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Understanding Machine Learning Cambridge University Press

An introduction to computational complexity theory, its connections and interactions with mathematics, and its central role in the natural and social sciences, technology, and philosophy Mathematics and Computation provides a broad, conceptual overview

of computational complexity theory—the mathematical study of efficient computation. With important practical applications to computer science and industry, computational complexity theory has evolved into a highly interdisciplinary field, with strong links to most mathematical areas and to a growing number of scientific endeavors. Avi Wigderson takes a sweeping survey of complexity theory, emphasizing the field ' s insights and challenges. He explains the ideas and motivations leading to key models, notions, and results. In particular, he looks at algorithms and complexity, computations and proofs, randomness and interaction, quantum and arithmetic computation, and cryptography and learning, all as parts of a cohesive whole with numerous cross-influences. Wigderson illustrates the immense breadth of the field, its beauty and richness, and its diverse and growing interactions with other areas of mathematics. He ends with a comprehensive look at the theory of computation, its methodology and aspirations, and the unique and fundamental ways in which it has shaped and will further shape science, technology, and society. For further reading, an extensive bibliography is provided for all topics covered. Mathematics and Computation is useful for undergraduate and graduate students in mathematics, computer science, and related fields, as well as researchers and teachers in these fields. Many parts require little background, and serve as an invitation to newcomers seeking an introduction to the theory of computation. Comprehensive coverage of computational complexity theory, and beyond High-

level, intuitive exposition, which brings conceptual clarity to this central and dynamic scientific discipline Historical accounts of the evolution and motivations of central concepts and models A broad view of the theory of computation's influence on science, technology, and society Extensive bibliography

Introduction to the Theory of Computation **Cambridge University Press**

This book constitutes the refereed proceedings of the 9th Annual European Symposium on Algorithms, ESA 2001, held in Aarhus, Denmark, in August 2001. The 41 revised full papers presented together with three invited contributions were carefully reviewed and selected from 102 submissions. The papers are organized in topical sections on caching and prefetching, online algorithms, data structures, optimization and approximation, sequences, scheduling, shortest paths, geometry, distributed algorithms, graph algorithms, pricing, broadcasting and multicasting, graph labeling and graph drawing, and graphs.

Algorithms - ESA 2001 Elsevier

Formal methods is the term used to describe the specification and verification of software and software systems using mathematical logic. Various methodologies have been developed and incorporated into software tools. An important subclass is distributed systems. There are

many books that look at particular methodologies for such systems, e.g. CSP, process algebra. This book offers a more balanced introduction for graduate students that describes the various approaches, their strengths and weaknesses, and when they are best used. Milner's CCS and its operational semantics are introduced, together with notions of behavioural equivalence based on bisimulation techniques and with variants of Hennessy-Milner modal logics. Later in the book, the presented theories are extended to take timing issues into account. The book has arisen from various courses taught in Iceland and Denmark and is designed to give students a broad introduction to the area, with exercises throughout.

Mathematics of Public Key Cryptography Princeton University Press

An Introduction to Formal Languages & Automata provides an excellent presentation of the material that is essential to an introductory theory of computation course. The text was designed to familiarize students with the foundations & principles of computer science & to strengthen the students' ability to carry out formal & rigorous mathematical argument.

Employing a problem-solving approach, the text provides students insight into the course material by stressing intuitive motivation & illustration of ideas through straightforward explanations & solid mathematical proofs. By emphasizing learning through problem solving, students learn the material primarily through problem-type illustrative examples that show the motivation behind the concepts, as well as their connection to the theorems & definitions.

What Can Be Computed?

MIT Press

This book contains a revised version of the dissertation the author wrote at the Department of Computer Science of the University of Chicago. The thesis was submitted to the Faculty of Physical Sciences in conformity with the requirements for the PhD degree in June 1999. It was honored with the 1999 ACM Doctoral Dissertation Award in May 2000.

Summary Computational complexity is the study of the inherent di culty of compu- tional problems and the power of the tools we may use to solve them. It aims to describe how many resources we need to compute the solution as a function of the problem size. Typical resources include time on sequential and parallel architectures and memory space. As we want to abstract away from details of input representation and speci cs of the computer model, we end up with classes of problems that we can solve within certain robust resource bounds such as polynomial time, parallel logarithmic time, and logarithmic space. Research in complexity theory boils down to determining the relationships between these

classes { inclusions and separations. In this dissertation, we focus on the role of randomness and look at various properties of hard problems in order to obtain separations. We also investigate the power of nondeterminism and alternation, as well as space versus time issues. Randomness provides a resource that seems to help in various situations.

Quantum Computing Cambridge University Press

This first part presents chapters on models of computation, complexity theory, data structures, and efficient computation in many recognized sub-disciplines of Theoretical Computer Science.

An Introduction to Formal Languages and Automata John Wiley & Sons

For upper level courses on Automata. Combining classic theory with unique applications, this crisp narrative is supported by abundant examples and clarifies key concepts by introducing important uses of techniques in real systems. Broad-ranging coverage allows instructors to easily customise course material to fit their unique requirements.

Cybernetics Abstracts Springer

This advanced graduate textbook gives an authoritative and insightful description of the major ideas and techniques of public key cryptography.

Encyclopedia of Microcomputers Springer Science & Business Media

Quantum phase transitions, driven by quantum fluctuations, exhibit intriguing features offering the possibility of potentially new applications, e.g. in quantum information sciences. Major advances have been made in both theoretical and experimental investigations of the nature

and behavior of quantum phases and transitions in cooperatively interacting many-body quantum systems. For modeling purposes, most of the current innovative and successful research in this field has been obtained by either directly or indirectly using the insights provided by quantum (or transverse field) Ising models because of the separability of the cooperative interaction from the tunable transverse field or tunneling term in the relevant Hamiltonian. Also, a number of condensed matter systems can be modeled accurately in this approach, hence granting the possibility to compare advanced models with actual experimental results. This work introduces these quantum Ising models and analyses them both theoretically and numerically in great detail. With its tutorial approach the book addresses above all young researchers who wish to enter the field and are in search of a suitable and self-contained text, yet it will also serve as a valuable reference work for all active researchers in this area.

The Complexity Theory Companion "O'Reilly Media, Inc."

Computational complexity is one of the most beautiful fields of modern mathematics, and it is increasingly relevant to other sciences ranging from physics to biology. But this beauty is often buried underneath layers of unnecessary formalism, and exciting recent results like interactive proofs, phase transitions, and quantum computing are usually considered too advanced for the typical student. This book

bridges these gaps by explaining the deep ideas of theoretical computer science in a clear and enjoyable fashion, making them accessible to non-computer scientists and to computer scientists who finally want to appreciate their field from a new point of view. The authors start with a lucid and playful explanation of the P vs. NP problem, explaining why it is so fundamental, and so hard to resolve. They then lead the reader through the complexity of mazes and games; optimization in theory and practice; randomized algorithms, interactive proofs, and pseudorandomness; Markov chains and phase transitions; and the outer reaches of quantum computing. At every turn, they use a minimum of formalism, providing explanations that are both deep and accessible. The book is intended for graduate and undergraduate students, scientists from other areas who have long wanted to understand this subject, and experts who want to fall in love with this field all over again.

Algorithms and Complexity Oxford University Press on Demand

The two-volume set LNCS 9985 and LNCS 9986 constitutes the refereed proceedings of the 14th International Conference on Theory of Cryptography, TCC 2016-B, held in Beijing, China, in November 2016. The total of 45 revised full papers presented in the proceedings were carefully reviewed and selected from 113 submissions. The papers were organized in topical sections named: TCC test-of-time award; foundations; unconditional security; foundations of multi-party protocols; round complexity and efficiency of multi-party

computation; differential privacy; delegation and IP; public-key encryption; obfuscation and multilinear maps; attribute-based encryption; functional encryption; secret sharing; new models.

Complexity Theory Cengage Learning

This book constitutes the thoroughly refereed proceedings of the 24th International Colloquium on Structural Information and Communication Complexity, SIROCCO 2017, held in Porquerolles, France, in June 2017. The 21 full papers presented were carefully reviewed and selected from 41 submissions. They are devoted to the study of the interplay between structural knowledge, communications, and computing in decentralized systems of multiple communicating entities. They are organized around the following topics: wireless networks; identifiers and labeling; mobile agents; probabilistic algorithms; computational complexity; dynamic networks.

Algorithms and Data Structures Springer Science & Business Media

The text covers random graphs from the basic to the advanced, including numerous exercises and recommendations for further reading.

Introduction to Random Graphs Springer

Introduces machine learning and its algorithmic paradigms, explaining the principles behind automated learning approaches and the considerations underlying their usage.

Computability and Complexity

Theory OUP Oxford

A very active field of research is emerging at the frontier of statistical physics, theoretical computer science/discrete mathematics, and coding/information theory. This book sets up a common language and pool of concepts, accessible to students and researchers from each of these fields.

Analysis of Boolean Functions Oxford University Press

A thorough exposition of quantum computing and the underlying concepts of quantum physics, with explanations of the relevant mathematics and numerous examples. The combination of two of the twentieth century's most influential and revolutionary scientific theories, information theory and quantum mechanics, gave rise to a radically new view of computing and information. Quantum information processing explores the implications of using quantum mechanics instead of classical mechanics to model information and its processing. Quantum computing is not about changing the physical substrate on which computation is done from classical to quantum but about changing the notion of computation itself, at the most basic level. The fundamental unit of computation is no longer the bit but the quantum bit or qubit. This comprehensive introduction to the field offers a thorough exposition of quantum computing and the underlying concepts of quantum physics, explaining all the relevant mathematics and offering numerous examples. With its careful development of concepts and thorough explanations, the book makes quantum computing accessible to students and professionals in mathematics, computer science, and engineering. A reader with no prior knowledge of quantum physics (but with

sufficient knowledge of linear algebra) will be able to gain a fluent understanding by working through the book.

Computational Complexity Springer Science & Business Media New and classical results in computational complexity, including interactive proofs, PCP, derandomization, and quantum computation. Ideal for graduate students.

Mathematical Foundations of Computer Science 1999 Princeton University Press Praise for the Third Edition "Researchers of any kind of extremal combinatorics or theoretical computer science will welcome the new edition of this book." - MAA Reviews Maintaining a standard of excellence that establishes The Probabilistic Method as the leading reference on probabilistic methods in combinatorics, the Fourth Edition continues to feature a clear writing style, illustrative examples, and illuminating exercises. The new edition includes numerous updates to reflect the most recent developments and advances in discrete mathematics and the connections to other areas in mathematics, theoretical computer science, and statistical physics. Emphasizing the methodology and techniques that enable problem-solving, The Probabilistic Method, Fourth Edition begins with a description of tools applied to probabilistic arguments, including basic techniques that use expectation and variance as well as the more advanced applications of martingales and correlation inequalities. The authors explore where probabilistic techniques have been applied successfully and also examine topical coverage such as discrepancy and random graphs, circuit complexity, computational

geometry, and derandomization of randomized algorithms. Written by two well-known authorities in the field, the Fourth Edition features: Additional exercises throughout with hints and solutions to select problems in an appendix to help readers obtain a deeper understanding of the best methods and techniques New coverage on topics such as the Local Lemma, Six Standard Deviations result in Discrepancy Theory, Property B, and graph limits Updated sections to reflect major developments on the newest topics, discussions of the hypergraph container method, and many new references and improved results The Probabilistic Method, Fourth Edition is an ideal textbook for upper-undergraduate and graduate-level students majoring in mathematics, computer science, operations research, and statistics. The Fourth Edition is also an excellent reference for researchers and combinatorists who use probabilistic methods, discrete mathematics, and number theory. Noga Alon, PhD, is Baumritter Professor of Mathematics and Computer Science at Tel Aviv University. He is a member of the Israel National Academy of Sciences and Academia Europaea. A coeditor of the journal Random Structures and Algorithms, Dr. Alon is the recipient of the Polya Prize, The Gödel Prize, The Israel Prize, and the EMET Prize. Joel H. Spencer, PhD, is Professor of Mathematics and Computer Science at the Courant Institute of New York University. He is the cofounder and coeditor of the journal Random Structures and Algorithms and is a Sloane Foundation Fellow. Dr. Spencer has written more than 200 published articles and is the coauthor of Ramsey Theory, Second Edition, also

published by Wiley.

Advances in Algorithms, Languages, and Complexity
Cambridge University Press
This book contains a collection of sixteen survey papers on recent developments in algorithms, formal languages, and computational complexity. These are the three areas in which Professor Ronald V. Book has made significant contributions, and the objective of the editors and the contributors is to honor Professor Book on his sixtieth birthday. Audience: Researchers and graduate students with interests in design and analysis of algorithms, in language theory, and in computational complexity.

Mathematics and Computation
Cambridge University Press
This revised and extensively expanded edition of Computability and Complexity Theory comprises essential materials that are core knowledge in the theory of computation. The book is self-contained, with a preliminary chapter describing key mathematical concepts and notations. Subsequent chapters move from the qualitative aspects of classical computability theory to the quantitative aspects of complexity theory. Dedicated chapters on undecidability, NP-completeness, and relative computability focus on the limitations of computability and the distinctions between feasible and intractable. Substantial new content in this edition includes: a chapter on nonuniformity studying Boolean circuits, advice classes and the important result of Karp?Lipton. a chapter studying properties of the fundamental probabilistic complexity classes a study of the alternating Turing machine and uniform circuit classes. an introduction of counting classes, proving the famous results of Valiant and Vazirani and of Toda a thorough treatment of the proof that IP is identical to PSPACE With its accessibility and well-devised organization, this text/reference is an excellent resource and guide

for those looking to develop a solid grounding in the theory of computing. Beginning graduates, advanced undergraduates, and professionals involved in theoretical computer science, complexity theory, and computability will find the book an essential and practical learning tool. Topics and features: Concise, focused materials cover the most fundamental concepts and results in the field of modern complexity theory, including the theory of NP-completeness, NP-hardness, the polynomial hierarchy, and complete problems for other complexity classes Contains information that otherwise exists only in research literature and presents it in a unified, simplified manner Provides key mathematical background information, including sections on logic and number theory and algebra Supported by numerous exercises and supplementary problems for reinforcement and self-study purposes