

## **Machine Learning in Massive Ultra-Reliable Low Latency Connectivity (mURLLC) in 6G**

**Abstract:** Massive Ultra-Reliable and Low-Latency Communications (mURLLC), which integrates URLLC with massive access, is emerging as a new and important service class in the next generation (6G) for time-sensitive traffics and has recently received tremendous research attention. However, realizing efficient, delay-bounded, and reliable communications for a massive number of user equipments (UEs) in mURLLC, is extremely challenging as it needs to simultaneously take into account the latency, reliability, and massive access requirements. To support these requirements, the third generation partnership project (3GPP) has introduced enhanced grant-free (GF) transmission in the uplink (UL), with multiple active configured-grants (CGs) for URLLC UEs. With multiple CGs (MCG) for UL, UE can choose any of these grants as soon as the data arrives, while with single CG (SCG), UE need to wait for the CG period to transmit the packet. In addition, non-orthogonal multiple access (NOMA) has been proposed to synergize with GF transmission to mitigate the serious transmission delay and network congestion problems. However, in the GF-NOMA scheme, the data is transmitted along with the pilot randomly, which is unknown at the BS and can lead to new research problems. In this talk, Machine Learning (ML) approaches in mURLLC systems will be presented. Promising research directions and possible ML solutions will also be discussed.

**Bio:** Arumugam Nallanathan is Professor of Wireless Communications and the founding head of the Communication Systems Research (CSR) group in the School of Electronic Engineering and Computer Science at Queen Mary University of London since September 2017. He was with the Department of Informatics at King's College London from December 2007 to August 2017, where he was Professor of Wireless Communications from April 2013 to August 2017. He was an Assistant Professor in the Department of Electrical and Computer Engineering, National University of Singapore from August 2000 to December 2007. His research interests include 6G Wireless Networks and Internet of Things (IoT). He published nearly 600 technical papers in scientific journals and international conferences. He is a co-recipient of the Best Paper Awards presented at the IEEE International Conference on Communications 2016 (ICC'2016), IEEE Global Communications Conference 2017 (GLOBECOM'2017) and IEEE Vehicular Technology Conference 2017 (VTC'2017). He is a co-recipient of IEEE Communications Society Leonard G. Abraham Prize, 2022.

He is an Editor-at-Large for IEEE Transactions on Communications and a senior editor for IEEE Wireless Communications Letters. He was an Editor for IEEE Transactions on Wireless Communications (2006-2011), IEEE Transactions on Vehicular Technology (2006-2017), IEEE Signal Processing Letters and a Guest Editor for IEEE Journal on Selected Areas in Communications (JSAC). He served as the Chair for the Signal Processing and Computing for Communications (SPCC-TC) of IEEE Communications Society and Technical Program Chair and member of Technical Program Committees in numerous IEEE conferences. He received the IEEE Communications Society SPCE outstanding service award 2012 and IEEE Communications Society RCC outstanding service award 2014. He has been selected as a Web of Science (ISI) Highly Cited Researcher in 2016 and 2022. He is an IEEE Fellow and IEEE Distinguished Lecturer.