Workshop Proposal to IEEE ANTS 2020, New Delhi, India

Dr. Seshadri Mohan, Dr. Nigel Jefferies, and Dr. Sachin Sharma

1. Special session/workshop title: The Role of AI/Machine Learning in the Evolution of Connected Vehicles

2. Length of the special session/workshop (half/full-day): Half Day

3. Names, main contact, and a short bio (200 words) of the organizers:

Dr. Seshadri Mohan, Professor, Systems Engineering Department, UA Little Rock, Little Rock, AR 72223, USA. Email: sxmohan@ualr.edu; (501) 658-6749; will serve as the main contact.

Dr. Seshadri Mohan is currently a professor in Systems Engineering Department at University of Arkansas at Little Rock, where, from August 2004 to June 2013, he served as the Chair of the Department of Systems Engineering. Prior to the current position he served as the Chief Technology Officer (CTO) and Acting CEO of IP SerVoniX, where he consulted for several telecommunication firms and venture firms, and served as the CTO of Telsima (formerly known as Kinera). Besides these positions, his industry experience spans a decade at New Jersey-based Telcordia (formerly Bellcore) and Bell Laboratories. Prior to joining Telcordia, he was an associate professor at Clarkson and Wayne State Universities. Dr. Mohan has authored/coauthored over 125 publications in the form of books, patents, and papers in refereed journals and conference proceedings with citations to his publications in excess of 5400. He is the inventor of 15 inventions with US and international patents. He has co-authored the textbook Source and Channel Coding: An Algorithmic Approach. He has also served as a Guest Editor for several Special issues of IEEE Network, IEEE Communications Magazine, and ACM MONET. In April 2011, he was awarded the 2010 IEEE Region 5 Outstanding Engineering Educator Award. He received the best paper award for the paper "A Multi-Path Routing Scheme for GMPLS-Controlled WDM Networks," presented at the 4th IEEE Advanced Networks and Telecommunications Systems conference. Dr. Mohan holds a Ph.D. degree in electrical and computer engineering from McMaster University, Canada, the Master's degree in electrical engineering from the Indian Institute of Technology, Kanpur, India, and the Bachelor's degree in Electronics and Telecommunications from the University of Madras, India.

Dr. Nigel Jefferies is a senior standards manager with Huawei Technologies and Chairman of the Wireless World Research Forum, a global partnership between industry and academia to develop a research agenda for mobile communications. Previously he was Head of Academic Relationships within Vodafone Group Research & Development and a Principal Mathematician at Racal Research Ltd. In the past he led the European-funded IST project SHAMAN, which studied the security of future mobile systems, and ran the Secure Applications Steering Group for Mobile VCE. Other collaborative research projects on various aspects of security for mobile communications include 3GS3 in the UK-funded LINK programme, and ASPeCT and USECA in

the European ACTS Program. His research interests include cryptography, security of systems and applications of mathematics to telecommunications. He received a PhD in functional analysis from Goldsmith's College, London, and an MA in mathematics from the Queen's College, Oxford. He is a Senior Member of the IEEE, a Fellow of the Institute of Mathematics and its Applications and a Chartered Mathematician.

Dr. Sachin Sharma is presently serving as the Associate Dean, International Affairs and Associate Professor, Department of Computer Science and Engineering at Graphic Era Deemed to be University, Dehradun, UK, India. He is also Co-founder and Chief Technology officer (CTO) of IntelliNexus LLC, Arkansas, USA. He also worked as a Senior Systems Engineer at Belkin International, Inc., Irvine, California, USA for two years. He received his Ph.D. degree in Engineering Science and Systems with specialization in Systems Engineering and the M.S. degree in Systems engineering from University of Arkansas (UA) at Little Rock, USA and the B.Tech. degree from SRM University, Chennai. During his B.Tech he participated in the student exchange program between UA Little Rock and SRM and spent two years at UA Little Rock. His research interests include wireless communication networks, IoT, Vehicular ad hoc networking and network security.

4. Brief description of the special session including abstract, scope and timeliness.

The field of connected vehicles stands at the confluence of three evolving disciplines – the Internet of Things (IoT), emerging standards for connectivity of vehicles, and AI/machine learning. The number of connected IoT devices is expected to grow from 9.5 billion devices in 2019 to 22.5 billion devices in 2025 [1]. More optimistic estimates project the number of IoT devices in 2025 to be 55 billion connected devices [2]. Consequently, applications of IoT devices have rapidly expanded to integrate intelligent sensing and processing along with smart applications of the technology into various fields such as smart homes, smart appliances, enterprises, smart transportation including connected vehicles, smart cities, agriculture, energy, security, healthcare, shopping, location-based services including tracking and other similar fields. The exponential growth of IoT is transforming the quality of living of human beings around the globe.

Fueling the growth in the evolution of vehicles towards total automation is the development of novel sensors, 3D cameras, lidars and radars and their ability to connect to the Internet, upload the data to a cloud. The sensors of an autonomous vehicle collect anywhere from 1.4 TB to 19 TB of data per hour. Whether or not the vehicles are autonomous, one of the key features of connected vehicles is that they are able to share data between themselves in real-time. For example, the scene of an accident or road work encountered by a vehicle can be immediately shared with vehicles it is connected to. Thus vehicles may learn about accidents or road work well in advance so as to enable

them to make smart decisions and establish alternate routes to their destinations. The workshop will help in understanding the role of these sensors with use cases.

The vast amount of raw data collected must by mined for it to become useful in ensuring traffic safety by means such as intelligent rerouting of traffic or distribution of information on roadwork activities or accidents. Machine learning is a mechanism that has become extremely powerful in extracting meaningful data. A number machine learning algorithms exist and can be broadly classified under unsupervised, supervised, and reinforcement learning algorithms. A number of algorithms exist under each category. The workshop will address the impact of machine learning and their applications to connected vehicles with several use cases.

Scope

The workshop will address a number of technical issues involving the application of artificial intelligence/machine learning to connected vehicles. The areas in which machine learning can be effective include, but not limited to:

- Channel estimation, especially with high-mobility vehicles with rapidly changing environment and channel conditions; machine learning can adapt to the environmental dynamics and estimate and even predict the channel characteristics;
- Prediction of traffic flow by applying machine learning to the vast amount of past traffic flow information, history of accidents, congestion, roadworks, detours, and other traffic incidents possibly due to weather;
- Resource allocation in wireless networks of connected vehicles by exploiting machine learning, utilizing information gathered from the previously mentioned aspects of channel estimation and traffic flow prediction, to efficiently allocate the scarce radio and network resources to connected vehicles; and
- Predicting the driving behaviors of drivers, the physical and emotional status, alert the drivers of possible corrective actions to take so as to avoid accidents.
- Application of machine learning to determine and even predict security threats to connected vehicles and ensuring privacy and security.

The above are only a few of the example topics in which some or most of the following subtopics apply.

- 3D computer vision in connected vehicles
- Action and behavior recognition of drivers/vehicles in connected vehicles
- Adversarial learning, adversarial attack and defense methods in connected vehicles

- Biometrics, face, gesture, body pose of driver in connected vehicles
- Computational photography, image and video synthesis in connected vehicles
- Efficient training and inference methods for networks in connected vehicles
- Explainable AI, fairness, accountability, privacy, transparency and ethics in connected vehicles
- Image retrieval in connected vehicles
- Low-level and physics-based vision analysis in connected vehicles
- Machine learning architectures and formulations in connected vehicles
- Motion and tracking in connected vehicles
- Neural generative models, auto encoders, GANs in connected vehicles
- Optimization and learning methods in connected vehicles
- Recognition (object detection, categorization) in connected vehicles
- Representation learning, deep learning in connected vehicles
- Scene analysis and understanding in connected vehicles
- Segmentation, grouping and shape in connected vehicles
- Transfer, low-shot, semi- and un- supervised learning in connected vehicles
- Video analysis and understanding in connected vehicles
- Vision + language, vision + other modalities in connected vehicles
- Visual reasoning and logical representation in connected vehicles
- General Machine Learning (active learning, clustering, online learning, ranking, reinforcement learning, semi-supervised learning, time series analysis, unsupervised learning, etc.) in connected vehicles
- Deep Learning (architectures, generative models, deep reinforcement learning, etc.) in connected vehicles
- Learning Theory (bandits, game theory, statistical learning theory, etc.) in connected vehicles
- Optimization (convex and non-convex optimization, matrix/tensor methods, sparsity, etc.) in connected vehicles
- Probabilistic Inference (Bayesian methods, graphical models, Monte Carlo methods, etc.) in connected vehicles
- Trustworthy Machine Learning (accountability, causality, fairness, privacy, robustness, etc.) in connected vehicles

Timeliness and intended audience

The topic is extremely relevant since the auto makers are engaged with the development of connected autonomous vehicles. 5G Automotive Association (5GAA) was established to facilitate a tighter collaboration between the telecom industry and auto manufactures and to create end-to-end solutions for future mobility and transportation services. As explained already the standards organizations are rapidly developing standards for connected vehicles. The audience will include researchers from both academia and industry personnel with interests in the field.

5. Planned format of the special session, including projected number of referred papers/talks, hot topic sessions, keynotes, and panel discussions.

The workshop will be organized in the following format:

The organizers of the workshop will provide an overview of relevant issues of connected vehicles and will be followed by other speakers. Besides contributed papers, speakers from the connected vehicles industry will be invited to speak and participate in the workshop panel. The panel will likely include CEOs, directors or researchers from Silicon Valley startups, Nissan, Ford, and possibly GM who will address various key topics listed under the preceding item. The workshop organizers will raise key questions for the panel and will be followed by a Q&A session with involvement by the audience. There are likely to be several peer reviewed and accepted papers, the authors of which will be participants and panelists.

6. Potential participants including program committee members and invited speakers.

Besides the speakers of contributed speakers, a few speakers may be invited from the following list:

- Mr. Ravi Puvula, Founder and CEO of Savari, a Silicon Valley startup,
- Mr. Gopi C. Surnilla, Technical Leader, Controls & Technology Innovation and Implementation Controls & Automated Systems Research & Adv. Engineering, Ford Motor Co., Mountain View, CA.
- Dr. Ashok Chandra, Formerly Wireless Advisor to Government of India
- Subodh Gujare, Lead Architect, CISCO R&D Center, Bengaluru.
- Subhas Mandal, Chief Architect of 5G and a Fellow at Wipro Limited
- Dr. Bhavani Shankar, Research Scientist, University of Luxemborg
- Dr. Sachin Sharma, Associate Professor, Graphic Era University, Dehradun
- Dr. Anand Srivastava, Professor and Dean of R&D, IIIT Delhi
- Dr. Purnima Lala, Assistant Professor, IILM College of Engineering and Technology, Greater Noida (India)
- Dr. Marcus Wong, Futurewei Technologies, USA
- Dr. Andrea Burgess, National Physical Laboratories, UK
- Dr. Stephan Sand, German Aerospace Center, Germany
- Dr. Pradipta Das, IISc, Bangaluru.

7. Brief description of publicity plan

We plan to actively advertise the CFP to twelve different IEEE mailing lists as well as via EDAS. Being a member of WWRF and the Chair of Connected Vehicles Working Group, I have extensive contacts in Europe and Asia.

8. Prior history of the special session

Besides having supervised PhD dissertations and published papers in the topic of the workshop, Dr. Mohan is presently the Chair of the 'Connected Vehicles' working group of Wireless World Research Forum (WWRF) https://www.wwrf.ch/vip-wg-connected-vehicles.html. He has organized sessions on connected vehicles at WWRF meetings at Barcelona, Spain; Durban, South Africa; Herning, Denmark; Tokyo, Japan; and London, UK. He has cofounded IntelliNexus, LLC involved in various aspects of connected vehicles, He has conducted or is scheduled to conduct three workshops on connected vehicles, one at IEEE ANTS 2019, Goa, India, Dec. 16-19, as part of "5G & Beyond for Rural-Upliftment", jointly with BIT SINDRI, IIT DHANBAD, IEEE 5G SUMMIT & 35th GISFI STANDARDIZATION SERIES MEETING (GSSM), and at the WWRF Meeting '44, June 2020.

Dr. Nigel Jefferies as the Chairman of WWRF has extensive experience in organizing WWRF meetings as well as WWRF 5G Huddles globally.

Dr. Sachin Sharma has worked extensively in the area of connected vehicles and served as the co-organizer of the ANTS 2019 workshop on connected vehicles.

CALL FOR PAPERS

(Our sincere apologies in case you receive multiple copies)

Workshop on The Role of AI/Machine Learning in the Evolution of Connected Vehicles

IEEE ANTS 2020

14-17 December 2020 // IIIT-D, New Delhi, India

https://ants2020.ieee-comsoc-ants.org/

Key Deadlines

Paper submission deadline: 10/31/2020
Decision notification to authors: 11/15/2020
Final paper & copyright submission deadline: 11/22/2020

Description

The field of connected vehicles stands at the confluence of three evolving disciplines – the Internet of Things (IoT), emerging standards for connectivity of vehicles, and AI/machine learning. The number of connected IoT devices is expected to grow from 9.5 billion devices in 2019 to 22.5 billion devices in 2025 [1]. More optimistic estimates project the number of IoT devices in 2025 to be 55 billion connected devices [2]. Consequently, applications of IoT devices have rapidly expanded to integrate intelligent sensing and processing along with smart applications of the technology into various fields such as smart homes, smart appliances, enterprises, smart transportation including connected vehicles, smart cities, agriculture, energy, security, healthcare, shopping, location-based services including tracking and other similar fields. The exponential growth of IoT is transforming the quality of living of human beings around the globe.

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Scope

The workshop will address a number of technical issues involving the application of artificial intelligence/machine learning to connected vehicles such as, but not limited to, the following:

- 3D computer vision in connected vehicles
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Potential authors are invited to submit papers via EDAS. The papers should follow the IEEE conference format.

Workshop Chairs

Dr. Seshadri Mohan, University of Arkansas at Little Rock, sxmohan@ualr.edu

Dr. Nigel Jefferies, Wireless World Research Forum Chairman and Huawei Technologies, chairman@wwrf.ch

Dr. Sachin Sharma, Graphic Era University, Dehradun, India, sachin.cse@geu.ac.in