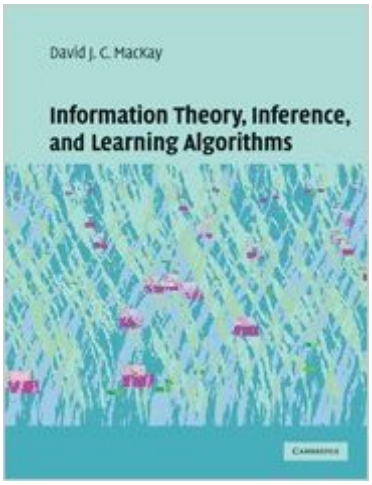
Information Theory, Inference And Learning Algorithms



Synopsis

Information theory and inference, often taught separately, are here united in one entertaining textbook. These topics lie at the heart of many exciting areas of contemporary science and engineering - communication, signal processing, data mining, machine learning, pattern recognition, computational neuroscience, bioinformatics, and cryptography. This textbook introduces theory in tandem with applications. Information theory is taught alongside practical communication systems, such as arithmetic coding for data compression and sparse-graph codes for error-correction. A toolbox of inference techniques, including message-passing algorithms, Monte Carlo methods, and variational approximations, are developed alongside applications of these tools to clustering, convolutional codes, independent component analysis, and neural networks. The final part of the book describes the state of the art in error-correcting codes, including low-density parity-check codes, turbo codes, and digital fountain codes -- the twenty-first century standards for satellite communications, disk drives, and data broadcast. Richly illustrated, filled with worked examples and over 400 exercises, some with detailed solutions, David MacKay’s groundbreaking book is ideal for self-learning and for undergraduate or graduate courses. Interludes on crosswords, evolution, and sex provide entertainment along the way. In sum, this is a textbook on information, communication, and coding for a new generation of students, and an unparalleled entry point into these subjects for professionals in areas as diverse as computational biology, financial engineering, and machine learning.

Book Information

Hardcover: 640 pages

Publisher: Cambridge University Press; 1 edition (October 6, 2003)

Language: English

ISBN-10: 0521642981

ISBN-13: 978-0521642989

Product Dimensions: 7.4 x 1.3 x 9.7 inches

Shipping Weight: 3.3 pounds (View shipping rates and policies)

Average Customer Review: 4.3 out of 5 starsÂ Â See all reviewsÂ (23 customer reviews)

Best Sellers Rank: #173,820 in Books (See Top 100 in Books) #25 inÂ Books > Computers & Technology > Computer Science > AI & Machine Learning > Computer Vision & Pattern Recognition #35 inÂ Books > Computers & Technology > Computer Science > AI & Machine Learning > Neural Networks #52 inÂ Books > Computers & Technology > Computer Science >

Customer Reviews

I find it interesting that most of the people reviewing this book seem to be reviewing it as they would any other information theory textbook. Such a review, whether positive or critical, could not hope to give a complete picture of what this text actually is. There are many books on information theory, but what makes this book unique (and in my opinion what makes it so outstanding) is the way it integrates information theory with statistical inference. The book covers topics including coding theory, Bayesian inference, and neural networks, but it treats them all as different pieces of a unified puzzle, focusing more on the connections between these areas, and the philosophical implications of these connections, and less on delving into depth in one area or another.This is a learning text, clearly meant to be read and understood. The presentation of topics is greatly expanded and includes much discussion, and although the book is dense, it is rarely concise. The exercises are absolutely essential to understanding the text. Although the author has made some effort to make certain chapters or topics independent, I think that this is one book for which it is best to more or less work straight through. For this reason and others, this book does not make a very good reference: occasionally nonstandard notation or terminology is used.The biggest strength of this text, in my opinion, is on a philosophical level. It is my opinion, and in my opinion it is a great shame, that the vast majority of statistical theory and practice is highly arbitrary. This book will provide some tools to (at least in some cases) anchor your thinking to something less arbitrary.

I am reviewing David MacKay's `Information Theory, Inference, and Learning Algorithms, but I haven't yet read completely. It will be years before I finish it, since it contains the material for several advanced undergraduate or graduate courses. However, it is already on my list of favorite texts and references. It is a book I will keep going back to time after time, but don't take my word for it. According to the back cover, Bob McEliece, the author of a 1977 classic on information theory recommends you buy two copies, one for the office and one for home. There are topics in this book I am aching to find the time to read, work through and learn.It can be used as a text book, reference book or to fill in gaps in your knowledge of Information Theory and related material. MacKay outlines several courses for which it can be used including: his Cambridge Course on Information Theory, Pattern Recognition and Neural Networks, a Short Course on Information Theory, and a Course on Bayesian Inference and Machine Learning. As a reference it covers topics not easily accessible in books including: a variety of modern codes (hash codes, low density parity check codes, digital

fountain codes, and many others), Bayesian inference techniques (maximum likelihood, LaPlace's method, variational methods and Monte Carlo methods). It has interesting applications such as information theory applied to genes and evolution and to machine learning.It is well written, with good problems, some help to understand the theory, and others help to apply the theory. Many are worked as examples, and some are especially recommended. He works to keep your attention and interest, and knows how to do it. For example chapter titles include `Why Have Sex' and `Crosswords and Codebreaking'.

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