

George Cybenko    Dianne P. O'Leary  
Jorma Rissanen  
Editors

# The Mathematics of Information Coding, Extraction, and Distribution



Springer

# Mathematics Of Information And Coding

**Robert R. Redfield**



## **Mathematics Of Information And Coding:**

**Mathematics of Information and Coding** Te Sun Han, Kingo Kobayashi, 2002 This book is intended to provide engineering and or statistics students communications engineers and mathematicians with the firm theoretic basis of source coding or data compression in information theory Although information theory consists of two main areas source coding and channel coding the authors choose here to focus only on source coding The reason is that in a sense it is more basic than channel coding and also because of recent achievements in source coding and compression An important feature of the book is that whenever possible the authors describe universal coding methods i e the methods that can be used without prior knowledge of the statistical properties of the data The authors approach the subject of source coding from the very basics to the top frontiers in an intuitively transparent but mathematically sound manner The book serves as a theoretical reference for communication professionals and statisticians specializing in information theory It will also serve as an excellent introductory text for advanced level and graduate students taking elementary or advanced courses in telecommunications electrical engineering statistics mathematics and computer science

**Information and Coding Theory** Gareth A. Jones, J. Mary Jones, 2012-12-06 As this Preface is being written the twentieth century is coming to an end Historians may perhaps come to refer to it as the century of information just as its predecessor is associated with the process of industrialisation Successive technological developments such as the telephone radio television computers and the Internet have had profound effects on the way we live We can see pictures of the surface of Mars or the early shape of the Universe The contents of a whole shelf load of library books can be compressed onto an almost weightless piece of plastic Billions of people can watch the same football match or can keep in instant touch with friends around the world without leaving home In short massive amounts of information can now be stored transmitted and processed with surprising speed accuracy and economy Of course these developments do not happen without some theoretical basis and as is so often the case much of this is provided by mathematics Many of the first mathematical advances in this area were made in the mid twentieth century by engineers often relying on intuition and experience rather than a deep theoretical knowledge to lead them to their discoveries Soon the mathematicians delighted to see new applications for their subject joined in and developed the engineers practical examples into wide ranging theories complete with definitions theorems and proofs

**The Theory of Information and Coding** Robert J. McEliece, 1977 This is a self contained introduction to the theory of information and coding It can be used either for self study or as the basis for a course at either the graduate or undergraduate level The text includes dozens of worked examples and several hundred problems for solution

Coding and Information Theory Richard Wesley Hamming, 1980

The Mathematics of Information Coding, Extraction and Distribution George Cybenko, Dianne P. O'Leary, Jorma Rissanen, 2012-12-06 High performance computing consumes and generates vast amounts of data and the storage retrieval and transmission of this data are major obstacles to effective use of computing power Challenges inherent

in all of these operations are security speed reliability authentication and reproducibility This workshop focused on a wide variety of technical results aimed at meeting these challenges Topics ranging from the mathematics of coding theory to the practicalities of copyright preservation for Internet resources drew spirited discussion and interaction among experts in diverse but related fields We hope this volume contributes to continuing this dialogue

**Coding and Information Theory** Steven Roman,1992-06-04 This book is an introduction to information and coding theory at the graduate or advanced undergraduate level It assumes a basic knowledge of probability and modern algebra but is otherwise self contained The intent is to describe as clearly as possible the fundamental issues involved in these subjects rather than covering all aspects in an encyclopedic fashion The first quarter of the book is devoted to information theory including a proof of Shannon's famous Noisy Coding Theorem The remainder of the book is devoted to coding theory and is independent of the information theory portion of the book After a brief discussion of general families of codes the author discusses linear codes including the Hamming Golay the Reed Muller codes finite fields and cyclic codes including the BCH Reed Solomon Justesen Goppa and Quadratic Residue codes An appendix reviews relevant topics from modern algebra

**Introduction to Coding and Information Theory** Steven Roman,1996-11-26 This book is intended to introduce coding theory and information theory to undergraduate students of mathematics and computer science It begins with a review of probability theory as applied to finite sample spaces and a general introduction to the nature and types of codes The two subsequent chapters discuss information theory efficiency of codes the entropy of information sources and Shannon's Noiseless Coding Theorem The remaining three chapters deal with coding theory communication channels decoding in the presence of errors the general theory of linear codes and such specific codes as Hamming codes the simplex codes and many others

*Information, Coding and Mathematics* Mario Blaum,Patrick G. Farrell,Henk C.A. van Tilborg,2013-03-09 Information Coding and Mathematics is a classic reference for both professional and academic researchers working in error correction coding and decoding Shannon theory cryptography digital communications information security and electronic engineering The work represents a collection of contributions from leading experts in turbo coding cryptography and sequences Shannon theory and coding bounds and decoding theory and applications All of the contributors have individually and collectively dedicated their work as a tribute to the outstanding work of Robert J McEliece Information Coding and Mathematics covers the latest advances in the widely used and rapidly developing field of information and communication technology

Information-Spectrum Methods in Information Theory Te Sun Han,2002-10-08 From the reviews This book nicely complements the existing literature on information and coding theory by concentrating on arbitrary nonstationary and or nonergodic sources and channels with arbitrarily large alphabets Even with such generality the authors have managed to successfully reach a highly unconventional but very fertile exposition rendering new insights into many problems

MATHEMATICAL REVIEWS **Codes:**  
An Introduction to Information Communication and Cryptography Norman L. Biggs,2008-12-16 Many people do not realise

that mathematics provides the foundation for the devices we use to handle information in the modern world. Most of those who do know probably think that the parts of mathematics involved are quite classical such as Fourier analysis and differential equations. In fact a great deal of the mathematical background is part of what used to be called pure mathematics indicating that it was created in order to deal with problems that originated within mathematics itself. It has taken many years for mathematicians to come to terms with this situation and some of them are still not entirely happy about it.

This book is an integrated introduction to Coding. By this I mean replacing symbolic information such as a sequence of bits or a message written in a natural language by another message using possibly different symbols. There are three main reasons for doing this: Economy, data compression, Reliability, correction of errors, and Security, cryptography. I have tried to cover each of these three areas in sufficient depth so that the reader can grasp the basic problems and go on to more advanced study. The mathematical theory is introduced in a way that enables the basic problems to be stated carefully

but without unnecessary abstraction. The prerequisites: sets and functions, matrices, finite probability should be familiar to anyone who has taken a standard course in mathematical methods or discrete mathematics. A course in elementary abstract algebra and/or number theory would be helpful but the book contains the essential facts and readers without this background should be able to understand what is going on.

There are a few places where reference is made to computer algebra systems. **The Theory of Information and Coding** R. J. McEliece, 2004-07-15. Student edition of the classic text in information and coding theory. Fundamentals of Information

Theory and Coding Design Roberto Togneri, Christopher J. S. de Silva, 2003-01-13. Books on information theory and coding have proliferated over the last few years but few succeed in covering the fundamentals without losing students in mathematical abstraction. Even fewer build the essential theoretical framework when presenting algorithms and implementation details of modern coding systems. Without abandoning the theoret

**Algebraic Coding Theory and Information Theory** Alexei Ashikhmin, Alexander Barg, Collected here are papers that were presented at or inspired by the DIMACS workshop Algebraic Coding Theory and Information Theory Rutgers University Piscataway NJ. Among the topics discussed are universal data compression, graph theoretical ideas in the construction of codes and lattices, decoding algorithms and computation of capacity in various communications schemes. The book is suitable for graduate students and researchers interested in coding and information theory. *Coding Theorems of Information Theory* Jacob Wolfowitz, 2012-12-06. The imminent exhaustion of

the first printing of this monograph and the kind willingness of the publishers have presented me with the opportunity to correct a few minor misprints and to make a number of additions to the first edition. Some of these additions are in the form of remarks scattered throughout the monograph. The principal additions are Chapter 11, most of Section 6.6 including Theorem 6.6.2, Sections 6.7.7.7 and 4.9. It has been impossible to include all the novel and interesting results which have appeared in the last three years. I hope to include these in a new edition or a new monograph to be written in a few years.

when the main new currents of research are more clearly visible There are now several instances where in the first edition only a weak converse was proved and in the present edition the proof of a strong converse is given Where the proof of the weaker theorem employs a method of general application and interest it has been retained and is given along with the proof of the stronger result This is wholly in accord with the purpose of the present monograph which is not only to prove the principal coding theorems but also while doing so to acquaint the reader with the most fruitful and interesting ideas and methods used in the theory I am indebted to Dr Information Security, Coding Theory and Related Combinatorics Dean Crnković, Vladimir Tonchev, 2011 Published in cooperation with NATO Emerging Security Challenges Division T p A Student's Guide to Coding and Information Theory Stefan M. Moser, Po-Ning Chen, 2012-01-26 This easy to read guide provides a concise introduction to the engineering background of modern communication systems from mobile phones to data compression and storage Background mathematics and specific engineering techniques are kept to a minimum so that only a basic knowledge of high school mathematics is needed to understand the material covered The authors begin with many practical applications in coding including the repetition code the Hamming code and the Huffman code They then explain the corresponding information theory from entropy and mutual information to channel capacity and the information transmission theorem Finally they provide insights into the connections between coding theory and other fields Many worked examples are given throughout the book using practical applications to illustrate theoretical definitions Exercises are also included enabling readers to double check what they have learned and gain glimpses into more advanced topics making this perfect for anyone who needs a quick introduction to the subject **Cryptography and Coding** Maura B. Paterson, 2021-12-14 This book constitutes the refereed proceedings of the 18th IMA International Conference on Cryptography and Coding IMACC 2021 held in December 2021 Due to COVID 19 pandemic the conference was held virtually The 14 papers presented were carefully reviewed and selected from 30 submissions The conference focuses on a diverse set of topics both in cryptography and coding theory **Encyclopaedia of Mathematics** Michiel Hazewinkel, 2013-12-01 This ENCYCLOPAEDIA OF MATHEMATICS aims to be a reference work for all parts of mathematics It is a translation with updates and editorial comments of the Soviet Mathematical Encyclopaedia published by Soviet Encyclopaedia Publishing House in five volumes in 1977 1985 The annotated translation consists of ten volumes including a special index volume There are three kinds of articles in this ENCYCLOPAEDIA First of all there are survey type articles dealing with the various main directions in mathematics where a rather fine subdivision has been used The main requirement for these articles has been that they should give a reasonably complete up to date account of the current state of affairs in these areas and that they should be maximally accessible On the whole these articles should be understandable to mathematics students in their first specialization years to graduates from other mathematical areas and depending on the specific subject to specialists in other domains of science engineers and teachers of mathematics These articles treat their material at a fairly general level and aim

to give an idea of the kind of problems techniques and concepts involved in the area in question They also contain background and motivation rather than precise statements of precise theorems with detailed definitions and technical details on how to carry out proofs and constructions The second kind of article of medium length contains more detailed concrete problems results and techniques Coding Theorems of Information Theory J. Wolfowitz, 2012-12-06 The objective of the present edition of this monograph is the same as that of earlier editions namely to provide readers with some mathematical maturity a rigorous and modern introduction to the ideas and principal theorems of probabilistic information theory It is not necessary that readers have any prior knowledge whatever of information theory The rapid development of the subject has had the consequence that any one book can now cover only a fraction of the literature The latter is often written by engineers for engineers and the mathematical reader may have some difficulty with it The mathematician who understands the content and methods of this monograph should be able to read the literature and start on research of his own in a subject of mathematical beauty and interest The present edition differs from the second in the following Chapter 6 has been completely replaced by one on arbitrarily varying channels Chapter 7 has been greatly enlarged Chapter 8 on semi continuous channels has been drastically shortened and Chapter 11 on sequential decoding completely removed The new Chapters 11 15 consist entirely of material which has been developed only in the last few years The topics discussed are rate distortion source coding multiple access channels and degraded broadcast channels Even the specialist will find a new approach in the treatment of these subjects Many of the proofs are new more perspicuous and considerably shorter than the original ones

*Boolean Models and Methods in Mathematics, Computer Science, and Engineering* Yves Crama, Peter L.

Hammer, 2010-06-28 A collection of papers written by prominent experts that examine a variety of advanced topics related to Boolean functions and expressions

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