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sphere packing; 3.4 Further reading; References; 4 Data compression: efficient coding of a random message; 4.1 A motivating example; 4.2 Prefix-free or instantaneous codes; 4.3 Trees and codes; 4.4 The Kraft Inequality; 4.5 Trees with probabilities
4.6 Optimal codes: Huffman code
4.7 Types of codes; 4.8 Some historical background; 4.9 Further reading; References; 5 Entropy and Shannon's Source Coding Theorem; 5.1 Motivation; 5.2 Uncertainty or entropy; 5.2.1 Definition; 5.2.2 Binary entropy function; 5.2.3 The Information Theory Inequality; 5.2.4 Bounds on the entropy; 5.3 Trees revisited; 5.4 Bounds on the efficiency of codes; 5.4.1 What we cannot do: fundamental limitations of source coding; 5.4.2 What we can do: analysis of the best codes; 5.4.3 Coding Theorem for a Single Random Message; 5.5 Coding of an information source
5.6 Some historical background
5.7 Further reading; 5.8 Appendix: Uniqueness of the definition of entropy; References; 6 Mutual information and channel capacity; 6.1 Introduction; 6.2 The channel; 6.3 The channel relationships; 6.4 The binary symmetric channel; 6.5 System entropies; 6.6 Mutual information; 6.7 Definition of channel capacity; 6.8 Capacity of the binary symmetric channel; 6.9 Uniformly dispersive channel; 6.10 Characterization of the capacity-achieving input distribution; 6.11 Shannon's Channel Coding Theorem; 6.12 Some historical background; 6.13 Further reading; References
7 Approaching the Shannon limit by turbo coding
7.1 Information Transmission Theorem; 7.2 The Gaussian channel; 7.3 Transmission at a rate below capacity; 7.4 Transmission at a rate above capacity; 7.5 Turbo coding: an introduction; 7.6 Further reading; 7.7 Appendix: Why we assume uniform and independent data at the encoder; 7.8 Appendix: Definition of concavity; References; 8 Other aspects of coding theory; 8.1 Hamming code and projective geometry; 8.2 Coding and game theory; 8.3 Further reading; References; References; Index

Sommario/riassunto

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.
