SEMINAR NOTICE

Department of Electrical and Systems Engineering

MAXIMUM LIKELIHOOD DIRECTION FINDING IN SPATIALLY COLORED NOISE FIELDS USING SPARSE SENSOR ARRAYS

PhD Preliminary Research Examination

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Abstract: Signal direction of arrival (DOA) estimation using sensor array processing is important in radar, sonar, navigation, and beamforming. In many of these applications, the noise field is spatially colored. The spatial correlation of the noise may significantly degrade the performance of estimators that ignore it. However, the DOA estimation problem is solvable only under certain constraints on the unknown noise covariance matrix.

We consider the problem of maximum likelihood (ML) DOA estimation of narrow-band signals using sparse sensor arrays, which consist of widely separated sub-arrays such that the unknown spatially colored noise field is uncorrelated between different sub-arrays. This sparse array structure results in a block-diagonal array noise covariance matrix, which guarantees the identifiability of DOAs. We develop ML DOA estimators for zero-mean or non-zero-mean Gaussian signals based on an Expectation-Maximization (EM) framework. For the latter case, we derive the Cramér-Rao bound (CRB) as well as the asymptotic error covariance matrix of the ML estimator that incorrectly assumes zero-mean Gaussian signals. We provide analytical and numerical performance comparisons for the existing deterministic and proposed ML estimators. The results show that the proposed estimators normally provide better accuracy than the existing deterministic ones, and that the presence of non-zero mean signals improves the accuracy of DOA estimation.

DATE: Wednesday, June 30, 2010
TIME: 1:00 p.m.
PLACE: Bryan Hall, Room 305

Thesis advisor:
Prof. Arye Nehorai

This seminar is in partial fulfillment
of the Doctor of Philosophy degree

Washington University in St. Louis
School of Engineering & Applied Science