

Generalized Sparse and Low-Rank Optimization for Ultra-Dense Networks: Models, Algorithms and Theory

Abstract:

Ultra-dense network (UDN) is a promising technology to further evolve wireless networks and meet the diverse performance requirements of 5G networks. With abundant access points, each with communication, computation and storage resources, UDN brings unprecedented benefits, including significant improvement in network spectral efficiency and energy efficiency, greatly reduced latency to enable intelligent mobile applications, and the capability of providing massive access for Internet of Things (IoT) devices. However, such great promises come with formidable research challenges. To design and operate such complex networks with various types of resources, efficient and innovative methodologies will be needed. This motivates the recent introduction of highly structured and generalizable models for network optimization. This tutorial shall present recent advances in structured sparse and generalized low-rank techniques for optimizing UDNs, with a comprehensive coverage including modeling, algorithm design, and theoretical analysis. Through motivating applications (e.g., mobile edge caching and wireless distributed learning), the powerfulness of this set of tools will be demonstrated, and their abilities in solving key design problems in UDNs will be highlighted. A special attention is paid on algorithmic approaches to deal with nonconvex objective functions and constraints, as well as computational scalability.

Speaker's Biography:

Jun Zhang, Hong Kong University of Science and Technology, Hong Kong

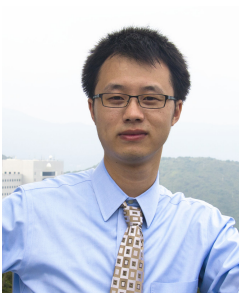


Jun Zhang (S'06-M'10-SM'15) received the B.Eng. degree in Electronic Engineering from the University of Science and Technology of China in 2004, the M.Phil. degree in Information Engineering from the Chinese University of Hong Kong in 2006, and the Ph.D. degree in Electrical and Computer Engineering from the University of Texas at Austin in 2009. He is currently a Research Assistant Professor in the Department of Electronic and Computer Engineering at the Hong Kong University of Science and Technology (HKUST). His research interests include dense wireless cooperative networks, mobile edge computing, cloud computing, and big data analytics systems.

Dr. Zhang co-authored the book *Fundamentals of LTE* (Prentice-Hall, 2010). He is a co-recipient of the 2016 Marconi Prize Paper Award in Wireless Communications, the 2014 Best Paper Award for the *EURASIP Journal on Advances in Signal Processing*, an IEEE GLOBECOM Best Paper Award in 2017, an IEEE ICC Best Paper Award in 2016, and an IEEE PIMRC Best Paper Award in 2014. One paper he co-authored received the 2016 Young Author Best Paper Award of the IEEE Signal Processing Society. He also received the 2016 IEEE ComSoc Asia-Pacific Best Young Researcher Award. He is an Editor of *IEEE Transactions on Wireless Communications*, and was a guest editor of

the special section on “Mobile Edge Computing for Wireless Networks” in IEEE Access. He frequently serves on the technical program committees of major IEEE conferences in wireless communications, such as ICC, Globecom, WCNC, VTC, etc., and served as a MAC track co-chair for IEEE WCNC 2011.

Yuanming Shi, ShanghaiTech University, Shanghai, China



Yuanming Shi (S’13-M’15) received the B.S. degree in electronic engineering from Tsinghua University, Beijing, China, in 2011. He received the Ph.D. degree in electronic and computer engineering from The Hong Kong University of Science and Technology (HKUST), in 2015. Since September 2015, he has been with the School of Information Science and Technology in ShanghaiTech University, as a tenure-track Assistant Professor. He visited University of California, Berkeley, CA, USA, from October 2016 to February 2017. Dr. Shi is a recipient of the 2016 IEEE Marconi Prize Paper Award in Wireless Communications, and the 2016 Young Author Best Paper Award by the IEEE Signal Processing Society. His research interests include machine learning, mathematical optimization, high-dimensional statistics, dense wireless networks, big data analysis, and Internet-of-Things (IoT).