CSMISS IT Seminar Series

Collaborative Signal and Information Processing (CSIP) in Microsensor Networks

by

Dr. Feng Zhao

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167 Conference Room

Collaborative signal and information processing (CSIP) in distributed sensor networks is an emerging research area that draws upon traditionally disparate disciplines, such as lower-power communication and computation, space-time signal processing, distributed and fault tolerant algorithms, adaptive systems, and sensor fusion and decision theory. Recent advances in wireless networking, microfabrication (e.g., MEMS) and embedded processing have enabled a new generation of sensor networks for a wide range of tracking and identification problems, including planetary sensor webs for scientific data collection. However, unlike centralized sensor platforms, distributed sensor nets are characterized by limited battery power, frequent node attrition, and variable data and communication quality. To scale up to more realistic tracking and classification applications involving tens of thousands of sensors, heterogeneous sensing modalities, multiple targets, and non-uniform spatio-temporal scales, these systems have to rely primarily on collaboration among distributed sensors to significantly improve tracking accuracy and reduce detection latency. The PARC Collaborative Sensing Project took a systemic approach to address the key CSIP issues of representing, processing, storing, and querying spatially distributed, multi-modal information from a sensor field. To extract reliable and timely information from a sensor field, CSIP must suport cross-node data aggregation, asynchronous execution, and progressive accuracy. Information driven sensor querying (IDSQ) was developed as a mechanism for mediating between data and queries in the network. IDSQ dynamically tasks sensor nodes to maximize information gain while minimizing latency and bandwidth consumption, thereby realizing energy-aware and low-latency computation and communication. In this talk, Dr. Zhao will describe the theory, algorithms, and experimental results from a recent DARPA field test, and from a testbed of electro-mechanical machine diagnosis.

Dr. Feng Zhao is a Principal Scientist and directs the Embedded Collaborative Computing Area, a part of the Systems and Practices Laboratory at Xerox PARC that addresses Collaborative Sensing and Smart Matter Diagnostics. His research interests include distributed sensor data analysis, diagnostics, qualitative reasoning, and control of dynamical systems. Dr. Zhao received his PhD in Electrical Engineering and Computer Science from MIT in 1992. From 1992 to 1999, he was Assistant and Associate Professor of Computer and Information Science at Ohio State University. Currently, he is also Consulting Associate Professor of Computer Science at Stanford. Dr. Zhao received the ONR Young Investigator Award and the NSF Young Investigator Award, and was an Alfred P. Sloan Research Fellow in Computer Science. He has authored or co-authored over 50 peer-reviewed technical papers in the areas of networked embedded systems, artificial intelligence, nonlinear control, and programming tools, and is a co-inventor of one US Patent and four pending patent applications.

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