Lecture Notes in Computer Science 7191

Commenced Publication in 1973
Founding and Former Series Editors:
Gerhard Goos, Juris Hartmanis, and Jan van Leeuwen

Fabian Theis   Andrzej Cichocki
Arie Yeredor   Michael Zibulevsky (Eds.)

Latent Variable Analysis and Signal Separation

10th International Conference, LVA/ICA 2012
Tel Aviv, Israel, March 12-15, 2012
Proceedings

Springer

Volume Editors

Fabian Theis
Helmholtz Center Munich, Institute of Bioinformatics and Systems Biology
Ingolstädter Landstr. 1, 85764 Neuherberg, Germany
E-mail: fabian.theis@helmholtz-muenchen.de

Andrzej Cichocki
Riken Brain Science Institute, Laboratory for Advanced Brain Signal Processing
2-1, Hirosawa, Wako-shi, 351-0198 Saitama, Japan
E-mail: a.cichocki@riken.jp

Arie Yeredor
Tel-Aviv University, School of Electrical Engineering
Tel-Aviv 69978, Israel
E-mail: arie@eng.tau.ac.il

Michael Zibulevsky
Technion – Israel Institute of Technology, Department of Computer Science
Haifa 32000, Israel
E-mail: mzib@cs.technion.ac.il

Preface

This volume contains the full papers presented at the 10th International Conference on Latent Variable Analysis and Signal Separation, LVA/ICA 2012, which was held in Tel Aviv, Israel, during March 12–15, 2012, at the Sheraton Tel-Aviv Hotel and Towers.

The series began nearly 13 years ago under the title of Independent Component Analysis (ICA) workshops (held approximately every 18 months), and has attracted hundreds of participants over the years, continuously broadening its horizons. Starting with the fundamentals of ICA and Blind Source Separation (BSS) in the late 1990s and early 2000, the theme of the series has gradually expanded to include additional forms and models of general mixtures of latent variables, and was therefore re-titled Latent Variable Analysis (LVA) for the previous (9th) LVA/ICA conference in St. Malo (France) in 2010, keeping the acronym ICA as well (at least for a while), for reference to its roots and origins. This volume of Springer's *Lecture Notes on Computer Science* (LNCS) continues the tradition which began in ICA 2004 (held in Granada, Spain), to publish the conference proceedings in this form.

The submissions to LVA/ICA 2012 reflected the diversity of research fields covered by the call for papers, in accordance with the expanded scope of the theme of the series. Topics ranging from theoretical issues such as causality analysis and measures, through novel methods for employing the well-established concepts of sparsity and non-negativity for matrix and tensor factorization, down to a variety of related applications ranging from audio and biomedical signals to precipitation analysis, can all be found among the papers collected in this volume. In addition, LVA/ICA 2012 continued a tradition established in ICA 2009 (in Paraty, Brazil), to host presentations and discussions related to the Signal Separation Evaluation Campaign (SiSEC). SiSEC 2011 consisted of two types of tasks: audio source separation and biomedical data analysis. Several papers associated with submissions to SiSEC 2011 can be found in this volume.

Four world-renowned keynote speakers were invited by the Organizing Committee to present highlights of their recent research:

- Michael Elad (Technion, Israel Institute of Technology, Israel) on "The Analysis Sparse Model—Definition, Pursuit, Dictionary Learning, and Beyond"
- Lieven De Lathauwer (Katholieke Universiteit Leuven, Belgium) on "Block Component Analysis, a New Concept for Blind Source Separation"
- Amnon Shashua (Hebrew University of Jerusalem, Israel) on "The Applications of Tensor Factorization in Inference, Clustering, Graph Theory, Coding and Visual Representations"
- Paris Smaragdis (University of Illinois at Urbana-Champaign, USA) on "From Bases to Exemplars, from Separation to Understanding"

Continuing an initiative introduced at LVA/ICA 2010, the Organizing Committee announced a Late-Breaking / Demo session, for presentation of results and ideas that were not yet fully formalized and evaluated by the full-paper submission deadline, but were sufficiently ripe for presentation at the time of the conference. These included signal separation methods or systems evaluated in SiSEC 2011 but not associated with a full-paper submission to the conference. Submissions to this session were in the form of a "Title + Abstract" only, and are not included in the proceedings.

We received more than 80 full-paper submissions to regular sessions and to special sessions. Each submission of a regular full paper was peer reviewed by at least two members of our Technical Program Committee (TPC) or by competent sub-reviewers assigned by the TPC members. Most papers received three reviews, and some papers received four reviews. Submissions to the special Audio Sessions were peer reviewed by other participants of the same sessions. This volume contains the 20 full papers accepted for oral presentation and 42 full papers accepted for poster presentation, for the regular as well as for the special sessions. In addition, the volume contains the two overview papers of SiSEC 2011, and a paper by Lieven De Lathauwer associated with his keynote talk.

The growing share of audio-processing-related submissions prompted the successful organization of two dedicated special sessions, titled "Real-World Constraints and Opportunities in Audio Source Separation" and "From Audio Source Separation to Multisource Content Analysis." Moreover, the Organizing Committee decided to designate one full-day of the conference as an "Audio-Day," dedicated to the presentation of audio-related papers, including the keynote talk by Paris Smaragdis (but excluding the SiSEC-related contributions, which were presented as part of the SiSEC Special Sessions).

The Organizing Committee would like to extend its warm thanks to those who made LVA/ICA 2012 possible. First and foremost, these are the authors, and, of course, the members of the Program Committee and the sub-reviewers. In addition, we thank the members of the International ICA Steering Committee for their support and advice. We also thank the SiSEC Chairs for their close and fruitful collaboration. We are deeply indebted to the Faculty of Engineering at Bar-Ilan University, and especially to Sharon Gannot and to the Speech and Audio Lab for hosting the Audio Day. The organizing team at Ortra Ltd., and especially Sharon Lapid, were very helpful and always responsive. We also thank Springer and the LNCS team for their continued collaboration, and in particular Frank Holzwarth, Anna Kramer, Christine Reiss and Alfred Hofmann for their help and responsiveness. Finally, we would like to thank our sponsors,

The Yitzhak and Chaya Weinstein Research Institute for Signal Processing, Tel Aviv University, Bar-Ilan University, The Technion - Israel Institute of Technology, and the Advanced Communication Center at Tel Aviv University.

January 2012   Andrzej Cichocki
                                                              Fabian Theis
                                                              Arie Yeredor
                                                        Michael Zibulevsky

Organization

Organizing Committee

General Chairs

Arie Yeredor	Tel-Aviv University, Israel
Michael Zibulevsky	Technion - Israel Institute of Technology, Israel

Program Chairs

Andrzej Cichocki	RIKEN Brain Science Institute, Japan
Fabian Theis	Helmholz Center Munich, Germany

SiSEC Evaluation Chairs

Shoko Araki	NTT, Japan
Guido Nolte	Fraunhofer Institute, Germany
Francesco Nesta	Fondazione Bruno Kessler IRST, Italy

Special Sessions

Emmanuel Vincent	INRIA, France
Pierre Leveau	Audionamix, France

Audio Day Arrangements

Sharon Gannot	Bar-Ilan University, Israel

Technical Program Committee

Tülay Adalı (USA)	Ali Mansour (Australia)
Shoko Araki (Japan)	Anke Meyer-Baese (USA)
Cesar Caiafa (Argentina)	Anh Huy Phan (Japan)
Jonathon Chambers (UK)	Mark Plumbley (UK)
Fengyu Cong (Finland)	Barnabás Póczos (USA)
Sergio Cruces (Spain)	Saeid Sanei (UK)
Yannick Deville (France)	Xizhi Shi (China)
Shuxue Ding (Japan)	Paris Smaragdis (USA)
Cédric Févotte (France)	Petr Tichavský (Czeck Republic)
Rémi Gribonval (France)	Ricardo Vigário (Finland)
Christian Jutten (France)	Vincent Vigneron (France)
Juha Karhunen (Finland)	Emmanuel Vincent (France)
Zbyněk Koldovský (Czeck Republic)	Vicente Zarzoso (France)
Elmar Lang (Germany)	Liqing Zhang (China)
Yuanqing Li (China)	Guoxu Zhou (Japan)
Danilo Mandic (UK)	

Additional Reviewers

Pablo Aguilera Bonet
Francis Bach
Nancy Bertin
Andrzej Cichocki
Nicolas Dobigeon
Derry Fitzgerald
Jinyu Han
Rodolphe Jenatton
Hong Kook Kim
Matthieu Kowalski
Pierre Leveau
Yanfeng Liang

Morten Mørup
Pejman Mowlaee
Gautham J. Mysore
Alexey Ozerov
Auxiliadora Sarmiento Vega
Hiroshi Sawada
Fabian Theis
Hugo Van Hamme
Arie Yeredor
Michael Zibulevsky

International ICA Steering Committee

Mark Plumbley (UK) (Chair)
Tülay Adalı (USA)
Jean-François Cardoso (France)
Andrzej Cichocki (Japan)
Lieven De Lathauwer (Belgium)
Scott Douglas (USA)
Rémi Gribonval (France)
Christian Jutten (France)
Te-Won Lee (USA)

Shoji Makino (Japan)
Klaus Robert Müller (Germany)
Erkki Oja (Finland)
Paris Smaragdis (USA)
Fabian Theis (Germany)
Ricardo Vigário (Finland)
Emmanuel Vincent (France)
Arie Yeredor (Israel)

Sponsoring Institutions

The Yitzhak and Chaya Weinstein Research Institute for Signal Processing
Tel-Aviv University
The Technion - Israel Institute of Technology
Bar-Ilan University
The Advanced Communication Center

Table of Contents

General LVA/ICA Theory, Methods and Extensions

Sparsity, Sparse Coding and Dictionary Learning

Non-negative and Other Factorizations

Audio Separation and Analysis

SiSEC 2011 Evaluation Campaign

Other Applications