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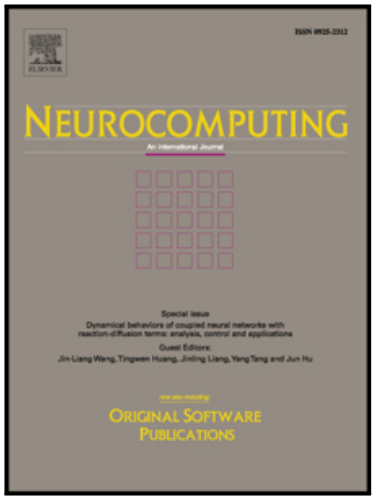

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Bayesian Tensor Factorization for Multi-way Analysis of Multi-dimensional EEG

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Abstract

Factorization-based analysis of multi-dimensional EEG (Electroencephalography) has become increasingly important in neuroscience research and practices with the capability of extracting latent multi-way features. However, how to sift the most informative factors of routinely noisy EEG remains unclear especially under the circumstance of no a priori knowledge. This study proposes a Bayesian tensor factorization (BTF) model as a "one-stop" solution to the challenges. BTF assumes non-informative priori on potential distribution of factors and noise derived from exponential family distribution. A high-dimensional variational Bayesian inference method is designed to iteratively estimate the posterior distribution of potential factors. The factor vectors whose elements are "small" values can then be identified as redundancy and filtered out afterwards. Finally, the study enables a generic factorization-based method for multi-way analysis of brain states. Results from experiments on synthesized tensors indicate that (1) BTF excels in processing EEG tensor mixed with intensive white noises in comparison with the traditional counterparts; and (2) the non-informative components in factors can be filtered out effectively (rank

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