

**Stony Brook University
The Graduate School**

Doctoral Defense Announcement

Abstract

Monte Carlo Methods for Signal Processing in Wireless Sensor Networks

By

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Advances in the manufacture of low power and inexpensive micro-sensors, coupled with progress in distributed signal processing and networking are enabling sensor networks to be the computing paradigm of the 21st century. These networks provide us immense opportunities through monitoring and sensing of various phenomena. Some recent areas of research in sensor networks from a signal processing perspective include distributed detection, estimation, localization, target tracking, sensor selection, sensor data fusion, and sensor network management and organization. In this dissertation, I address three problems in sensor networks (a) sensor self localization with beacon position uncertainty (b) target tracking using quantized data and (c) fusion of random measures for target tracking. These problems are addressed from a Bayesian standpoint, when the underlying idea is that all information about any phenomena can be obtained through its posterior distribution. Analytical expressions for these posterior distributions, is in many scenarios unattainable, and therefore we resort to Monte Carlo methods. In the sensor self-localization problem, we characterize the uncertainty in the beacon's location using probabilistic descriptions and propose a distributed algorithm by which sensor nodes with unknown location information obtain estimates of their positions. In dealing with constraints of limited communication and power resources in sensor networks we propose to track and localize the objects using minimal quantized information. For distributed target tracking architectures we present methods for combining summaries of random measures obtained from cluster nodes to the fusion node which combines them to obtain a global summary. .

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