DEPARTMENT OF COMPUTER SCIENCE

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Resilient Distributed Consensus, Optimization, and Learning in Networked Cyber-Physical Systems

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Abstract: Distributed consensus, optimization, and learning algorithms are increasingly used in networked cyber-physical systems but they are prone to Byzantine attacks. In this talk, we will present distributed algorithms for resilient aggregation in high-dimensional problems. The first approach is based on the notion of centerpoint, which is an extension of the median in higher dimensions. Centerpoint is used in a resilient distributed stochastic gradient descent algorithm in a cooperative network and evaluated using examples of target pursuit in multi-robot systems. The second approach is based on adaptive weight assignment and is used for resilient distributed multi-task learning and distributed reinforcement learning. Our results show better learning performance than the non-cooperative case and resilience in the presence of Byzantine agents.

Bio: Xenofon Koutsoukos is the Thomas R. Walters Professor in the Department of Computer Science at the School of Engineering at Vanderbilt University. He is also a Senior Research Scientist with the Institute for Software Integrated Systems and holds a secondary appointment in the Department of Electrical and Computer Engineering. He received his PhD from the University of Notre Dame in 2000. He was a Member of Research Staff with the Xerox Palo Alto Research Center (PARC) (2000–2002). He has coauthored more than 350 journal and conference papers and he is co-inventor of four US patents. His research work is in the area of cyber-physical systems with emphasis on learning-enabled systems, security and resilience, diagnosis and fault tolerance, distributed algorithms, formal methods, and adaptive resource management. Prof. Koutsoukos was the recipient of the NSF Career Award in 2004, the Excellence in Teaching Award in 2009 from the Vanderbilt University School of Engineering, and the 2011 NASA Aeronautics Research Mission Directorate (ARMD) Associate Administrator (AA) Award in Technology and Innovation. He is a Fellow of the IEEE for his contributions to the design of resilient cyber-physical systems.