Edge Intelligence Enabled by Multi-Device Systems

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***Abstract*—Edge intelligence focuses on pushing the data processing of resource-intensive AI-based applications to the Edge of the network. Indeed, Edge computing enables machine and deep learning models to be trained and provisioned in proximity of users without minimal or none cloud support. This enables the creation of a new type of end applications with low energy footprint and better decision making capabilities. For instance, applications for autonomous driving, health monitoring, and augmented reality, among others. Unfortunately, the lack of dense and potent computing infrastructure on the Edge is a critical limitation that prevents the adoption of Edge intelligence. On the other hand, the ever-increasing availability of programmable smart devices in everyday environments is giving rise to computing scenarios that involve collaboration between multiple devices. Examples of such scenarios range from resource sharing (e.g., mobile device crowds for sensing and computing) to scenarios requiring active collaboration between multiple devices (e.g., opportunistic device-to-device networks). The theme of the panel is to overview how multi-device collaborative systems can be exploited to enable Edge intelligence for end applications. In particular, the panel is interested on discussing the exploitation of computational resources of smart devices for executing distributed AI-based applications, as well as, the self-organization of smart devices to enable federated learning architectures that can train machine and deep learning models incrementally.**

***Index Terms*—Edge Intelligence, Federated learning, Deep and machine learning, Artificial Intelligence, Pervasive computing, Device-to-Device collaboration, Opportunistic crowd, Context-awareness, Mobile devices, Mobile crowds, Multi-Device sensing, Multi-Device computing**

MODERATOR

Tristan Braud: is a postdoctoral research fellow at HKUST-DT Systems and Media Lab (SyMLab) at the Hong Kong University of Science and Technology, Hong Kong. He got his PhD from Université Grenoble Alpes, France in 2016. Before that, he was an engineering student at Grenoble INP Phelma/Ensimag, France, and received both a MSC from the Politecnico di Torino, Italy, and Grenoble INP, France. His major research interests include mobile computing, cloud and edge computing, human centered system designs and AR.

PANELISTS

Huber Flores: is an Associate Professor of Pervasive Computing at the Institute of Computer Science, University of Tartu, Estonia as well as a Docent (Affiliate Professor) at the University of Helsinki, Finland. Prior to that, he held the prestigious Academy of Finland Postdoctoral Fellowship and the competitive Faculty of Science Postdoctoral Fellowship of the University of Helsinki. He has been awarded several times due to his excellent ideas and research skills. Among his multiple awards, we can mention the Nokia Jorma Ollila Award (2018) given by the Nokia Foundation to support outstanding research in Finland, and the (twice) Tiger University Scholarship award (2012, 2013) that is given to the top 5 students across all the Estonian Universities. Prof. Flores is also an active member of ACM (SIGMOBILE) and IEEE societies. His major research interests include distributed systems, pervasive and mobile computing, and mobile cloud computing. He consistently publishes at top-ranked conferences, such as Ubicomp/IMWUT, ICDCS, CHI, PerCom, MobiSys, HotMobile, WWW; and journals such as IEEE Communications, IEEE Transactions on Mobile Computing, Pervasive and Mobile Computing, and IEEE Pervasive. He has served as an organizer and committee member of multiple mobile computing and networking venues, which includes IJCAI, ECAI, IUI, WWW, IPDPS Workshops, MobiCom@CHANTS, Student Workshop@CoNext, PerCrowd@PerCom, and HotPOST@INFOCOM.

Stephan Sigg: is an Associate Professor at Aalto University in the Department of Communications and Networking, Finland. From October 2013 to September 2015, he was with the Computer Networks Group of Georg-August-University Goettingen, Germany. Before, he was a researcher at UT-Braunschweig, Germany and an academic guest in the Wearable Computing Lab at ETH Zurich and in the Nodes Laboratory at University of Helsinki. From December 2010 to March 2013, Stephan was with the National Institute of Informatics (NII), Japan, in the Information systems architecture research division and a part-time lecturer at Waseda University, Japan. He was a visiting Professor for Distributed and Ubiquitous Systems at the TU Braunschweig, Germany in the winter term 2010, a PostDoc researcher at the chair of Pervasive Computing Systems (TecO) of the Karlsruhe Institute of Technology (KIT), Germany in 2010 and a PostDoc researcher

at the chair for Distributed and Ubiquitous Systems at the TU Braunschweig, Germany from 2008 to 2010. He obtained his PhD (Dr. rer. nat.; 2008) from University of Kassel, Germany where he was with the chair for Communication Technology (ComTec) from 2005 to 2007.

Petteri Nurmi: is an internationally well-recognized researcher in the fields of ubiquitous computing and sensing. He is an Associate Professor at University of Helsinki, Finland. Prior to that, he was a 50th Anniversary Lecturer in Foundations of Pervasive Data Science at Lancaster University. Prof. Nurmi has a comprehensive publication record, with over 90 published articles, and an extensive citation record (2000+ citations, h-index of 23). He consistently publishes at top-ranked conferences, such as Ubicomp, MobiCom, SenSys, MobiSys, IUI, WWW, PerCom. and journals such as IEEE Pervasive, IEEE Transactions on Mobile Computing, Pervasive and Mobile Computing, and ACM Transactions on Intelligent Information Systems. He has served as external evaluator for ERC starting grant proposals; he was the program chair for MobiCASE 2015; and he serves as a program committee member and reviewer to several top conferences in the field. He has also actively participated in conference organization activities (workshop chair for PerCom 2018 and Pervasive 2009, Demonstration Chair for PerCom 2017, poster chair for MobileHCI 2013 and Work-in-Progress Chair for PerCom 2020). He also formerly worked as Science Advisor for Moprim, a company focusing on analysis of mobility information.

Mostafa Ammar: is a Regents' Professor with the School of Computer Science at the Georgia Institute of Technology. He is currently serving as the Interim Chair of the School. Dr. Ammar received the S.B. and S.M. degrees from the Massachusetts Institute of Technology and the Ph.D. from the University of Waterloo, Ontario, Canada. Dr. Ammar's research interests are in network architectures, protocols and services. He has contributions in many areas within networking research, most recently in disruption-tolerant networks, mobile cloud computing, network virtualization, packet scheduling in modern networks, and adaptive video streaming. To date, 37 Ph.D. students have completed their degrees under his supervision; many have gone on to distinguished careers in academia and industry. Dr. Ammar has served the networking research community in multiple roles. Most notably, he served as the Editor-in-Chief of the IEEE/ACM Transactions on Networking (ToN) from 1999 to 2003, and he was the co-TPC Chair for the IEEE ICNP 1997, ACM CoNEXT 2006 and ACM SIGMETRICS 2007 conferences. His awards include the IBM Faculty Partnership Award (1996), Best Paper Award at the 7th WWW conference (1998), the GT Outstanding Doctoral Thesis Advisor Award (2006), the Outstanding Service Award from the IEEE Technical Committee on Computer Communications (2010), the ACM Mobihoc Best Paper Award (2012), and the Best Paper Award at IFIP Network Traffic Measurement and Analysis Conference (2018). He received the 2018 Alumni Achievement Award from the Faculty of Engineering at the University of Waterloo. Dr. Ammar is Fellow of the ACM and Fellow of the IEEE.