

Multiway Component Analysis and Tensor Decompositions and their Potential Applications

Andrzej CICHOCKI

in collaboration with

Guoxu ZHOU, Zhaoshui HE and Shengli XIE

Riken BSI, Laboratory for Advanced Brain Signal Processing, Wako-shi, JAPAN,
<http://www.bsp.brain.riken.jp/> a.cichocki@riken.jp

Faculty of Automation, Guangdong University of Technology, Guangzhou, China.

Abstract:

In recent years, the demands for analysis of multidimensional and very large-scale data have escalated as the dimensionality and sheer volume of data has grown rapidly in, bioinformatics, social networks, neuroscience, imaging, and financial markets. Although the basic models for matrix and tensor (i.e., multiway array) decompositions and factorizations such as Tucker and Canonical Polyadic (CP) decomposition models were proposed long time ago, they have only recently emerged as promising tools for exploratory analysis of large-scale and multidimensional data in diverse applications, especially, when it comes to dimensionality reduction, multilinear independent component analysis, feature extraction, classification, brain computer interface, prediction and multiway clustering. By virtue of their multiway nature, tensors provide powerful tools for the analysis and fusion of large-scale, multi-modal, massive data together with a mathematical backbone for the discovery of underlying hidden complex data structures. In this talk, we review some recent efficient unsupervised learning algorithms for multilinear blind source separation (BSS), nonnegative tensor factorizations and multiway component extraction using various criteria, constraints and assumptions. Moreover, we briefly overview emerging models and approaches for multi-block constrained matrix/tensor decompositions in applications to group and linked multilinear BSS/ICA, Multiway Canonical Correlation Analysis (MCCA) and Higher Order (tensor) Partial Least Squares (HOPLS) problems.



Brief Biography Andrzej Cichocki received the M.Sc. (with honors), Ph.D. and Dr.Sc. (Habilitation) degrees, all in electrical engineering, from [Warsaw University of Technology](#) (Poland). Since 1976, he has been with the [Institute of Theory of Electrical Engineering, Measurement and Information Systems, Faculty of Electrical Engineering](#) at the Warsaw University of Technology, where he obtain a title of a full Professor in 1995. He spent several years at [University Erlangen-Nuerenberg](#) (Germany), at the Chair of Applied and Theoretical Electrical Engineering, as an Alexander-von-Humboldt Research Fellow and Guest Professor. In 1995-1997 he was a team leader of the laboratory for Artificial Brain Systems, at Frontier Research Program RIKEN (Japan), in the Brain Information Processing Group. He is currently Senior Team Leader and Head of the laboratory for [Advanced Brain Signal Processing, at RIKEN Brain Science Institute](#) (JAPAN). He is co-author of more than 300 technical papers and 4 monographs (two of them translated to Chinese): [Nonnegative Matrix and Tensor Factorizations: Applications to Exploratory Multi-way Data Analysis](#), John Wiley-2009; [Adaptive Blind Signal and Image Processing](#) (co-authored with Professor Shun-ichi Amari ;Wiley, April 2003 -revised edition), [CMOS Switched-Capacitor and Continuous-Time Integrated Circuits and Systems](#) (co-authored with Professor Unbehauen; Springer-Verlag, 1989) and [Neural Networks for Optimizations and Signal Processing](#) (1994). His profile and h-index can be found at: <http://scholar.google.com/citations?user=wpZDx1cAAAAJ&hl=en>