Independent Component Analysis: A Tutorial Introduction (MIT Press)

Synopsis

Independent component analysis (ICA) is becoming an increasingly important tool for analyzing large data sets. In essence, ICA separates an observed set of signal mixtures into a set of statistically independent component signals, or source signals. In so doing, this powerful method can extract the relatively small amount of useful information typically found in large data sets. The applications for ICA range from speech processing, brain imaging, and electrical brain signals to telecommunications and stock predictions.In Independent Component Analysis, Jim Stone presents the essentials of ICA and related techniques (projection pursuit and complexity pursuit) in a tutorial style, using intuitive examples described in simple geometric terms. The treatment fills the need for a basic primer on ICA that can be used by readers of varying levels of mathematical sophistication, including engineers, cognitive scientists, and neuroscientists who need to know the essentials of this evolving method. An overview establishes the strategy implicit in ICA in terms of its essentially physical underpinnings and describes how ICA is based on the key observations that different physical processes generate outputs that are statistically independent of each other. The book then describes what Stone calls "the mathematical nuts and bolts" of how ICA works. Presenting only essential mathematical proofs, Stone guides the reader through an exploration of the fundamental characteristics of ICA. Topics covered include the geometry of mixing and unmixing; methods for blind source separation; and applications of ICA, including voice mixtures, EEG, fMRI, and fetal heart monitoring. The appendixes provide a vector matrix tutorial, plus basic demonstration computer code that allows the reader to see how each mathematical method described in the text translates into working Matlab computer code.

Book Information

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Customer Reviews

Independent component analysis is a recent and powerful addition to the methods that scientists and engineers have available to explore large data sets in high-dimensional spaces. This book is a clearly written introduction to the foundations of ICA and the practical issues that arise in applying it to a wide range of problems. (Terrence J. Sejnowski, Howard Hughes Medical Institute, Salk Institute for Biological Studies, and University of California, San Diego)This fantastic book provides a broad introduction to both the theory and applications of independent component analysis. I recommend it to any student interested in exploring this emerging field. (Martin J. McKeown, Associate Professor of Medicine (Neurology), University of British Columbia)This monograph provides a delightful tour, through the foothills of linear algebra to the higher echelons of independent components analysis, in a graceful and deceptively simple way. Its careful construction, introducing concepts as they are needed, discloses the fundamentals of source separation in a remarkably accessible and comprehensive fashion. (Karl J. Friston, University College London)

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It is the clearest explanation I’ve ever found on the topic. It allows you to understand technically

what is the problem to be solved and why the methods do what they do.Definitely highly recommended.

nothing short of excellent for the beginner. I believe the statistics refresher material is extremely well integrated, enough to make for fast reading for the more advanced. I like the approach very much.

This is a good introduction to the topic. You will learn fast, and with relevant examples. Unfortunately, I found a bunch of errors/typos in the formulas. I’m afraid this may defeat the purpose of introducing the novice to this topic. I can understand typos in a monograph are of little consequence, since the readership is already expert. However, this is an intro book; the last thing you want is a bunch of errors that mislead the novice.

You might be led to believe while looking at the contents that this is an elementary treatment. Beware. This may look like that, but really if you skip those portions, this is an insightful pack. It contains a lot of insights, but may not be rigorous on theory. The intuition you get is however remarkable, and can lead to a string of future exploits.

Great info presented well. Super easy to understand. It does exactly what it says - it gives you a simple introduction, examples, and helps you develop intuition for the technique.

The content is easy to understand and example Matlab codes are concise and simple. There are some typos (also in the codes) but do not affect the understanding of this topic.

James Stone’s monograph is a refreshing new book amongst the many other `new books’ on Independent Component Analysis (ICA). The author brings his teaching experience to present the theory and practice of ICA in a highly accessible form using a duplication of words and straight-forward mathematics.Particular attention is given in the earlier chapters to the description of the linear signal mixing process giving the Reader a good basis for understanding the fundamental assumptions upon which ICA and its application to Blind Source Separation are based.The book is aimed at the Reader with a technical but not necessarily formal mathematics background. Illustrative examples and functional algorithms in MatLab are frequent and references are made to the author’s available electronic resources. As such it is suitable to both the newcomer to ICA, and to the more expert engineer or scientist.This Reviewer rates this book very highly.

I can’t stress how reader friendly this book is. It is by far the best introduction on component analysis. It is written in such a way that those with a weaker math background can understand it while those with years of experience will not be bored, at certain times it even reads like a story.It addition to being readable the book contains an impressive amount of content for its size. This content is presented in an organized manner, and in such a way that the user can immediately apply the techniques to their own problems.If you are interested in independent component analysis or one of its relatives I highly recommend this valuable, reasonably price book.

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