

Handbook of Blind Source Separation

**Independent Component analysis
and Applications**

**Pierre Comon
Christian Jutten**



Handbook Of Blind Source Separation Independent Component Analysis And Applications

Rajesh Singh, Anita Gehlot



Handbook Of Blind Source Separation Independent Component Analysis And Applications:

Handbook of Blind Source Separation Pierre Comon, Christian Jutten, 2010-02-17 Edited by the people who were forerunners in creating the field together with contributions from 34 leading international experts this handbook provides the definitive reference on Blind Source Separation giving a broad and comprehensive description of all the core principles and methods numerical algorithms and major applications in the fields of telecommunications biomedical engineering and audio acoustic and speech processing Going beyond a machine learning perspective the book reflects recent results in signal processing and numerical analysis and includes topics such as optimization criteria mathematical tools the design of numerical algorithms convolutive mixtures and time frequency approaches This Handbook is an ideal reference for university researchers R algebraic identification of under determined mixtures time frequency methods Bayesian approaches blind identification under non negativity approaches semi blind methods for communications Shows the applications of the methods to key application areas such as telecommunications biomedical engineering speech acoustic audio and music processing while also giving a general method for developing applications *Blind Source Separation* Xianchuan Yu, Dan Hu, Jindong Xu, 2013-12-13 A systematic exploration of both classic and contemporary algorithms in blind source separation with practical case studies The book presents an overview of Blind Source Separation a relatively new signal processing method Due to the multidisciplinary nature of the subject the book has been written so as to appeal to an audience from very different backgrounds Basic mathematical skills e g on matrix algebra and foundations of probability theory are essential in order to understand the algorithms although the book is written in an introductory accessible style This book offers a general overview of the basics of Blind Source Separation important solutions and algorithms and in depth coverage of applications in image feature extraction remote sensing image fusion mixed pixel decomposition of SAR images image object recognition fMRI medical image processing geochemical and geophysical data mining mineral resources prediction and geoanomalies information recognition Firstly the background and theory basics of blind source separation are introduced which provides the foundation for the following work Matrix operation foundations of probability theory and information theory basics are included here There follows the fundamental mathematical model and fairly new but relatively established blind source separation algorithms such as Independent Component Analysis ICA and its improved algorithms Fast ICA Maximum Likelihood ICA Overcomplete ICA Kernel ICA Flexible ICA Non negative ICA Constrained ICA Optimised ICA The last part of the book considers the very recent algorithms in BSS e g Sparse Component Analysis SCA and Non negative Matrix Factorization NMF Meanwhile in depth cases are presented for each algorithm in order to help the reader understand the algorithm and its application field A systematic exploration of both classic and contemporary algorithms in blind source separation with practical case studies Presents new improved algorithms aimed at different applications such as image feature extraction remote sensing image fusion mixed pixel decomposition of SAR images image object recognition and MRI

medical image processing With applications in geochemical and geophysical data mining mineral resources prediction and geoanomalies information recognition Written by an expert team with accredited innovations in blind source separation and its applications in natural science Accompanying website includes a software system providing codes for most of the algorithms mentioned in the book enhancing the learning experience Essential reading for postgraduate students and researchers engaged in the area of signal processing data mining image processing and recognition information geosciences life sciences

Blind Source Separation Ganesh R. Naik, Wenwu Wang, 2014-05-21 Blind Source Separation intends to report the new results of the efforts on the study of Blind Source Separation BSS The book collects novel research ideas and some training in BSS independent component analysis ICA artificial intelligence and signal processing applications Furthermore the research results previously scattered in many journals and conferences worldwide are methodically edited and presented in a unified form The book is likely to be of interest to university researchers R Dr Wenwu Wang works at University of Surrey UK

Independent Component Analysis for Audio and Biosignal Applications Ganesh R. Naik, 2012-10-10 Independent Component Analysis ICA is a signal processing method to extract independent sources given only observed data that are mixtures of the unknown sources Recently Blind Source Separation BSS by ICA has received considerable attention because of its potential signal processing applications such as speech enhancement systems image processing telecommunications medical signal processing and several data mining issues This book brings the state of the art of some of the most important current research of ICA related to Audio and Biomedical signal processing applications The book is partly a textbook and partly a monograph It is a textbook because it gives a detailed introduction to ICA applications It is simultaneously a monograph because it presents several new results concepts and further developments which are brought together and published in the book

Blind Source Separation Yong Xiang, Dezhong Peng, Zuyuan Yang, 2014-09-16 This book provides readers a complete and self contained set of knowledge about dependent source separation including the latest development in this field The book gives an overview on blind source separation where three promising blind separation techniques that can tackle mutually correlated sources are presented The book further focuses on the non negativity based methods the time frequency analysis based methods and the pre coding based methods respectively

Advances in Independent Component Analysis and Learning Machines Ella Bingham, Samuel Kaski, Jorma Laaksonen, Jouko Lampinen, 2015-05-14 In honour of Professor Erkki Oja one of the pioneers of Independent Component Analysis ICA this book reviews key advances in the theory and application of ICA as well as its influence on signal processing pattern recognition machine learning and data mining Examples of topics which have developed from the advances of ICA which are covered in the book are A unifying probabilistic model for PCA and ICA Optimization methods for matrix decompositions Insights into the FastICA algorithm Unsupervised deep learning Machine vision and image retrieval A review of developments in the theory and applications of independent component analysis and its influence in important areas such

as statistical signal processing pattern recognition and deep learning A diverse set of application fields ranging from machine vision to science policy data Contributions from leading researchers in the field

On Statistical Pattern Recognition in Independent Component Analysis Mixture Modelling Addisson Salazar,2012-07-20 A natural evolution of statistical signal processing in connection with the progressive increase in computational power has been exploiting higher order information Thus high order spectral analysis and nonlinear adaptive filtering have received the attention of many researchers One of the most successful techniques for non linear processing of data with complex non Gaussian distributions is the independent component analysis mixture modelling ICAMM This thesis defines a novel formalism for pattern recognition and classification based on ICAMM which unifies a certain number of pattern recognition tasks allowing generalization The versatile and powerful framework developed in this work can deal with data obtained from quite different areas such as image processing impact echo testing cultural heritage hypnograms analysis web mining and might therefore be employed to solve many different real world problems

Advances in Heuristic Signal Processing and Applications Amitava Chatterjee,Hadi Nobahari,Patrick Siarry,2013-06-05 There have been significant developments in the design and application of algorithms for both one dimensional signal processing and multidimensional signal processing namely image and video processing with the recent focus changing from a step by step procedure of designing the algorithm first and following up with in depth analysis and performance improvement to instead applying heuristic based methods to solve signal processing problems In this book the contributing authors demonstrate both general purpose algorithms and those aimed at solving specialized application problems with a special emphasis on heuristic iterative optimization methods employing modern evolutionary and swarm intelligence based techniques The applications considered are in domains such as communications engineering estimation and tracking digital filter design wireless sensor networks bioelectric signal classification image denoising and image feature tracking The book presents interesting state of the art methodologies for solving real world problems and it is a suitable reference for researchers and engineers in the areas of heuristics and signal processing

From Algebraic Structures to Tensors Gérard Favier,2020-01-02 Nowadays tensors play a central role for the representation mining analysis and fusion of multidimensional multimodal and heterogeneous big data in numerous fields This set on Matrices and Tensors in Signal Processing aims at giving a self contained and comprehensive presentation of various concepts and methods starting from fundamental algebraic structures to advanced tensor based applications including recently developed tensor models and efficient algorithms for dimensionality reduction and parameter estimation Although its title suggests an orientation towards signal processing the results presented in this set will also be of use to readers interested in other disciplines This first book provides an introduction to matrices and tensors of higher order based on the structures of vector space and tensor space Some standard algebraic structures are first described with a focus on the hilbertian approach for signal representation and function approximation based on Fourier series and orthogonal polynomial

series Matrices and hypermatrices associated with linear bilinear and multilinear maps are more particularly studied Some basic results are presented for block matrices The notions of decomposition rank eigenvalue singular value and unfolding of a tensor are introduced by emphasizing similarities and differences between matrices and tensors of higher order

Modeling in Computational Biology and Biomedicine Frédéric Cazals,Pierre Kornprobst,2012-11-06 Computational biology mathematical biology biology and biomedicine are currently undergoing spectacular progresses due to a synergy between technological advances and inputs from physics chemistry mathematics statistics and computer science The goal of this book is to evidence this synergy by describing selected developments in the following fields bioinformatics biomedicine and neuroscience This work is unique in two respects first by the variety and scales of systems studied and second by its presentation Each chapter provides the biological or medical context follows up with mathematical or algorithmic developments triggered by a specific problem and concludes with one or two success stories namely new insights gained thanks to these methodological developments It also highlights some unsolved and outstanding theoretical questions with a potentially high impact on these disciplines Two communities will be particularly interested in this book The first one is the vast community of applied mathematicians and computer scientists whose interests should be captured by the added value generated by the application of advanced concepts and algorithms to challenging biological or medical problems The second is the equally vast community of biologists Whether scientists or engineers they will find in this book a clear and self contained account of concepts and techniques from mathematics and computer science together with success stories on their favorite systems The variety of systems described represents a panoply of complementary conceptual tools On a practical level the resources listed at the end of each chapter databases software offer invaluable support for getting started on a specific topic in the fields of biomedicine bioinformatics and neuroscience

Sensors, Signal and Image Processing in Biomedicine and Assisted Living Dimitris K. Iakovidis,2020-11-04 This is a collection of recent advances on sensors systems and signal image processing methods for biomedicine and assisted living It includes methods for heart sleep and vital sign measurement human motion related signal analysis assistive systems and image and video based diagnostic systems It provides an overview of the state of the art challenges in the respective topics and future directions This will be useful for researchers in various domains including computer science electrical engineering biomedicine and healthcare researchers

Latent Variable Analysis and Signal Separation Fabian Theis,Andrzej Cichocki,Arie Yeredor,Michael Zibulevsky,2012-03-01 This book constitutes the proceedings of the 10th International Conference on Latent Variable Analysis and Signal Separation LVA ICA 2012 held in Tel Aviv Israel in March 2012 The 20 revised full papers presented together with 42 revised poster papers 1 keynote lecture and 2 overview papers for the regular as well as for the special session were carefully reviewed and selected from numerous submissions Topics addressed are 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

Artificial Intelligence and Computational Intelligence Jingsheng Lei, Fu Lee Wang, Hepu Deng, Duoqian Miao, 2012-09-28 This volume proceedings contains revised selected papers from the 4th International Conference on Artificial Intelligence and Computational Intelligence AICI 2012 held in Chengdu China in October 2012 The total of 163 high quality papers presented were carefully reviewed and selected from 724 submissions The papers are organized into topical sections on applications of artificial intelligence applications of computational intelligence data mining and knowledge discovery evolution strategy expert and decision support systems fuzzy computation information security intelligent control intelligent image processing intelligent information fusion intelligent signal processing machine learning neural computation neural networks particle swarm optimization and pattern recognition

Intelligent Circuits and Systems Rajesh Singh, Anita Gehlot, 2021-08-01 ICICS 2020 is the third conference initiated by the School of Electronics and Electrical Engineering at Lovely Professional University that explored recent innovations of researchers working for the development of smart and green technologies in the fields of Energy Electronics Communications Computers and Control ICICS provides innovators to identify new opportunities for the social and economic benefits of society This conference bridges the gap between academics and R D institutions social visionaries and experts from all strata of society to present their ongoing research activities and foster research relations between them It provides opportunities for the exchange of new ideas applications and experiences in the field of smart technologies and finding global partners for future collaboration The ICICS 2020 was conducted in two broad categories Intelligent Circuits Intelligent Systems and Emerging Technologies in Electrical Engineering

Advanced Signal Processing On Brain Event-related Potentials: Filtering Erps In Time, Frequency And Space Domains Sequentially And Simultaneously Fengyu Cong, Tapani Ristaniemi, Heikki Lyytinen, 2015-04-15 This book is devoted to the application of advanced signal processing on event related potentials ERPs in the context of electroencephalography EEG for the cognitive neuroscience ERPs are usually produced through averaging single trials of preprocessed EEG and then the interpretation of underlying brain activities is based on the ordinarily averaged EEG We find that randomly fluctuating activities and artifacts can still present in the averaged EEG data and that constant brain activities over single trials can overlap with each other in time frequency and spatial domains Therefore before interpretation it will be beneficial to further separate the averaged EEG into individual brain activities The book proposes systematic approaches pre process wavelet transform WT independent component analysis ICA and nonnegative tensor factorization NTF to filter averaged EEG in time frequency and space domains to sequentially and simultaneously obtain the pure ERP of interest Software of the proposed approaches will be open accessed

Comprehensive Chemometrics Steven Brown, Roma Tauler, Beata Walczak, 2020-05-26 Comprehensive Chemometrics Second Edition Four Volume Set features expanded and updated coverage along with new content that covers advances in the field since the

previous edition published in 2009 Subject of note include updates in the fields of multidimensional and megavariate data analysis omics data analysis big chemical and biochemical data analysis data fusion and sparse methods The book follows a similar structure to the previous edition using the same section titles to frame articles Many chapters from the previous edition are updated but there are also many new chapters on the latest developments Presents integrated reviews of each chemical and biological method examining their merits and limitations through practical examples and extensive visuals Bridges a gap in knowledge covering developments in the field since the first edition published in 2009 Meticulously organized with articles split into 4 sections and 12 sub sections on key topics to allow students researchers and professionals to find relevant information quickly and easily Written by academics and practitioners from various fields and regions to ensure that the knowledge within is easily understood and applicable to a large audience Presents integrated reviews of each chemical and biological method examining their merits and limitations through practical examples and extensive visuals Bridges a gap in knowledge covering developments in the field since the first edition published in 2009 Meticulously organized with articles split into 4 sections and 12 sub sections on key topics to allow students researchers and professionals to find relevant information quickly and easily Written by academics and practitioners from various fields and regions to ensure that the knowledge within is easily understood and applicable to a large audience

Analytical Methods in Statistics Matúš Maciak, Michal Pešta, Martin Schindler, 2020-07-19 This book collects peer reviewed contributions on modern statistical methods and topics stemming from the third workshop on Analytical Methods in Statistics AMISTAT 2019 held in Liberec Czech Republic on September 16 19 2019 Real life problems demand statistical solutions which in turn require new and profound mathematical methods As such the book is not only a collection of solved problems but also a source of new methods and their practical extensions The authoritative contributions focus on analytical methods in statistics asymptotics estimation and Fisher information robustness stochastic models and inequalities and other related fields further they address e g average autoregression quantiles neural networks weighted empirical minimum distance estimators implied volatility surface estimation the Grenander estimator non Gaussian component analysis meta learning and high dimensional errors in variables models

Innovative Technologies and Signal Processing in Perinatal Medicine Danilo Pani, Chiara Rabotti, Maria Gabriella Signorini, Laura Burattini, 2020-10-20 Pregnancy is a critical time for the health of the mother and the fetus with important potential risks for both Tools for antenatal diagnosis and pregnancy monitoring can support prevention and management of potential risks and complications In particular the perinatal period spanning from the third trimester of pregnancy up to one month after birth is the most critical for the baby For this reason in the last decades biomedical engineering supported and fostered the scientific research towards the identification of new models parameters algorithms and tools that can improve the quality of fetal monitoring predict the outcomes and allow physicians to intervene in an appropriate manner to ensure a healthy future for the baby This book follows the First International Summer School on

Technologies and Signal Processing in Perinatal Medicine and reflects some of its most important master lectures It represents a valuable guide for students and young researchers approaching this topic for the first time as well as experienced researchers and practitioners looking for a clear representation of the themes and techniques presented by recognized experts in the field Presents current and innovative technologies for fetal and neonatal monitoring Emphasis on both technology signal processing and clinical aspects Offers a clear didactic approach to the subject matter **Advances in Contemporary Statistics and Econometrics** Abdelaati Daouia, Anne Ruiz-Gazen, 2021-06-14 This book presents a unique collection of contributions on modern topics in statistics and econometrics written by leading experts in the respective disciplines and their intersections It addresses nonparametric statistics and econometrics quantiles and expectiles and advanced methods for complex data including spatial and compositional data as well as tools for empirical studies in economics and the social sciences The book was written in honor of Christine Thomas Agnan on the occasion of her 65th birthday Given its scope it will appeal to researchers and PhD students in statistics and econometrics alike who are interested in the latest developments in their field *Encyclopedia of Image Processing* Phillip A. Laplante, 2018-11-08 The Encyclopedia of Image Processing presents a vast collection of well written articles covering image processing fundamentals e g color theory fuzzy sets cryptography and applications e g geographic information systems traffic analysis forgery detection Image processing advances have enabled many applications in healthcare avionics robotics natural resource discovery and defense which makes this text a key asset for both academic and industrial libraries and applied scientists and engineers working in any field that utilizes image processing Written by experts from both academia and industry it is structured using the ACM Computing Classification System CCS first published in 1988 but most recently updated in 2012

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