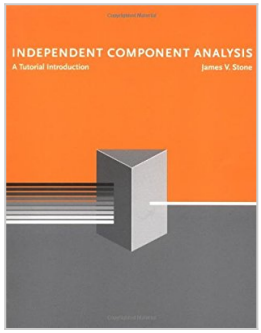

Independent Component Analysis: A Tutorial Introduction (MIT Press)

By James V. Stone

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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.

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Editorial Review

Review

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)

From the Inside Flap
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James V. Stone is a Reader in the Psychology Department of the University of Sheffield. He is coauthor (with John P. Frisby) of the widely used text *Seeing: The Computational Approach to Biological Vision*

(second edition, MIT Press, 2010), and author of *Independent Component Analysis: A Tutorial Introduction* (MIT Press, 2004).

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