

Genetic Algorithm and Multi Criteria Decision Making Approach for Compressive Sensing Based Direction of Arrival Estimation

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Abstract : One of the essential challenges in array signal processing, which has drawn enormous research interest over the past several decades, is estimating the direction of arrival (DOA) of plane waves impinging on an array of sensors. In recent years, the Compressive Sensing based DoA estimation methods have been proposed by researchers, and it has been discovered that the Compressive Sensing (CS)-based algorithms achieved significant performances for DoA estimation even in scenarios where there are multiple coherent sources. On the other hand, the Genetic Algorithm, which is a method that provides a solution strategy inspired by natural selection, has been used in sparse representation problems in recent years and provides significant improvements in performance. With all of those in consideration, in this paper, a method that combines the Genetic Algorithm (GA) and the Multi-Criteria Decision Making (MCDM) approaches for Direction of Arrival (DoA) estimation in the Compressive Sensing (CS) framework is proposed. In this method, we generate a multi-objective optimization problem by splitting the norm minimization and reconstruction loss minimization parts of the Compressive Sensing algorithm. With the help of the Genetic Algorithm, multiple non-dominated solutions are achieved for the defined multi-objective optimization problem. Among the pareto-frontier solutions, the final solution is obtained with the multiple MCDM methods. Moreover, the performance of the proposed method is compared with the CS-based methods in the literature.

Keywords : genetic algorithm, direction of arrival estimation, multi criteria decision making, compressive sensing

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