ROBUST DIRECTION OF ARRIVAL ESTIMATION FOR SPEECH ENHANCEMENT IN NOISY REVERBERANT ROOMS

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This paper describes an eigendecomposition based approach to estimate the direction of arrival (DOA) of speech or noise sources in a reverberant room by using a microphone array. Unitary ESPRIT, a DOA estimation algorithm for narrowband signals, is applied to these wideband signals, which results in DOA estimates for each frequency. A single estimate is then obtained by means of a histogram. The estimated DOAs of the speech source are used to enhance a noisy speech signal by means of a superdirective beamformer. Experiments in a noisy reverberant room showed a higher estimation accuracy, and thus a better speech enhancement performance, at low SNRs compared to other DOA estimation techniques.

GLOBAL ERROR-TOLERANT ALGORITHMS FOR LOCATION DISCOVERY IN AD-HOC WIRELESS NETOWORKS

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We address location discovery problem in ad-hoc wireless Networks. Location discovery is a task with fundamental role in multi-hop wireless networks since many other middleware tasks, such as coverage, tracking and routing, as well as many applications need accurate location of nodes. We have developed simple, yet accurate mathematical abstraction of the problem. We have also developed an atomic tri-lateration procedure for calculating the position of a node in presence of measurements errors. We have statistically analyzed the procedure with respect to a number of parameters, such as error distribution and relative positions of the nodes and used that information for improving effectiveness of the location discovery procedure. Furthermore, we have developed randomized iterative improvement algorithm for fast location discovery in wireless ad-hoc networks. We experimentally verified the exceptional effectiveness of the procedure in presence of errors for both cetralized and localized version of the algorithm.

ACOUSTIC TARGET CLASSIFICATION USING DISTRIBUTED SENSOR ARRAYS

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Target classification using distributed sensor arrays remains a challenging problem due to the non-stationarity of target signatures, large geographical area coverage of sensor arrays, and the requirements of time-critical and reliable information delivery. In this paper, we develop an algorithm to derive effective and stable features from both the frequency and the time-frequency domains of the acoustic signals. A modified data fusion algorithm for distributed sensor arrays is also developed in order to integrate the classification results from different sensors and provide fault-tolerance. By using data fusion, the accuracy of the classification can be increased by as many as 50%.

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