Thesis title: Sparse Models and Convex Optimisation for Convolutive Blind Source Separation.

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Abstract

Blind source separation from underdetermined mixtures is usually a two-step process: the estimation of the mixing filters, followed by that of the sources. An enabling assumption is that the sources are sparse and disjoint in the time-frequency domain. For convolutive mixtures, the solution is not straightforward due to the permutation and scaling ambiguities. The sparsity of the filters in the time-domain is also an enabling factor for blind filter estimation approaches that are based on cross-relation. However, such approaches are restricted to the single source setting.

In this thesis, we jointly exploit the sparsity of the sources and mixing filters for blind estimation of sparse filters from stereo convolutive mixtures of several sources. First, we show why the sparsity of the filters can help solve the permutation problem in convolutive source separation, in the absence of scaling. Then, we propose a two-stage estimation framework, which is primarily based on the time-frequency domain cross-relation and an ℓ^1 minimisation formulation: a) a clustering step to group the time-frequency points where only one source is active, for each source; b) a convex optimisation step which estimates the filters. The resulting algorithms are assessed on audio source separation and filter estimation problems.