Task: Undercomplete Blind Subspace Deconvolution

Observation $\mathbf{x}$ is causal FIR filtered mixture of hidden, independent, multidimensional *components*:

$$\mathbf{x}(t) = \sum_{l=0}^{L} \mathbf{H}_l \mathbf{s}(t-l). \tag{1}$$

Assumptions ($\mathbf{s} = [\mathbf{s}^1; \ldots; \mathbf{s}^M]$):

- for a given m, $\mathbf{s}^m(t) \in \mathbb{R}^{d_m}$ is i.i.d. in time t,
- there is at most a single Gaussian component among $\mathbf{s}^m$s,
- independent components: $I(\mathbf{s}^1, \ldots, \mathbf{s}^M) = 0$,
- undercomplete task: $dim(\mathbf{x}) > dim(\mathbf{s})$.

Goal: $\hat{\mathbf{s}}$. Specially: (i) $L = 0$: ISA $\xrightarrow{\forall d_m = 1}$ ICA, (ii) $d_m = 1$: BSD.

Solution: In short

- Former algorithm [Szabó et al., JMLR, 2007]:

  $$\boxed{\text{uBSSD} = \text{time concatenation} + \text{ISA}}.$$

  Problem: the associated ISA task is 'high dimensional'.
- Alternative (present work):

  $$\boxed{\text{uBSSD} = \text{linear prediction} + \text{ISA}}.$$

  Good news:
  - no ISA dimensionality problem,
  - needs smaller number of samples + can solve tasks with deeper temporal convolutions.