

IST-049
Distributed Information Processing for Wireless Sensor Networks

Tiffany Jing Li

Assistant Professor, Department of Electrical Engineering and Computer Science,
Lehigh University, Bethlehem, PA

Xingkai Bao

Graduate Student, Department of Electrical Engineering and Computer Science,
Lehigh University, Bethlehem, PA

Hend Alqamzi

Graduate Student, Department of Electrical Engineering and Computer Science,
Lehigh University, Bethlehem, PA

Peiyu Tan

Graduate Student, Department of Electrical Engineering and Computer Science,
Lehigh University, Bethlehem, PA

Industry Participants

Commiverse Laboratories, Inc.,

Abstract

Listed by the *MIT Technology Review* as the number one emerging technology, wireless sensor networks that consist of many tiny, low-power and cheap wireless sensors are undergoing a quiet revolution, promising to have a significant impact throughout society that could quite possibly dwarf previous milestones in the information revolution. From detection of biological agents and toxic chemicals to environmental measurement of temperature, pressure and vibration, from real-time video surveillance systems to monitoring of wild habitats, sensor network have found and will continue to find tremendous exciting applications.

Usually mission-driven and application specific, wireless sensor networks must operate under a set of unique constraints and requirements. Specifically, unlike many other wireless devices like cellular phones and PDAs where energy can be recharged from time to time, the energy provisioned for a wireless sensor node is not expected to be renewed throughout its mission. The limited amount of energy available to wireless sensors has a significant impact on almost all aspects of system design and operation, from the amount of information that the node can process, to the volume of wireless data it can carry across large distance.

One enabling technology for sensor networks is distributed information processing, and in particular, distributed source coding (DSC). Also known as distributed compression or the Slepian-Wolf problem, DSC refers to the compression of multiple sources which are geographically-separated but content-related (e.g. outputs from sensor nodes in a dense sensor network). The sources do not communicate, but send their compressed data to a central point (e.g. the base station) which performs a joint decompression/decoding and subsequent information processing. The goal of this project is to study the various information processing techniques to find a practical and efficient distributed compression scheme that can perform well on a variety of real-life data sets.