2010 Asilomar Conference on Signals, Systems and Computers
Student Paper Contest Results

Judging Panel

Dr. Xinmiao Zhang, Panel Chairperson, Case Western Reserve University; Dr. Brian Evans, UT Austin; Dr. Oscar Gustafsson, Linköping University; Dr. Rabinder Madan, Office of Naval Research

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1st place: $500.00 prize, plaque, and free registration at the 2011 Conference

Naveen Ramakrishnan, The Ohio State University

Distributed Signature Learning and Calibration for Large-Scale Sensor Networks

Co-authors: Emre Ertin & Randolph Moses, The Ohio State University

Abstract

In this paper, we consider the problem of joint sensor calibration and target signature estimation using distributed measurements from a large-scale wireless sensor network with random link variations. Specifically, we propose a new Distributed Space-Alternating Generalized Expectation Maximization (EM) algorithm, DSAGE, which can estimate the (constrained) parameters of interest, using measurements from the sensor nodes, in a distributed manner. Unlike a centralized algorithm that relies on pooling measurement vectors from the network, DSAGE operates at the parameter space reducing the communication bandwidth. We model the sensor network as a connected graph and show that the gossip-based distributed consensus can be used to update the estimates at each iteration of the DSAGE algorithm. As a result the proposed algorithm is robust to link and node failures, unlike previously suggested distributed sub-gradient methods that rely on formation and maintenance of a stable network infrastructure to perform iterations in parameter space. We prove the guaranteed convergence of the algorithm to the centralized data pooling solution and compare its performance with the derived Cramer-Rao bound, using simulations.

2nd place: $400.00 Prize and plaque

Chathuranga Weeraddana, University of Oulu

Weighted Sum-Rate Maximization for a Set of Interfering Links via Branch and Bound

Co-authors: Marian Codreanu, Matti Latva-aho, University of Oulu; Anthony Ephremides, University of Maryland

Abstract

We consider the problem of weighted sum-rate maximization (WSRMax) for an arbitrary set of interfering links. This problem is known to be NP-hard; therefore, it is extremely difficult to solve even for a relative small number of links. The main contribution of this paper is to provide a solution method, based on the branch and bound technique, which

solves WSRMax problem with an optimality certificate. At each step of the proposed algorithm, an upper and a lower bound are computed for the optimal value of the underlying problem. The algorithm terminates when the difference between the upper and the lower bound is smaller than a specified tolerance. The proposed method allows to evaluate the performance loss encountered by all heuristic methods which have been previously proposed to obtain suboptimal solutions for the same problem. The proposed algorithm is also useful to provide performance benchmarks by back-substituting it into many existing network design problems which rely on solving WSRMax problem.

3rd place: $300.00 Prize and plaque

Murat Akcakaya, Washington University in St.Louis

Biologically Inspired Coupled Antenna Array for Direction of Arrival Estimation

Co-authors: Carlos H. Muravchik, Universidad Nacional de La Plata; Arye Nehorai, Washington University in St. Louis

Abstract

Inspired by the female Ormia ochracea's mechanically coupled ears, we propose to design a small-size transmission coupled antenna array with high performance radiation pattern. The mechanical coupling provides the female Ormia with high localization accuracy despite the small distance between its ears compared with the incoming wavelength of the source signal. The mechanical coupling between the Ormia's ears has been modeled by a pair of differential equations. In this paper, after solving these differential equations governing the Ormia ochracea's ear response, we convert the response to pre-specified radio frequencies. Using the converted response, we then implement the biologically inspired coupling as a multi-input multi-output filter on a uniform linear antenna array output. We derive the maximum likelihood estimates of source direction of arrivals (DOAs), and compute the corresponding Cramer-Rao bound on the DOA estimation error as a performance measure. We use Monte Carlo numerical examples to demonstrate the advantages of the coupling effect.