

SenSIP Seminar Series

Machine Learning for Large-Scale MIMO Systems: Enabling Mobility and Enhancing Reliability

Presenter: Ahmed Alkhateeb

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Abstract

Supporting high mobility and reliability in millimeter wave (mmWave) MIMO systems enables a wide range of important applications such as vehicular communications and wireless virtual/augmented reality. Realizing this in practice, however, requires overcoming several challenges. First, identifying the optimal beamforming vectors in large antenna array based mmWave systems requires considerable training overhead, which significantly affects the efficiency of these mobile systems. Second, the use of narrow beams and the sensitivity of mmWave signals to blockages greatly impact the reliability of highly-mobile links. Further, highly-mobile users in dense mmWave deployments need to frequently hand-off between base stations, which is associated with critical control and latency overhead. In this talk, I will first motivate the use of large-scale MIMO in future wireless systems and highlight the key challenges. Then, I will present our recent work on leveraging machine/deep learning tools to address two of these challenges, namely the high mobility and reliability. In particular, I will describe how deep learning models can learn mmWave beam prediction in line-of-sight and non-line-of-sight scenarios, which can dramatically reduce the training overhead in highly-mobile mmWave systems. I will then show that machine learning tools can also be exploited to predict link blockages and proactively hand-off users between base stations. Finally, I will give a brief overview of the other research directions in my group, including the synergy between mmWave imaging, communications, and localization, and the use of large intelligent MIMO surfaces in future wireless systems.

Biography:



Ahmed Alkhateeb received his B.S. degree (distinction with honor) and M.S. degree in Electrical Engineering from Cairo University, Egypt, in 2008 and 2012, and his Ph.D. degree in Electrical Engineering from The University of Texas at Austin, USA, in August 2016. In Sept. 2016- Dec. 2017, he was a Wireless Communications Researcher at the Connectivity Lab, Facebook, in Menlo Park, CA. He joined ASU in Spring 2018, where he is currently an Assistant Professor in the School of Electrical, Computer, and Energy Engineering. He has held R&D internships at FutureWei Technologies (Huawei) in Chicago, IL, and Samsung Research America (SRA) in Dallas, TX. His research interests are in the broad areas of wireless communications, communication theory, signal processing, machine learning, and applied math. Dr. Alkhateeb is the recipient of the 2012 MCD Fellowship from The University of Texas at Austin and the 2016 IEEE Signal Processing Society Young Author Best Paper Award for his work on hybrid precoding and channel estimation in millimeter wave communication systems.

Refreshments will be served. Sponsored by the SenSIP Center and NSF I/UCRC

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