and properly, and assure the safety of traffic networks.

Topics of the workshop
Contributions are sought in (but are not limited to) the following topics:
- Functional safety of ITSs,
- Safety of the Intended Functionality (SOTIF),
- Reliability/ interpretability /trustworthiness of AI based systems,
- Scenario/model based V&V,
- Risk assessment of scenario-based virtual testing,
- Ways to assess the criticality of operational scenarios,
- Safety, security and performance issues of the coordination between automated vehicles and smart infrastructures,
- Understanding of human driver behaviors and intentions,
- Implications from regulatory entities,

- Challenges of road safety considering a mix of automated vehicles and regular ones in future roadways,
- Challenges of intelligent moving block operation in railways.

2 Workshop Format

SRToITS2023 will be a full-day workshop with a mix of keynotes (we plan to host two keynotes), paper presentations and discussion sessions.

Schedule:

9.00-9.40	**Keynote:** Automated driving safety - when is an automated vehicle ready for the road?	Martin Törngren, (30 min Presentation + 10 min Q&A)
9.40-10.00	Reliability Evaluation of Autonomous Transportation System Architecture Based on Markov Chain	Bingyv Shen, Guangyun Liu, Shaowu Cheng, Xiantong Li, Kui Li and Chen Liang, (15 min Presentation + 5 min Q&A)
10.00-10.30	Coffee Break	
10.30-10.50	Uncertainty Quantification for Semantic Segmentation Models via Evidential Reasoning	Rui Wang, Mengying Wang, Ci Liang and Zhouxian Jiang (15 min Presentation + 5 min Q&A)
10.50-11.10	Research on the Reliability of High-Speed Railway Dispatching and Commanding Personnel with Multi Physiological Signals	Liuxing Hu and Wei Zheng, (15 min Presentation + 5 min Q&A)
11.10-11.30	Research on Brain Load prediction based on machine learning for High-speed Railway dispatching	Dandan Bi, Xiaorong Meng and Wei Zheng, (15 min Presentation + 5 min Q&A)
11.30-13.00	Lunch Break	
13.00-13.40	**Keynote:** Using Monte Carlo and stochastic models to understand rare accident mechanisms and improve safety	Olivier Cazier, (30 min Presentation + 10 min Q&A)
13.40-14.10	HIT Transportation Research Introduction	Ci Liang
14.10-14.30	Towards an Effective Generation of Functional Scenarios for AVs to Guide Sampling	Hugues Blache, Pierre-Antoine Laharotte and El Faouzi Nour-Eddin, (15 min Presentation + 5 min Q&A)

14.30-14.50	Rear-end Collision Risk Analysis for Autonomous Driving	Ci Liang, Mohamed Ghazel, Yusheng Ci, Nour-Eddin El Faouzi, Rui Wang and Wei Zheng, (15 min Presentation + 5 min Q&A)
14.50-15.30	Coffee Break	
15.30-15.50	Improving road traffic safety and performance – barriers and directions towards cooperative automated vehicles	Gianfilippo Fornaro and Martin Törngren (15 min Presentation + 5 min Q&A)
15.50-16.10	Paired Safety Rule Structure for Human-machine Cooperation with Feature Update and Evolution	Satoshi Otsuka, Natsumi Watanabe, Takehito Ogata, Donato Di Paola, Daniel Hillen, Joshua Frey, Nishanth Laxman and Jan Reich, (15 min Presentation + 5 min Q&A)
16.10-16.30	Summary	

2.1 Keynote 1

Keynote speaker: Martin Törngren is a Professor in Embedded Control Systems at the Department of Engineering Design at KTH Royal Institute of Technology since 2002. In 1994 he received the SAAB-Scania award for qualified contributions in distributed control systems, and in 2004 the ITEA achievement award 2004 for contributions to the EAST-EEA project. From 1999 to 2004 he served as the Chairman of the Swedish real-time systems association, and he has represented KTH as a core partner in the EU networks of excellence in embedded systems design, Artist2 and ArtistDesign, and in the Artemis industrial association. He is the director of the TECoSA Swedish national competence center on Trustworthy Edge Computing Systems and Applications. His main research interests lie in safety and complexity management of automated and connected cyber-physical systems.

Title: Automated driving safety - when is an automated vehicle ready for the road?

Abstract: Automated driving is a fascinating endeavor, representing a big leap in capabilities and complexity. The enormous investments into automated vehicles (AVs) have led to a rapid technological advancement with tremendous impact in the automotive and beyond. Yet, many challenges remain as the hype cycle has taken us through the trough of disillusionment. This talk will address the question of "when an AV is ready for the roads" with respect to acceptable risks, from philosophical, technical and societal viewpoints. In this talk I will attempt to summarize the current state of affairs and discuss some of the key remaining hurdles. Introducing automated vehicles at a somewhat large scale, beyond very limited operational design domains (ODDs), requires the advancement of approaches for cost-effective development, operations and their integration, to pave the way for trustworthy AVs. Key ingredients in development includes new system architectures and methodologies, including for verification and validation where model-based engineering will play an important role. The integration

to form "trustworthy DevOps" requires the consideration of the whole life-cycle of activities (beyond primary functions being automated), ODD and operations engineering, and the provisioning of integrated AV and smart infrastructure designs. The talk will also give highlights of research at KTH along these strands including ongoing initiatives towards open research testbeds including AD-EYE (https://www.adeye.se/) and TECoSA (https://www.tecosa.center.kth.se/).

2.2 Keynote 2

Keynote speaker: <u>Olivier Cazier</u> is currently the founder of the company Chez Conseil en Infrastructures de Transport Environnement&Circulation Sécurité, specializing in reliability, availability, maintenance and safety for Railway, and a senior consultant for modernizing Railways lines in Eastern France and Occitania. He has been the Head of the Department Technological and Process Innovation of SNCF Network. He has been a member of the Scientific Committee and organization Committee of GeoRail 2011, 2014, 2017. His main interests lie in safety and security of transportation, FDMS, and innovation for intelligent transportation systems.

Title: Using Monte Carlo and stochastic models to understand rare accident mechanisms and improve safety

Abstract: Designing an "intelligent" transportation system requires, in order to make it safe, to understand the mechanisms that may lead to relevant accidents. But in a modern transportation system, accidents or even incidents are very rare, and it takes hundreds or thousands of years of observation to be able to confirm that the required safety levels are fulfilled. In addition, if accidents are very rare, it is difficult, almost not impossible, to observe accident mechanisms and to have feedback on safety analyses. However, when we know the overall behavior of a system and its laws of operation, it is possible to model the system by Monte Carlo based models, or in the simplest cases by stochastic models, and use these models to diagnose the causes of the events. A good example of the application of Monte Carlo and stochastic models is the railway crossing: the common belief is that the main cause of accidents is the error or carelessness of the motorized driver. However, a stochastic model shows that this hypothesis is not consistent with accident statistics that the causes resulting in accidents at low-traffic-flow crossings are very different from those at busy crossings and that an effective intelligent accident prevention system will have to be introduced to take into account the various causes. This talk will address the Monte Carlo and stochastic based methodologies and their applications in rare accident /corner case analysis in Railways.

3 Acknowledgements

Particularly, we want to express our thanks to the SAFECOMP chairpersons and organizers, who provided us the opportunity to organize the workshop at SAFECOMP 2023 as a hybrid event.

We hope that all participants will benefit from the workshop, enjoy the conference and will join us again in the future!

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