**Distributionally Robust Optimization and Machine Learning for Communication Networks**

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**Abstract**: Recently, distributionally robust optimization theory is introduced to overcome the shortcomings of these two approaches, which assumes that the distribution of the random variable is within an ambiguity set. This talk will give a detailed introduction to distributionally robust optimization techniques including the mathematic foundations and their applications in the wireless communication area. First, this talk will briefly explain the decision under uncertainty and the background of the distributionally robust optimization. Second, this talk will explain the concept of uncertainty set and how to choose and build up an uncertainty set based on the statistic learning techniques and historical data samples. Third, this talk will discuss the discrepancy-based distributionally robust optimization approach with Wasserstein distance. Fourth, this talk will discuss the distributionally robust reinforcement learning method which can make the agent more robust when it makes the decision in a high noise environment. In addition, this talk will introduce various communication applications by distributionally robust optimization and distributionally robust machine learning techniques including ultra-reliable communication, age of information minimization in healthcare IoT, computation offloading in space-air-ground integrated networks, etc. Finally, this talk will discuss the conclusions and future work.

**Bio**: Zhu Han received the B.S. degree in electronic engineering from Tsinghua University, in 1997, and the M.S. and Ph.D. degrees in electrical engineering from the University of Maryland, College Park, in 1999 and 2003, respectively. From 2000 to 2002, he was an R&D Engineer of JDSU, Germantown, Maryland. From 2003 to 2006, he was a Research Associate at the University of Maryland. From 2006 to 2008, he was an assistant professor in Boise State University, Idaho. Currently, he is a John and Rebecca Moores Professor in Electrical and Computer Engineering Department as well as Computer Science Department at University of Houston, Texas. His research interests include security, wireless resource allocation and management, wireless communication and networking, game theory, and wireless multimedia. Dr. Han is an NSF CAREER award recipient of 2010. Dr. Han has several IEEE conference best paper awards, and winner of 2011 IEEE Fred W. Ellersick Prize, 2015 EURASIP Best Paper Award for the Journal on Advances in Signal Processing and 2016 IEEE Leonard G. Abraham Prize in the field of Communication Systems (Best Paper Award for IEEE Journal on Selected Areas on Communications). Dr. Han is the winner 2021 IEEE Kiyo Tomiyasu Award. He has been an IEEE fellow since 2014, AAAS fellow since 2020 and IEEE Distinguished Lecturer from 2015 to 2018. Dr. Han is a 1% highly cited researcher according to Web of Science since 2017.