Quantum Radar Synthesis Lectures On Quantum Computing

Adiabatic quantum computation (AQC) is an alternative to the better-known gate model of quantum computation. The two models are polynomially equivalent, but otherwise quite dissimilar: one property that distinguishes AQC from the gate model is its analog nature. Quantum annealing (QA) describes a type of heuristic search algorithm that can be implemented to run in the ``native instruction set'' of an AQC platform. D-Wave Systems Inc. manufactures {quantum annealing processor chips} that exploit quantum properties to realize QA computations in hardware. The chips form the centerpiece of a novel computing platform designed to solve NP-hard optimization problems. Starting with a 16-qubit prototype announced in 2007, the company has launched and sold increasingly larger models: the 128-qubit D-Wave One system was announced in 2010 and the 512-qubit D-Wave Two system arrived on the scene in 2013. A 1,000-qubit model is expected to be available in 2014. This monograph presents an introductory overview of this unusual and rapidly developing approach to computation. We start with a survey of basic principles of quantum computation and what is known about the AQC model and the QA algorithm paradigm. Next we review the D-Wave technology stack and discuss some challenges to building and using quantum computing systems at a commercial scale. The last chapter reviews some experimental efforts to understand the properties and capabilities of these unusual platforms. The discussion throughout is aimed at an audience of computer scientists with little background in quantum computation or in physics. Table of Contents: Acknowledgments / Introduction / Adiabatic Quantum Computation / Quantum Annealing / The D-Wave Platform / Computational Experience / Bibliography / Author's Biography

Quantum robotics is an emerging engineering and scientific research discipline that explores the application of quantum mechanics, quantum computing, quantum algorithms, and related fields to robotics. This work broadly surveys advances in our scientific understanding and engineering of quantum mechanisms and how these developments are expected to impact the technical capability for robots to sense, plan, learn, and act in a dynamic environment. It also discusses the new technological potential that quantum approaches may unlock for sensing and control, especially for exploring and manipulating quantum-scale environments. Finally, the work surveys the state of the art in current implementations, along with their benefits and limitations, and provides a roadmap for the future.

Synthetic Aperture Radar Imaging Mechanism for Oil Spills delivers the critical tool needed to understand the latest technology in radar imaging of oil spills, particularly microwave radar as a main source to understand analysis and applications in the field of marine pollution. Filling the gap between modern physics quantum theory and applications of radar imaging of oil spills, this reference is packed with technical details associated with the potentiality of synthetic aperture radar (SAR) and the key methods used to extract the value-added information necessary, such as location, size, perimeter and chemical details of the oil slick from SAR measurements. Rounding out with practical simulation trajectory movements of oil spills using radar images, this book brings an effective new source of technology and applications for today’s oil and marine pollution engineers. Bridges the gap between theory and application of the techniques involving oil spill monitoring Helps readers understand a new approach to four-dimensional automatic detection Provides advanced knowledge on image processing based on intelligent learning machine algorithms and new techniques for detection, such as quantum and multi-objective algorithms

The adiabatic quantum computation (AQC) is based on the adiabatic theorem to approximate solutions of the Schrödinger equation. The design of an AQC algorithm involves the construction of a Hamiltonian that describes the behavior of the quantum system. This Hamiltonian is expressed as a linear interpolation of an initial Hamiltonian whose ground state is easy to compute, and a final Hamiltonian whose ground state corresponds to the solution of a given combinatorial optimization problem. The adiabatic theorem asserts that if the time evolution of a quantum system described by a Hamiltonian is large enough, then the system remains close to its ground state. An AQC algorithm uses the adiabatic theorem to approximate the ground state of the final Hamiltonian that corresponds to the solution of the given optimization problem. In this book, we investigate the computational simulation of AQC algorithms applied to the MAX-SAT problem. A symbolic analysis of the AQC solution is given in order to understand the involved computational complexity of AQC algorithms. This approach can be extended to other combinatorial optimization problems and can be used for the classical simulation of an AQC algorithm where a Hamiltonian problem is constructed. This construction requires the computation of a sparse matrix of dimension 2n × 2n, by means of tensor products, where n is the dimension of the quantum system. Also, a general scheme to design AQC algorithms is proposed, based on a natural correspondence between optimization Boolean variables and quantum bits. Combinatorial graph problems are in correspondence with pseudo-Boolean maps that are reduced in polynomial time to quadratic maps. Finally, the relation among NP-hard problems is investigated, as well as its logical representability, and is applied to the design of AQC algorithms. It is shown that every monadic second-order logic (MSOL) expression has associated pseudo-Boolean maps that can be obtained by expanding the given expression, and also can be reduced to quadratic forms. Table of Contents: Preface / Acknowledgments / Introduction / Approximability of NP-hard Problems / Adiabatic Quantum Computing / Efficient Hamiltonian Construction / AQC for Pseudo-Boolean Optimization / A General Strategy to Solve NP-Hard Problems / Conclusions / Bibliography / Authors' Biographies

Synthetic Aperture Radar Imaging Mechanism for Oil Spills

Toward a New Understanding of Space, Time and Matter

High Level Structures for Quantum Computing

Quantum Radar

Adiabatic Quantum Computation and Quantum Annealing

Concepts, Principles, and Practices

In Home Is Where the Wind Blows, Sir Fred Hoyle, one of this century's most eminent scientists and author of dozens of successful books, both fiction and nonfiction, offers a revealing and charming account of his life and work. Mathematician, physicist, astronomer, cosmologist - Sir Fred is perhaps best known, in scientific circles, for his brilliant explanation of the origin of the elements from hydrogen nuclei in stars (a process known as nucleosynthesis) and for developing (with Sir Hermann Bondi and Thomas Gold) the elegant but controversial steady-state theory of the Universe (which assumes the continuous creation of matter). In 1950, in the last of a series of radio lectures on astronomy that he delivered on the air for the BBC, Sir Fred coined the term "Big Bang" to characterize the competing expanding-Universe theory, which has since become the dominant paradigm. Ironically, the term has become a permanent addition to the language of cosmology. Sir Fred's name has become well known to the general public because of his unusual ability to describe the ideas of science in a simple and accessible way. In addition to his scientific work, he has written more than a dozen works of popular science (many of them widely translated) and more than a dozen works of science fiction (most of them in collaboration with his son, Geoffrey). In all his work, Sir Fred has shown himself to be ready and able to challenge established thinking. In the author's amusing and memorable account of his childhood in Home Is Where the Wind Blows, the reader will see how this came to be true. Possessed since infancy with a strong streak of independence, he was encouraged by his parents, throughout his school years, to trust his own judgment and to think for himself.

Highly effective thinking is an art that engineers and scientists can be taught to develop. By presenting actual experiences and analyzing them as they are described, the author conveys the developmental thought processes employed and shows a style of thinking that leads to successful results is something that can be learned. Along with spectacular successes, the author also conveys how failures contributed to shaping the thought processes. Provides the reader with a style of thinking that will enhance a person's ability to function as a problem-solver of complex technical issues. Consists of a collection of stories about the author's participation in significant discoveries, relating how those discoveries came about and, most importantly, provides analysis about the thought processes and reasoning that took place as the author and his associates progressed through engineering problems.

This book brings together reviews by internationally renowed experts on quantum optics and photonics. It describes novel experiments at the limit of single photons, and presents advances in this emerging research area. It also includes reprints and historical descriptions of some of the first pioneering experiments at a single-photon level and nonlinear optics, performed before the inception of lasers and modern light detectors, often with the human eye serving as a single-photon detector. The book comprises 19 chapters, 10 of which describe modern quantum photonics results, including single-photon sources, direct measurement of the photon's spatial wave function, nonlinear interactions and non-classical light, nanophotonics for room-temperature single-photon sources, time-multiplexed methods for optical quantum information processing, the role of photon statistics in visual perception, light-by-light coherent control using metamaterials, nonlinear nanoplasmonics, nonlinear polarization optics, and ultrafast nonlinear optics in the mid-infrared.

Provides a classical physics-based explanation of quantum physics, including a description of photon creation and annihilation, and successful working models of both photons and electrons. This book shows classical field theory to describe atomic scale events, including photon emission and annihilation.

Ensemble Methods in Data Mining

Art of Doing Science and Engineering

MATLAB for Neuroscientists

Approximability of Optimization Problems through Adiabatic Quantum Computation

Photon Creation - Annihilation

Quantum Image Processing

"Quantum computation, one of the latest joint ventures between physics and the theory of computation, is a scientific field whose main goals include the development of hardware and algorithms based on the quantum mechanical properties of those physical systems used to implement such algorithms." "Solving difficult tasks (for example, the Satisfiability Problem and other NP-complete problems) requires the development of sophisticated algorithms, many of which employ stochastic processes as their mathematical basis. Discrete random walks are a popular choice among those stochastic processes." "Inspired on the success of discrete random walks in algorithm development, quantum walks, an emerging field of quantum computation, is a generalization of random walks into the quantum mechanical world." "The purpose of this lecture is to provide a concise yet comprehensive introduction to quantum walks."--BOOK JACKET.

It should appeal to plasma physicists interested in charged-particle dynamics, as well as to applied physicists needing to know more about micro- and millimeter-wave technologies.

Beautifully illustrated and engagingly written, Twelve Lectures in Quantum Mechanics presents theoretical physics with a breathtaking array of examples and anecdotes. Basdevant’s style is clear and stimulating, in the manner of a brisk lecture that can be followed with ease and enjoyment. Here is a sample of the book’s style, from the opening of Chapter 1: "If one were to ask a passer-by to quote a great formula of physics, chances are that the answer would be ‘E = mc2’.... There is no way around it: all physics is quantum, from elementary particles, to stellar physics and the Big Bang, not to mention semiconductors and solar cells."

This book provides a comprehensive introduction to quantum image processing, which focuses on extending conventional image processing tasks to the quantum computing frameworks. It summarizes the available quantum image representations and their operations, reviews the possible quantum image applications and their implementation, and discusses the open questions and future development trends. It offers a valuable reference resource for graduate students and researchers interested in this emerging interdisciplinary field.

Negative Quantum Channels

The Survival of a Mathematician

Continuum Electromagnetic Theory

Underwater Communications

Yearbook of Varna University of Management

Automatic Detection Algorithms of Oil Spill in Radar Images

Volume XIII includes scientific articles and reports from the 16th International Scientific Conference on the topic of „The science and digitalisation in help of business, education and tourism “ , September 7th -8th , 2020, Varna, Bulgaria.

This book tells the story of the second quantum revolution which will shape the 21st century as much as the first quantum revolution shaped the 20th century. It provides unique orientation in today's discussion and the latest progress on the interpretation of quantum physics and its further technological potential. As you read this book the first prototypes of this revolution are being built in laboratories worldwide. Super-technologies such as nanotechnology, quantum computers, quantum information processing, and others will soon shape our daily lives, even if physicists themselves continue to disagree on how to interpret the central theory of modern physics. The book will thus also touch on the profound philosophical questions at the heart of quantum mechanics.

This text presents a modern theory of analysis, control, and optimization for dynamic networks. Mathematical techniques of Lyapunov drift and Lyapunov optimization are developed and shown to enable constrained optimization of time averages in general stochastic systems. The focus is on communication and queueing systems, including wireless networks with time-varying channels, mobility, and randomly arriving traffic. A simple drift-plus-penalty framework is used to optimize time averages such as throughput, throughput-utility, power, and distortion. Explicit performance-delay tradeoffs are provided to illustrate the cost of approaching optimality. This theory is also applicable to problems in operations research and economics, where energy-efficient and profit-maximizing decisions must be made without knowing the future. Topics in the text include the following: - Queue stability theory - Backpressure, max-weight, and virtual queue methods - Primal-dual methods for non-convex stochastic utility maximization - Universal scheduling theory for arbitrary sample paths - Approximate and randomized scheduling theory - Optimization of renewal systems and Markov decision systems Detailed examples and numerous problem set questions are provided to reinforce the main concepts. Table of Contents: Introduction / Introduction to Queues / Dynamic Scheduling Example / Optimizing Time Averages / Optimizing Functions of Time Averages / Approximate Scheduling / Optimization of Renewal Systems / Conclusions

This book is a brief introduction to negative quantum channels, i.e., linear, trace-preserving (and consistent) quantum maps that are not completely positive. The flat and sharp operators are introduced and explained. Complete positivity is presented as a mathematical property, but it is argued that complete positivity is not a physical requirement of all quantum operations. Negativity, a measure of the lack of complete positivity, is proposed as a tool for empirically testing complete positivity assumptions. Table of Contents: Preface / Acknowledgments / Introduction and Definition of Terms / Tomography / Non-Positive Reduced Dynamics / Complete Positivity / Physical Motivation of Complete Positivity / Measures of Complete Positivity / Negative Channels / Negative Climates with Diagonal Composite Dynamics / Rabi Channels / Physical Motivations for Sharp Operations / Negative Qubit Channel Examples with Multi-Qubit Baths / Proposed Experimental Demonstration of Negativity / Implications of Negative Channels / Uses for Negative Channels / Conclusions / Bibliography / Author's Biography

Law and Policy for the Quantum Age

Introduction to Semi-supervised Learning

From Entanglement to Quantum Computing and Other Super-Technologies

Home is where the Wind Blows

Quantum Computing Since Democritus

The Second Quantum Revolution

'Sidney Coleman was the master teacher of quantum field theory. All of us who knew him became his students and disciples. Sidney’s legendary course remains fresh and bracing, because he chose his topics with a sure feel for the essential, and treated them with elegant economy.' Frank WilczekNobel Laureate in Physics 2004 Sidney Coleman was a physicist's physicist. He is largely unknown outside of the theoretical physics community, and known only by reputation to the younger generation. He was an unusually effective teacher, famed for his wit, his insight and his encyclopedic knowledge of the field to which he made many important contributions. There are many first-rate quantum field theory books (the venerable Bjorken and Drell, the more modern Itzykson and Zuber, the now-standard Peskin and Schroeder, and the recent Zee), but the immediacy of Prof. Coleman's approach and his ability to present an argument simply without sacrificing rigor makes his book easy to read and ideal for the student. Part of the motivation in producing this book is to pass on the work of this outstanding physicist to later generations, a record of his teaching that he was too busy to leave himself.

Underwater vehicles and underwater moorings are increasing in tactical importance. As such, it is critical to have a robust and secure communication system connecting underwater vehicles on a long seaborne mission and a ground station. As a matter of fact, the deployment of efficient communication links with underwater vehicles is one of the greatest technological challenges presently confronted by the world's naval forces.To circumvent most of the limitations involved in the use of RF or acoustic channels for perfectly secure communications with underwater vehicles, it is worth considering the feasibility of an optical channel to facilitate a two-way satellite communication link secured via perfectly secure ciphers enabled by a quantum key distribution protocol.This book offers a concise review of underwater communications systems. Our approach is pedagogical, making a strong emphasis on the physics behind the attenuating properties of the oceanic environment and the propagation of electromagnetic signals in the ELF, VLF, and optical bands. We assume the reader is familiar with the basic principles of classical electrodynamics and optics.The system design, components, and noise analysis of an underwater optical communications device are discussed in detail. Furthermore, we offer simulations of the performance of the communication system for different types of ocean waters. Our final conclusion is that it appears to be feasible to design and build underwater communications using optical classical and quantum channels secured with quantum key distribution protocols.

Adiabatic quantum computation (AQC) is an alternative to the better-known gate model of quantum computation. The two models are polynomially equivalent, but otherwise quite dissimilar: one property that distinguishes AQC from the gate model is its analog nature. Quantum annealing (QA) describes a type of heuristic search algorithm that can be implemented to run in the ``native instruction set'' of an AQC platform. D-Wave Systems Inc. manufactures {quantum annealing processor chips} that exploit quantum properties to realize QA computations in hardware. The chips form the centerpiece of a novel computing platform designed to solve NP-hard optimization problems. Starting with a 16-qubit prototype announced in 2007, the company has launched and sold increasingly larger models: the 128-qubit D-Wave One system was announced in 2010 and the 512-qubit D-Wave Two system arrived on the scene in 2013. A 1,000-qubit model is expected to be available in 2014. This monograph presents an introductory overview of this unusual and rapidly developing approach to computation. We start with a survey of basic principles of quantum computation and what is known about the AQC model and the QA algorithm paradigm. Next we review the D-Wave technology stack and discuss some challenges to building and using quantum computing systems at a commercial scale. The last chapter reviews some experimental efforts to understand the properties and capabilities of these unusual platforms. The discussion throughout is aimed at an audience of computer scientists with little background in quantum computation or in physics.

Synthetic Aperture Radar Automatic Detection Algorithms (SARADA) for Oil Spills conveys the pivotal tool required to fully comprehend the advanced algorithms in radar monitoring and detection of oil spills, particularly quantum computing and algorithms as a keystone to comprehending theories and algorithms behind radar imaging and detection of marine pollution. Bridging the gap between modern quantum mechanics and computing detection algorithms of oil spills, this book contains precise theories and techniques for automatic identification of oil spills from SAR measurements. Based on modern quantum physics, the book also includes the novel theory on radar imaging mechanism of oil spills. With the use of precise quantum simulation of trajectory movements of oil spills using a sequence of radar images, this book demonstrates the use of SARADA for contamination by oil spills as a promising novel technique. Key Features: Introduces basic concepts of a radar remote sensing. Fills a gap in the knowledge base of quantum theory and microwave remote sensing. Discusses the important aspects of oil spill imaging in radar data in relation to the quantum theory. Provides recent developments and progresses of automatic detection algorithms of oil spill from radar data. Presents 2-D oil spill radar data in 4-D images.

Chapters from a Cosmologist's Life

Quantum Robotics

Learning to Learn

The Geometry of Heisenberg Groups

Foreword by David Kaiser

Sentiment Analysis and Opinion Mining

This book is concerned with the models of quantum computation. Information processing based on the rules of quantum mechanics provides us with new opportunities for developing more efficient algorithms and protocols. However, to harness the power offered by quantum information processing it is essential to control the behavior of quantum mechanical objects in a precise manner. As this seems to be conceptually difficult at the level of quantum states and unitary gates, high-level quantum programming languages have been proposed for this purpose. The aim of this book is to provide an introduction to abstract models of computation used in quantum information theory. Starting from the abstract models of Turing machine and finite automata, we introduce the models of Boolean circuits and Random Access Machine and use them to present quantum programming techniques and quantum programming languages. Table of Contents: Introduction / Turing machines / Quantum Finite State Automata / Computational Circuits / Random Access Machines / Quantum Programming Environment / Quantum Programming Languages / Imperative quantum programming / Functional Quantum Programming / Outlook

MATLAB for Neuroscientists serves as the only complete study manual and teaching resource for MATLAB, the globally accepted standard for scientific computing, in the neurosciences and psychology. This unique introduction can be used to learn the entire empirical and experimental process (including stimulus generation, experimental control, data collection, data analysis, modeling, and more), and the 2nd Edition continues to ensure that a wide variety of computational problems can be addressed in a single programming environment. This updated edition features additional material on the creation of visual stimuli, advanced psychophysics, analysis of LFP data, choice probabilities, synchrony, and advanced spectral analysis. Users at a variety of levels—advanced undergraduates, beginning graduate students, and researchers looking to modernize their skills—will learn to design and implement their own analytical tools, and gain the fluency required to meet the computational needs of neuroscience practitioners. The first complete volume on MATLAB focusing on neuroscience and psychology applications Problem-based approach with many examples from neuroscience and cognitive psychology using real data Illustrated in full color throughout Careful tutorial approach, by authors who are award-winning educators with strong teaching experience

Containing contributions from leading researchers in this field, this book provides a complete overview of this field from the frontiers of theoretical physics research for graduate students and researchers. It introduces the most current approaches to this problem, and reviews their main achievements.

"One of the themes of the book is how to have a fulfilling professional life. In order to achieve this goal, Krantz discusses keeping a vigorous scholarly program going and finding new challenges, as well as dealing with the everyday tasks of research, teaching, and administration." "In short, this is a survival manual for the professional mathematician – both in academics and in industry and government agencies. It is a sequel to the author's A Mathematician's Survival Guide."--BOOK JACKET.

Quantum Photonics: Pioneering Advances and Emerging Applications

System Engineering Analysis, Design, and Development

Quantum Walks for Computer Scientists

Lectures on Quantum Mechanics

A Primer on Current Science and Future Perspectives

Quantum Computing Environments

In this text we present a technical overview of the emerging field of quantum computation along with new research results by the authors. What distinguishes our presentation from that of others is our focus on the relationship between quantum computation and computer science. Specifically, our emphasis is on the computational model of quantum computingrather than on the engineering issues associated with its physical implementation. We adopt this approach for the same reason that a book on computer programming doesn't cover the theory and physical realization of semiconductors. Another distinguishing feature of this text is our detailed discussion of the circuit complexity of quantum algorithms. To the extent possible we have presented the material in a form that is accessible to the computer scientist, but in many cases we retain the conventional physics notation so that the reader will also be able to consult the relevant quantum computing literature. Although we expect the reader to have a solid understanding of linear algebra, we do not assume a background in physics. This text is based on lectures given as short courses and invited presentations around the world, and it has been used as the primary text for a graduatecourse at George Mason University. In all these cases our challenge has been the same: how to present to a generalaudience a concise introduction to the algorithmic structure and applications of quantum computing on an extremely short period of time. The feedback from these courses and presentations has greatly aided in making our exposition of challenging concepts more accessible to a general audience. Table of Contents: Introduction / The Algorithmic Structure of Quantum Computing / Advantages and Limitations of Quantum Computing / Amplitude Amplification / Case Study: Computational Geometry / The Quantum Fourier Transform / Case Study: The Hidden Subgroup / Circuit Complexity Analysis of Quantum Algorithms / Conclusions / Bibliography

Praise for the first edition: “ This excellent text will be useful to everysystem engineer (SE) regardless of the domain. It covers ALLrelevant SE material and does so in a very clear, methodicalfashion. The breadth and depth of the author's presentation ofSE principles and practices is outstanding. ” -Philip Allen This textbook presents a comprehensive, step-by-step guide toSystem Engineering analysis, design, and development via anintegrated set of concepts, principles, practices, andmethodologies. The methods presented in this text apply to any typeof human system -- small, medium, and large organizational systemsand system development projects delivering engineered systems orservices across multiple business sectors such as medical,transportation, financial, educational, governmental, aerospace anddefense, utilities, political, and charity, among others. Provides a common focal point for “ bridgingthe gap ” between and unifying System Users, System Acquirers,multi-discipline System Engineering, and Project, Functional, andExecutive Management education, knowledge, and decision-making fordeveloping systems, products, or services Each chapter provides definitions of key terms,guiding principles, examples, author ’ s notes, real-worldexamples, and exercises, which highlight and reinforce key SE&Dconcepts and practices Addresses concepts employed in Model-BasedSystems Engineering (MBSE), Model-Driven Design (MDD), UnifiedModeling Language (UMLTM) / Systems Modeling Language(SysMLTM), and Agile/Spiral/V-Model Development such asuser needs, stories, and use cases analysis; specificationdevelopment; system architecture development; User-Centric SystemDesign (UCSD); interface definition & control; systemintegration & test; and Verification & Validation(V&V) Highlights/introduces a new 21st Century SystemsEngineering & Development (SE&D) paradigm that is easy tounderstand and implement. Provides practices that are critical stagingpoints for technical decision making such as Technical StrategyDevelopment; Life Cycle requirements; Phases, Modes, & States;SE Process; Requirements Derivation; System ArchitectureDevelopment, User-Centric System Design (UCSD); EngineeringStandards, Coordinate Systems, and Conventions; et al. Thoroughly illustrated, with end-of-chapter exercises andnumerous case studies and examples, Systems EngineeringAnalysis, Design, and Development, Second Edition is a primarytextbook for multi-discipline, engineering, system analysis, andproject management undergraduate/graduate level students and avaluable reference for professionals.

This book explains the evolution of techniques and strategies in quantum computing, discussing the digital transition towards the quantum computing application in various sectors. The book provides a comprehensive insight into the quantum mechanics and quantum computing techniques and tools and how they have evolved and the impacted in supporting and flourishing business during the quantum computing era. This book includes chapters that discuss the most primitive quantum schemes to the most recent use of Internet, finance and radar technology, thus leveraging greater use of new technologies like security and Internet and others. The content is relevant for an audience that is involved in the research and development of advanced quantum systems. It gives the industry, researchers, and students interested in learning the various quantum computing sectors with the necessary information and tools that can be used to research, design and develop advanced quantum computing systems and techniques.

This book presents basic geometric and algebraic properties of the Heisenberg group and its relation to the skew field of quaternions, symplectic structures and representations, and describes some of its applications. It offers a clear exposition of mathematical topics referring to applications in signal theory, physics and information theory. It has relevance for undergraduate and graduate students, a variety of researchers, and specialists in data processing.

With Applications in Signal Theory, Optics, Quantization, and Field Quantization

Quantities, Units and Symbols in Physical Chemistry

An Introduction to Scientific Research

Quantum Computer Science

From Tenure-track to Emeritus

Lectures On Quantum Theory Mathematical And Structural Foundations

Ensemble methods have been called the most influential development in Data Mining and Machine Learning in the past decade. They combine multiple models into one usually more accurate than the best of its components. Ensembles can provide a critical boost to industrial challenges -- from investment timing to drug discovery, and fraud detection to recommendation systems -- where predictive accuracy is more vital than model interpretability. Ensembles are useful with all modeling algorithms, but this book focuses on decision trees to explain them most clearly. After describing trees and their strengths and weaknesses, the authors provide an overview of regularization -- today understood to be a key reason for the superior performance of modern ensembling algorithms. The book continues with a clear description of two recent developments: Importance Sampling (IS) and Rule Ensembles (RE). IS reveals classic ensemble methods -- bagging, random forests, and boosting -- to be special cases of a single algorithm, thereby showing how to improve their accuracy and speed. REs are linear rule models derived from decision tree ensembles. They are the most interpretable version of ensembles, which is essential to applications such as credit scoring and fault diagnosis. Lastly, the authors explain the paradox of how ensembles achieve greater accuracy on new data despite their (apparently much greater) complexity. This book is aimed at novice and advanced analytic researchers and practitioners -- especially in Engineering, Statistics, and Computer Science. Those with little exposure to ensembles will learn why and how to employ this breakthrough method, and advanced practitioners will gain insight into building even more powerful models. Throughout, snippets of code in R are provided to illustrate the algorithms described and to encourage the reader to try the techniques. The authors are industry experts in data mining and machine learning who are also adjunct professors and popular speakers. Although early pioneers in discovering and using ensembles, they here distill and clarify the recent groundbreaking work of leading academics (such as Jerome Friedman) to bring the benefits of ensembles to practitioners. Table of Contents: Ensembles Discovered / Predictive Learning and Decision Trees / Model Complexity, Model Selection and Regularization / Importance Sampling and the Classic Ensemble Methods / Rule Ensembles and Interpretation Statistics / Ensemble Complexity

Exceptionally useful guide to pragmatic scientific method: design of experiments and apparatus, analysis of data, sampling and measurement, numerical computation, much more. Broad applications. References. Illustrations.

This book offers a concise review of quantum radar theory. Our approach is pedagogical, making emphasis on the physics behind the operation of a hypothetical quantum radar. We concentrate our discussion on the two major models proposed to date: interferometric quantum radar and quantum illumination. In addition, this book offers some new results, including an analytical study of quantum interferometry in the X-band radar region with a variety of atmospheric conditions, a derivation of a quantum radar equation, and a discussion of quantum radar jamming. This book assumes the reader is familiar with the basic principles of non-relativistic quantum mechanics, special relativity, and classical electrodynamics. Our discussion of quantum electrodynamics and its application to quantum radar is brief, but all the relevant equations are presented in the text. In addition, the reader is not required to have any specialized knowledge on classical radar theory. Table of Contents: Introduction / The Photon / Photon Scattering / Classical Radar Theory / Quantum Radar Theory / Quantum Radar Cross Section / Conclusions

The first IUPAC Manual of Symbols and Terminology for Physicochemical Quantities and Units (the Green Book) of which this is the direct successor, was published in 1969, with the object of 'securing clarity and precision, and wider agreement in the use of symbols, by chemists in different countries, among physicists, chemists and engineers, and by editors of scientific journals'. Subsequent revisions have taken account of many developments in the field, culminating in the major extension and revision represented by the 1988 edition under the simplified title Quantities, Units and Symbols in Physical Chemistry. This 2007, Third Edition, is a further revision of the material which reflects the experience of the contributors with the previous editions. The book has been systematically brought up to date and new sections have been added. It strives to improve the exchange of scientific information among the readers in different disciplines and across different nations. In a rapidly expanding volume of scientific literature where each discipline has a tendency to retreat into its own jargon this book attempts to provide a readable compilation of widely used terms and symbols from many sources together with brief understandable definitions. This is the definitive guide for scientists and organizations working across a multitude of disciplines requiring internationally approved nomenclature.

Scientific and Technical Aerospace Reports

An Introduction to Scientific Computing in MATLAB

Stochastic Network Optimization with Application to Communication and Queueing Systems

Introduction to the Physics of Gyrotrons

Volume 13

Improving Accuracy Through Combining Predictions

Takes students and researchers on a tour through some of the deepest ideas of maths, computer science and physics.

Semi-supervised learning is a learning paradigm concerned with the study of how computers and natural systems such as humans learn in the presence of both labeled and unlabeled data. Traditionally, learning has been studied either in the unsupervised paradigm (e.g., clustering, outlier detection) where all the data are unlabeled, or in the supervised paradigm (e.g., classification, regression) where all the data are labeled. The goal of semi-supervised learning is to understand how combining labeled and unlabeled data may change the learning behavior, and design algorithms that take advantage of such a combination. Semi-supervised learning is of great interest in machine learning and data mining because it can use readily available unlabeled data to improve supervised learning tasks when the labeled data are scarce or expensive. Semi-supervised learning also shows potential as a quantitative tool to understand human category learning, where most of the input is self-evidently unlabeled. In this introductory book, we present some popular semi-supervised learning models, including self-training, mixture models, co-training and multiview learning, graph-based methods, and semi-supervised support vector machines. For each model, we discuss its basic mathematical formulation. The success of semi-supervised learning depends critically on some underlying assumptions. We emphasize the assumptions made by each model and give counterexamples when appropriate to demonstrate the limitations of the different models. In addition, we discuss semi-supervised learning for cognitive psychology. Finally, we give a computational learning theoretic perspective on semi-supervised learning, and we conclude the book with a brief discussion of open questions in the field. Table of Contents: Introduction to Statistical Machine Learning / Overview of Semi-Supervised Learning / Mixture Models and EM / Co-Training / Graph-Based Semi-Supervised Learning / Semi-Supervised Support Vector Machines / Human Semi-Supervised Learning / Theory and Outlook

It is often said that quantum technologies are poised to change the world as we know it, but cutting through the hype, what will quantum technologies actually mean for countries and their citizens? In Law and Policy for the Quantum Age, Chris Jay Hoofnagle and Simson L. Garfinkel explain the genesis of quantum information science (QIS) and the resulting quantum technologies that are most exciting: quantum sensing, computing, and communication. This groundbreaking, timely text explains how quantum technologies work, how countries will likely employ QIS for future national defense and what the legal landscapes will be for these nations, and how companies might (or might not) profit from the technology. Hoofnagle and Garfinkel argue that the consequences of QIS are so profound that we must begin planning for them today. This title is available as Open Access on Cambridge Core.

Sentiment analysis and opinion mining is the field of study that analyzes people's opinions, sentiments, evaluations, attitudes, and emotions from written language. It is one of the most active research areas in natural language processing and is also widely studied in data mining, Web mining, and text mining. In fact, this research has spread outside of computer science to the management sciences and social sciences due to its importance to business and society as a whole. The growing importance of sentiment analysis coincides with the growth of social media such as reviews, forum discussions, blogs, micro-blogs, Twitter, and social networks. For the first time in human history, we now have a huge volume of opinionated data recorded in digital form for analysis.Sentiment analysis systems are being applied in almost every business and social domain because opinions are central to almost all human activities and are key influencers of our behaviors. Our beliefs and perceptions of reality, and the choices we make, are largely conditioned on how others see and evaluate the world. For this reason, when we need to make a decision we often seek out the opinions of others. This is true not only for individuals but also for organizations.This book is a comprehensive introductory and survey text. It covers all important topics and the latest developments in the field with over 400 references. It is suitable for students, researchers and practitioners who are interested in social media analysis in general and sentiment analysis in particular. Lecturers can readily use it in class for courses on natural language processing, social media analysis, text mining, and data mining. Lecture slides are also available online.Table of Contents: Preface / Sentiment Analysis: A Fascinating Problem / The Problem of Sentiment Analysis / Document Sentiment Classification / Sentence Subjectivity and Sentiment Classification / Aspect-Based Sentiment Analysis / Sentiment Lexicon Generation / Opinion Summarization / Analysis of Comparative Opinions / Opinion Search and Retrieval / Opinion Spam Detection / Quality of Reviews / Concluding Remarks / Bibliography / Author Biography

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