Decomposition-Based Algorithms for Sparse System Identification

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Abstract

Sparsity represents a key feature in system identification scenarios where only a small percentage of the impulse response components have a significant magnitude. Many important applications can be formulated in terms of sparse system identification problems, e.g., in the fields of network/acoustic echo cancellation, satellite-linked communications, radar systems, underwater communications, microphone arrays, etc. In these frameworks, adaptive filters represent some of the most popular solutions for real-world/real-time applications. However, in many applications, a major limitation is the high length of the impulse response (e.g., hundreds/thousands of coefficients), which poses significant challenges in terms of complexity, convergence, and accuracy of the solution.

In this presentation, we focus on a recent approach that exploits the impulse response decomposition based on the nearest Kronecker product and low-rank approximations, which fits very well for sparse system identification problems. The basic idea is to transform a high-dimension system identification problem into smaller problems (i.e., shorter filters) that are connected to match the original purpose. The resulting gain is twofold, in terms of both performance and complexity.