北京大学高能效计算与应用中心学术报告

Invited Talk, Center for Energy-Efficient Computing and Applications

STRUCTURES AS SENSORS: SMALLER-DATA LEARNING IN THE PHYSICAL WORLD

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ABSTRACT: Machine learning has become a useful tool for many data-rich problems. However, its use in cyber-physical systems (CPS) has been limited because of its need for large amounts of well-labeled data that needed to be tailored for each deployment. This is especially challenging due to the high number of variables that can affect data in the physical space (e.g. weather, time, persons, etc.) This talk introduces the problem through the concept of Structure as Sensors (SaS). In SaS, the structure (e.g. a building) acts as the physical elements of the sensor, and the structural response is interpreted to obtain information about the occupants, and environments around the building. Due to the size and complexity of structures, traditional approaches would require prohibitively large amount of training data in order to obtain the desired robustness needed in a real-world system. This talk introduces three physical-based approaches to reduce the data demand for robust learning in SaS: 1) generate data through the use of physical models, 2) improve sensed data through actuation of the sensing system and 3) combine and transfer data from multiple deployments using the physical understanding.

BIOGRAPHY: Pei Zhang is an associate research professor in the ECE departments at Carnegie Mellon University. He received his bachelor's degree with honors from California Institute of Technology in 2002, and his Ph.D. degree in Electrical Engineering from Princeton University in 2008. While at Princeton University, he developed the ZebraNet system, which is used to track zebras in Kenya. It was the first deployed, wireless, ad- hoc, mobile sensor network for which he received the Test-of-Time award. His recent work focuses on utilizing the physical properties of devices and structures as a sensor to discover physical information that surrounds them. As part of this, his work combines machine learning-based data models, physics models, as well as heuristic models to improve the understanding of the sensing system. His approach is applied to the field of medicine, drones, farming and was part of a startup. His work has been featured in popular media including CNN, Science Channel, Discovery Channel, CBS News, CNET, Popular Science, BBC Focus, etc. In addition, he has won several awards including the NSF CAREER award, SenSys Test of Time Award, Google faculty award, and a member of the Department of Defense Computer Science Studies Panel.