SEMINAR NOTICE

Preston M. Green Department of Electrical and Systems Engineering

STATISTICAL PERFORMANCE ANALYSIS OF SPARSE LINEAR ARRAYS

DISSERTATION DEFENSE
By

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Abstract: By exploiting their so-called difference coarray model, sparse linear arrays, such as co-prime and nested arrays, can resolve up to O(M2) sources using only O(M) sensors. We aim at statistically analyzing the performance of sparse linear arrays. First, we analyze the performance of two commonly used coarray-based MUSIC direction estimators and derive a closed-form expression of the asymptotic mean-squared error (MSE) of both estimators. Using this expression, we show that when the source number exceeds the sensor number, the MSE remains strictly positive as the signal-to-noise ratio (SNR) approaches infinity. This finding theoretically explains the “saturation” behavior of coarray-based MUSIC estimators that had been observed in previous studies. Then, we derive the Cramér-Rao bound (CRB) for general sparse linear arrays under the assumption that the sources are uncorrelated. We establish the connection between our CRB and the classical stochastic CRB and investigate the behavior of our CRB for co-prime and nested arrays with many sensors. We analytically show that for a fixed number of sensors, the CRB for co-prime and nested arrays decreases much faster than that of uniform linear arrays (ULAs). For a fixed aperture, co-prime and nested arrays require many more snapshots to reach the same CRB as ULAs, which demonstrates the trade-off between the number of spatial samples and the number of temporal samples. Next, we further analyze the performance of sparse linear arrays by considering sensor location errors. We derive a closed-form expression of the asymptotic MSE of commonly used coarray-based MUSIC estimators and show that deterministic sensor location errors introduce a constant estimation bias that cannot be mitigated by only increasing the SNR. We also extend our derivations to the stochastic error model and analyze the Gaussian case, and derive the CRB for joint estimation of DOA parameters and deterministic sensor location errors. Numerical results verify our theoretical derivations.

DATE: **Monday, August 6, 2018**
TIME: **1:00 p.m.**
PLACE: **Green Hall, Room 0120**

Dissertation advisor:
Dr. Arye Nehorai

This seminar is in partial fulfillment
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SCHOOL OF ENGINEERING & APPLIED SCIENCE