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Data-Adaptive Beamforming: Generalized Least Squares and other Subspace Methods

Thursday, 7 November 2024 09:55 (25 minutes)

Generalized least squares (GLS) beamforming is a method for determining the direction of arrival and trace velocity of transient infrasound signals that may be otherwise obscured by persistent, correlated background noise, such as microbaroms. This method complements the adaptive F-detector by using an estimate of the noise background to form a generalized power ratio, which is used to estimate plane wave parameters (trace velocity and back-azimuth). Using a suite of fully synthetic signals, we first investigate the resolving power of the GLS estimator as a function of signal to noise ratio compared with a conventional, non-adaptive estimator. Recorded infrasonic signals from the Forensics Surface Experiment, where a persistent signal was observed from the south, will then be used to evaluate the GLS method. Initial analyses suggest that GLS beamforming results in a lower F-statistic during noise regions and a higher F-statistic value for transient signals compared to the Bartlett beam. Algorithmically determining an optimal window to characterize the background noise presents a significant challenge and different approaches will be discussed. This talk will discuss our evaluation of the GLS method and initial steps in testing additional signal subspace algorithms.

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