Title: The Performance of Deterministic Matched Subspace Detectors: Informative Versus Useful Subspace Components

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Abstract

We consider the standard problem of detecting the presence of a deterministic signal vector given a noisy observation. In such a setting, the Neyman-Pearson detector is an energy detector, summing the squared magnitude of each component of the observation. We explore how the conditional distributions of this test statistic shift when adding additional components and showcase that not all components may be useful in detection. With this observation in mind, we define the number of subspace components that maximize detection ability. We apply this idea to deterministic matched subspace detectors using subspaces estimated from finite, noisy, signal-bearing training data. Through numerical simulation, we demonstrate that a detector using only the useful subspace components is optimal and outperforms a detector that uses all informative subspace components.