Graphical Models Oxford Statistical Science Series

Gaussian Markov Random Field (GMRF) models are most widely used in spatial statistics - a very active area of research in which few up-to-date reference works are available. This is the first book on the subject that provides a unified framework of GMRFs with particular emphasis on the computational aspects. This book includes extensive case-studie
This book constitutes the refereed proceedings of the 9th European Conference on Symbolic and Quantitative Approaches to Reasoning with Uncertainty, ECSQARU 2007, held in Hammammet, Tunisia, Oktober 31 - November 2, 2007. The 78 revised full papers presented together with 3 invited papers were carefully reviewed and selected from over hundret submissions for inclusion in the book. The papers are organized in topical sections on Bayesian networks, graphical models, learning causal networks, planning, causality and

independence, preference modelling and decision, argumentation systems, inconsistency handling, belief revision and merging, belief functions, fuzzy models, many-valued logical systems, uncertainty logics, probabilistic reasoning, reasoning models under uncertainty, uncertainty measures, probabilistic classifiers, classification and clustering, and industrial applications.

In the past decade, a number of different research communities within the computational sciences have studied learning in networks, starting from a number of different points of view. There has been substantial progress in these different communities and surprising convergence has developed between the formalisms. The awareness of this convergence and the growing interest of researchers in understanding the essential unity of the subject underlies the current volume. Two research communities which have used graphical or network formalisms to particular advantage are the belief network community and the neural network community. Belief

networks arose within computer science and statistics and were developed with an emphasis on prior knowledge and exact probabilistic calculations. Neural networks arose within electrical engineering, physics and neuroscience and have emphasised pattern recognition and systems modelling problems. This volume draws together researchers from these two communities and presents both kinds of networks as instances of a general unified graphical formalism. The book focuses on probabilistic methods for learning and inference in graphical models, algorithm analysis and design, theory and applications. Exact methods, sampling methods and variational methods are discussed in detail. Audience: A wide cross-section of computationally oriented researchers, including computer scientists, statisticians, electrical engineers, physicists and neuroscientists.

The idea of modelling systems using graph theory has its origin in several scientific areas: in statistical physics (the study of large particle systems), in genetics (studying

inheritable properties of natural species), and in interactions in contingency tables. The use of graphical models in statistics has increased considerably over recent years and the theory has been greatly developed and extended. This book provides the first comprehensive and authoritative account of the theory of graphical models and is written by a leading expert in the field. It contains the fundamental graph theory required and a thorough study of Markov properties associated with various type of graphs. The statistical theory of log-linear and graphical models for contingency tables, covariance selection models, and graphical models with mixed discrete-continous variables in developed detail. Special topics, such as the application of graphical models to probabilistic expert systems, are described briefly, and appendices give details of the multivarate normal distribution and of the theory of regular exponential families. The author has recently been awarded the RSS Guy Medal in Silver 1996 for his innovative contributions to statistical

theory and practice, and especially for his work on graphical models.

9th European Conference, ECSQARU 2007, Hammamet, Tunisia, October 31 - November 2, 2007, Proceedings

Bayesian Networks and Influence Diagrams: A Guide to Construction and Analysis

Markov Networks in Evolutionary Computation

Handbook of Defeasible Reasoning and Uncertainty Management Systems

AMS Special Session Algebraic Methods in Statistics and Probability, March 27-29, 2009, University of Illinois at Urbana-Champaign, Champaign, IL

Event History Analysis with R

The ?eld of bioinformatics has two main objectives: the creation and main- nance of biological databases, and the discovery of knowledge from life sciences datainordertounr avelthemysteriesofbiologicalfunction,leadingtonewdrugs andtherapiesforhumandisease.Life sciencesdatacomeinthe formofbiological sequences, structures, pathways, or literature. One major aspect of discovering biological knowledge is to search, predict, or model speci?c information in a given dataset in order to generate new interesting knowledge. Computer science methods such as evolutionary computation, machine learning, and data mining all have a great deal to o?er the ?eld of bioinformatics. The goal of the 7th - ropean Conference on Evolutionary Computation, Machine Learning, and Data

Mining in Bioinformatics (EvoBIO 2009) was to bring together experts in these ?elds in order to discuss new and novel methods for tackling complex biological problems. The 7th EvoBIO conference was held in Tubing ¨ en, Germany during April 15–17, 2009 at the Eberhard-Karls-Universitat ¨ Tu ¨bingen. EvoBIO 2009 was held jointly with the 12th European Conference on Genetic Programming (- roGP 2009), the 9th European Conference on Evolutionary Computation in Combinatorial Optimization (EvoCOP 2009), and the Evo Workshops. C-lectively, the conferences and workshops are organized under the name Evo* (www.evostar.org).

Written by some major contributors to the development of this class of graphical models, Chain Event Graphs introduces a viable and straightforward new tool for statistical inference, model selection and learning techniques. The book extends established technologies used in the study of discrete Bayesian Networks so that they apply in a much more general setting As the first book on Chain Event Graphs, this monograph is expected to become a landmark work on the use of event trees and coloured probability trees in statistics, and to lead to the increased use of such tree models to describe hypotheses about how events might unfold. Features: introduces a new and exciting discrete graphical model based on an event tree focusses on illustrating inferential techniques, making its methodology accessible to a very broad audience and, most importantly, to practitioners illustrated by a wide range of examples, encompassing important present and future applications includes exercises to test comprehension and can easily be used as a course book introduces relevant software packages Rodrigo A. Collazo is a methodological and computational statistician based at the Naval Systems Analysis Centre (CASNAV) in Rio de

Janeiro, Brazil. Christiane Görgen is a mathematical statistician at the Max Planck Institute for Mathematics in the Sciences, Leipzig, Germany. Jim Q. Smith is a professor of statistics at the University of Warwick, UK. He has published widely in the field of statistics, AI, and decision analysis and has written two other books, most recently Bayesian Decision Analysis: Principles and Practice (Cambridge University Press 2010).

The range of Bayesian inference algorithms and their different applications has been greatly expanded since the first implementation of a Kalman filter by Stanley F. Schmidt for the Apollo program. Extended Kalman filters or particle filters are just some examples of these algorithms that have been extensively applied to logistics, medical services, search and rescue operations, or automotive safety, among others. This book takes a look at both theoretical foundations of Bayesian inference and practical implementations in different fields. It is intended as an introductory guide for the application of Bayesian inference in the fields of life sciences, engineering, and economics, as well as a source document of fundamentals for intermediate Bayesian readers.

This volume contains the proceedings of the AMS Special Session on Algebraic and Geometric Methods in Applied Discrete Mathematics, held on January 11, 2015, in San Antonio, Texas. The papers present connections between techniques from “pure” mathematics and various applications amenable to the analysis of discrete models, encompassing applications of combinatorics, topology, algebra, geometry, optimization, and representation theory. Papers not only present novel results, but also survey the current state of knowledge of important topics in applied discrete mathematics. Particular highlights include: a new computational framework, based on

geometric combinatorics, for structure prediction from RNA sequences; a new method for approximating the optimal solution of a sum of squares problem; a survey of recent Helly-type geometric theorems; applications of representation theory to voting theory and game theory; a study of fixed points of tensors; and exponential random graph models from the perspective of algebraic statistics with applications to networks. This volume was written for those trained in areas such as algebra, topology, geometry, and combinatorics who are interested in tackling problems in fields such as biology, the social sciences, data analysis, and optimization. It may be useful not only for experts, but also for students who wish to gain an applied or interdisciplinary perspective.

Chain Event Graphs

Algebraic Methods in Statistics and Probability II

Statistical Machine Learning

A Mathematical Theory of Arguments for Statistical Evidence

Topics in Intersection Graph Theory

Volume II: AI Algorithms

A self-contained introduction to probability, exchangeability and Bayes' rule provides a theoretical understanding of the applied material. Numerous examples with R-code that can be run "as-is" allow the reader to perform the data analyses themselves. The development of Monte Carlo and Markov chain Monte Carlo methods in the context of data analysis examples provides motivation for these

computational methods.

This volume covers a wide range of existing and emerging topics in applied health economics, including behavioural economics, medical care risk, social insurance, discrete choice models, cost-effectiveness analysis, health and immigration, and more.

Probabilistic networks, also known as Bayesian networks and influence diagrams, have become one of the most promising technologies in the area of applied artificial intelligence. This book provides a comprehensive guide for practitioners who wish to understand, construct, and analyze intelligent systems for decision support based on probabilistic networks. Intended primarily for practitioners, this book does not require sophisticated mathematical skills. The theory and methods presented are illustrated through more than 140 examples, and exercises are included for the reader to check his/her level of understanding.

The subject of this book is the reasoning under uncertainty based on sta tistical evidence, where the word

reasoning is taken to mean searching for arguments in favor or against particular hypotheses of interest. The kind of reasoning we are using is composed of two aspects. The first one is inspired from classical reasoning in formal logic, where deductions are made from a knowledge base of observed facts and formulas representing the domain spe cific knowledge. In this book, the facts are the statistical observations and the general knowledge is represented by an instance of a special kind of sta tistical models called functional models. The second aspect deals with the uncertainty under which the formal reasoning takes place. For this aspect, the theory of hints [27] is the appropriate tool. Basically, we assume that some uncertain perturbation takes a specific value and then logically eval uate the consequences of this assumption. The original uncertainty about the perturbation is then transferred to the consequences of the assumption. This kind of reasoning is called assumption-based reasoning. Before going into more details about the content of this book, it might be

interesting to look briefly at the roots and origins of assumption-based reasoning in the statistical context. In 1930, R. A. Fisher [17] defined the notion of fiducial distribution as the result of a new form of argument, as opposed to the result of the older Bayesian argument.

Algebraic and Geometric Methods in Discrete Mathematics

Bioinformatics Research and Development

Artificial Neural Networks - ICANN 2007

Time-Like Graphical Models

New Frontiers in Graph Theory

Algebraic Statistics for Computational Biology

The author studies continuous processes indexed by a special family of graphs. Processes indexed by vertices of graphs are known as probabilistic graphical models. In 2011, Burdzy and Pal proposed a continuous version of graphical models indexed by graphs with an embedded time structure— so-called time-like graphs. The author extends the notion of time-like graphs and finds properties of processes indexed by them. In particular, the author solves the conjecture of uniqueness of the distribution for the process indexed by graphs with infinite number of vertices. The author provides a new result showing the stochastic heat equation as a

limit of the sequence of natural Brownian motions on time-like graphs. In addition, the author's treatment of time-like graphical models reveals connections to Markov random fields, martingales indexed by directed sets and branching Markov processes.

This book is the first of a two-volume set that constitutes the refereed proceedings of the 17th International Conference on Artificial Neural Networks, ICANN 2007, held in Porto, Portugal, September 2007. Coverage includes advances in neural network learning methods, advances in neural network architectures, neural dynamics and complex systems, data analysis, evolutionary computing, agents learning, as well as temporal synchronization and nonlinear dynamics in neural networks.

In order best exploit the incredible quantities of data being generated in most diverse disciplines data sciences increasingly gain worldwide importance. The book gives the mathematical foundations to handle data properly. It introduces basics and functionalities of the R programming language which has become the indispensable tool for data sciences. Thus it delivers the reader the skills needed to build own tool kits of a modern data scientist.

Reasoning under uncertainty is always based on a specified language or for malism, including its particular syntax and semantics, but also on its associated inference mechanism. In the present

volume of the handbook the last aspect, the algorithmic aspects of uncertainty calculi are presented. Theory has suffi ciently advanced to unfold some generally applicable fundamental structures and methods. On the other hand, particular features of specific formalisms and ap proaches to uncertainty of course still influence strongly the computational meth ods to be used. Both general as well as specific methods are included in this volume. Broadly speaking, symbolic or logical approaches to uncertainty and nu merical approaches are often distinguished. Although this distinction is somewhat misleading, it is used as a means to structure the present volume. This is even to some degree reflected in the two first chapters, which treat fundamental, general methods of computation in systems designed to represent uncertainty. It has been noted early by Shenoy and Shafer, that computations in different domains have an underlying common structure. Essentially pieces of knowledge or information are to be combined together and then focused on some particular question or domain. This can be captured in an algebraic structure called valuation algebra which is described in the first chapter. Here the basic operations of combination and focus ing (marginalization) of knowledge and information is modeled abstractly subject to simple axioms.

Second International Conference, BIRD 2008,

Vienna, Austria, July 7-9, 2008 Proceedings
A Unified Framework
Graphical Tools for the Exploration of Multivariate Categorical Data
17th International Conference, Boston, MA, USA, September 14-18, 2014, Proceedings, Part III
Mathematical Foundations of Data Science Using R
Symbolic and Quantitative Approaches to Reasoning with Uncertainty

The recent rapid growth in the variety and complexity of new machine learning architectures requires the development of improved methods for designing, analyzing, evaluating, and communicating machine learning technologies. Statistical Machine Learning: A Unified Framework provides students, engineers, and scientists with tools from mathematical statistics and nonlinear optimization theory to become experts in the field of machine learning. In particular, the material in this text directly supports the mathematical analysis and design of old, new, and not-yet-invented nonlinear high-dimensional machine learning algorithms. Features: Unified empirical risk minimization framework supports rigorous mathematical analyses of widely used supervised, unsupervised, and reinforcement machine learning algorithms Matrix calculus methods for supporting machine learning analysis and design applications Explicit

conditions for ensuring convergence of adaptive, batch, minibatch, MCEM, and MCMC learning algorithms that minimize both unimodal and multimodal objective functions Explicit conditions for characterizing asymptotic properties of M-estimators and model selection criteria such as AIC and BIC in the presence of possible model misspecification This advanced text is suitable for graduate students or highly motivated undergraduate students in statistics, computer science, electrical engineering, and applied mathematics. The text is self-contained and only assumes knowledge of lower-division linear algebra and upper-division probability theory. Students, professional engineers, and multidisciplinary scientists possessing these minimal prerequisites will find this text challenging yet accessible. About the Author: Richard M. Golden (Ph.D., M.S.E.E., B.S.E.E.) is Professor of Cognitive Science and Participating Faculty Member in Electrical Engineering at the University of Texas at Dallas. Dr. Golden has published articles and given talks at scientific conferences on a wide range of topics in the fields of both statistics and machine learning over the past three decades. His long-term research interests include identifying conditions for the convergence of deterministic and stochastic machine learning algorithms and investigating estimation and inference in the presence of possibly

misspecified probability models.

With an emphasis on social science applications, Event History Analysis with R, Second Edition, presents an introduction to survival and event history analysis using real-life examples. Since publication of the first edition, focus in the field has gradually shifted towards the analysis of large and complex datasets. This has led to new ways of tabulating and analysing tabulated data with the same precision and power as that of an analysis of the full data set. Tabulation also makes it possible to share sensitive data with others without violating integrity. The new edition extends on the content of the first by both improving on already given methods and introducing new methods. There are two new chapters, Explanatory Variables and Regression, and Register- Based Survival Data Models. The book has been restructured to improve the flow, and there are significant updates to the computing in the supporting R package. Features • Introduction to survival and event history analysis and how to solve problems with incomplete data using Cox regression. • Parametric proportional hazards models, including the Weibull, Exponential, Extreme Value, and Gompertz distributions. • Parametric accelerated failure time models with the Lognormal, Loglogistic, Gompertz, Exponential, Extreme Value, and Weibull distributions. • Proportional hazards models for

occurrence/exposure data, useful with tabular and register based data, often with a huge amount of observed events. • Special treatments of external communal covariates, selections from the Lexis diagram, and creating period as well as cohort statistics. • " Weird bootstrap " sampling suitable for Cox regression with small to medium-sized data sets. • Supported by an R package (https://CRAN.R-project.org/package=eha), including code and data for most examples in the book. • A dedicated home page for the book at http://ehar.se/r/ehar2 This substantial update to this popular book remains an excellent resource for researchers and practitioners of applied event history analysis and survival analysis. It can be used as a text for a course for graduate students or for self-study.

Graphical models in their modern form have been around since the late 1970s and appear today in many areas of the sciences. Along with the ongoing developments of graphical models, a number of different graphical modeling software programs have been written over the years. In recent years many of these software developments have taken place within the R community, either in the form of new packages or by providing an R interface to existing software. This book attempts to give the reader a gentle introduction to graphical modeling using R and the main features of some of these packages. In addition, the book provides examples

of how more advanced aspects of graphical modeling can be represented and handled within R. Topics covered in the seven chapters include graphical models for contingency tables, Gaussian and mixed graphical models, Bayesian networks and modeling high dimensional data.

Markov networks and other probabilistic graphical modes have recently received an upsurge in attention from Evolutionary computation community, particularly in the area of Estimation of distribution algorithms (EDAs). EDAs have arisen as one of the most successful experiences in the application of machine learning methods in optimization, mainly due to their efficiency to solve complex real-world optimization problems and their suitability for theoretical analysis. This book focuses on the different steps involved in the conception, implementation and application of EDAs that use Markov networks, and undirected models in general. It can serve as a general introduction to EDAs but covers also an important current void in the study of these algorithms by explaining the specificities and benefits of modeling optimization problems by means of undirected probabilistic models. All major developments to date in the progressive introduction of Markov networks based EDAs are reviewed in the book. Hot current research trends and future perspectives in the enhancement and applicability of EDAs are also covered. The

contributions included in the book address topics as relevant as the application of probabilistic-based fitness models, the use of belief propagation algorithms in EDAs and the application of Markov network based EDAs to real-world optimization problems. The book should be of interest to researchers and practitioners from areas such as optimization, evolutionary computation, and machine learning.

CONCUR 2003 - Concurrency Theory

23rd Canadian Conference on Artificial Intelligence, Canadian AI 2010, Ottawa, Canada, May 31 - June 2, 2010, Proceedings

7th European Conference, EvoBIO 2009 Tübingen, Germany, April 15-17, 2009 Proceedings

Spatial Statistics: Methodological Aspects and Applications

Medical Image Computing and Computer-Assisted Intervention - MICCAI 2014

A Guided Tour of Artificial Intelligence Research

This volume is based on lectures presented at the AMS Special Session on Algebraic Methods in Statistics and Probability--held March 27–29, 2009, at the University of Illinois at Urbana-Champaign--and on contributed articles solicited for this volume. A decade after the publication of Contemporary Mathematics Vol. 287, the present volume

demonstrates the consolidation of important areas, such as algebraic statistics, computational commutative algebra, and deeper aspects of graphical models. In statistics, this volume includes, among others, new results and applications in cubic regression models for mixture experiments, multidimensional Fourier regression experiments, polynomial characterizations of weakly invariant designs, toric and mixture models for the diagonal-effect in two-way contingency tables, topological methods for multivariate statistics, structural results for the Dirichlet distributions, inequalities for partial regression coefficients, graphical models for binary random variables, conditional independence and its relation to sub-determinants covariance matrices, connectivity of binary tables, kernel smoothing methods for partially ranked data, Fourier analysis over the dihedral groups, properties of square non-symmetric matrices, and Wishart distributions over symmetric cones. In probability, this volume includes new results related to discrete-time semi Markov processes, weak convergence of convolution products in semigroups, Markov bases for directed random graph models, functional analysis

in Hardy spaces, and the Hewitt-Savage zero-one law. Table of Contents: S. A. Andersson and T. Klein -- Kiefer-complete classes of designs for cubic mixture models; V. S. Barbu and N. Limnios -- Some algebraic methods in semi-Markov chains; R. A. Bates, H. Maruri-Aguilar, E. Riccomagno, R. Schwabe, and H. P. Wynn -- Self-avoiding generating sequences for Fourier lattice designs; F. Bertrand -- Weakly invariant designs, rotatable designs and polynomial designs; C. Bocci, E. Carlini, and F. Rapallo -- Geometry of diagonal-effect models for contingency tables; P. Bubenik, G. Carlsson, P. T. Kim, and Z.-M. Luo -- Statistical topology via Morse theory persistence and nonparametric estimation; G. Budzban and G. Hognas -- Convolution products of probability measures on a compact semigroup with applications to random measures; S. Chakraborty and A. Mukherjea -- Completely simple semigroups of real $d\times d$ matrices and recurrent random walks; W.-Y. Chang, R. D. Gupta, and D. S. P. Richards -- Structural properties of the generalized Dirichlet distributions; S. Chaudhuri and G. L. Tan -- On qualitative comparison of partial regression coefficients for Gaussian graphical Markov models; M. A. Cueto, J.

Morton, and B. Sturmfels -- Geometry of the restricted Boltzmann machine; M. Drton and H. Xiao -- Smoothness of Gaussian conditional independence models; W. Ehm -- Projections on invariant subspaces; S. M. Evans -- A zero-one law for linear transformations of Levy noise; H. Hara and A. Takemura -- Connecting tables with zero-one entries by a subset of a Markov basis; K. Khare and B. Rajaratnam -- Covariance trees and Wishart distributions on cones; P. Kidwell and G. Lebanon -- A kernel smoothing approach to censored preference data; M. S. Massa and S. L. Lauritzen -- Combining statistical models; S. Petrovi?, A. Rinaldo, and S. E. Fienberg -- Algebraic statistics for a directed random graph model with reciprocation; G. Pistone and M. P. Rogantin -- Regular fractions and indicator polynomials; M. A. G. Viana -- Dihedral Fourier analysis; T. von Rosen and D. Von Rosen -- On a class of singular nonsymmetric matrices with nonnegative integer spectra; A. S. Yasamin -- Some hypothesis tests for Wishart models on symmetric cones. (CONM/516)

The three-volume set LNCS 8673, 8674, and 8675 constitutes the refereed proceedings of the 17th International Conference on Medical Image Computing and Computer-Assisted Intervention, MICCAI 2014, held

in Boston, MA, USA, in September 2014. Based on rigorous peer reviews, the program committee carefully selected 253 revised papers from 862 submissions for presentation in three volumes. The 53 papers included in the third volume have been organized in the following topical sections: shape and population analysis; brain; diffusion MRI; and machine learning.

As chapters in this book demonstrate, BNP has important uses in clinical sciences and inference for issues like unknown partitions in genomics. Nonparametric Bayesian approaches (BNP) play an ever expanding role in biostatistical inference from use in proteomics to clinical trials. Many research problems involve an abundance of data and require flexible and complex probability models beyond the traditional parametric approaches. As this book's expert contributors show, BNP approaches can be the answer. Survival Analysis, in particular survival regression, has traditionally used BNP, but BNP's potential is now very broad. This applies to important tasks like arrangement of patients into clinically meaningful subpopulations and segmenting the genome into functionally distinct regions. This book is designed to both

review and introduce application areas for BNP. While existing books provide theoretical foundations, this book connects theory to practice through engaging examples and research questions. Chapters cover: clinical trials, spatial inference, proteomics, genomics, clustering, survival analysis and ROC curve.

Bayesian networks currently provide one of the most rapidly growing areas of research in computer science and statistics. In compiling this volume we have brought together contributions from some of the most prestigious researchers in this field. Each of the twelve chapters is self-contained. Both theoreticians and application scientists/engineers in the broad area of artificial intelligence will find this volume valuable. It also provides a useful sourcebook for Graduate students since it shows the direction of current research.

A Dialogue with the Social Sciences

Graphical Models with R

Gaussian Markov Random Fields

Theory and Applications

17th International Conference, Porto, Portugal, September 9-13, 2007, Proceedings, Part I

Learning in Graphical Models

Assembling a collection of very prominent researchers in the field, the Handbook of Spatial Statistics presents a comprehensive treatment of both classical and state-of-the-art aspects of this maturing area. It takes a unified, integrated approach to the material, providing cross-references among chapters.The handbook begins with a historical intro

Praise for the first edition: "[This book] succeeds singularly at providing a structured introduction to this active field of research. ... it is arguably the most accessible overview yet published of the mathematical ideas and principles that one needs to master to enter the field of high-dimensional statistics. ... recommended to anyone interested in the main results of current research in high-dimensional statistics as well as anyone interested in acquiring the core mathematical skills to enter this area of research." —Journal of the American Statistical Association Introduction to High-Dimensional Statistics, Second Edition preserves the philosophy of the first edition: to be a concise guide for students and researchers discovering the area and interested in the mathematics involved. The main concepts and ideas are presented in simple settings, avoiding thereby unessential

technicalities. High-dimensional statistics is a fast-evolving field, and much progress has been made on a large variety of topics, providing new insights and methods. Offering a succinct presentation of the mathematical foundations of high-dimensional statistics, this new edition: Offers revised chapters from the previous edition, with the inclusion of many additional materials on some important topics, including compress sensing, estimation with convex constraints, the slope estimator, simultaneously low-rank and row-sparse linear regression, or aggregation of a continuous set of estimators. Introduces three new chapters on iterative algorithms, clustering, and minimax lower bounds. Provides enhanced appendices, minimax lower-bounds mainly with the addition of the Davis-Kahan perturbation bound and of two simple versions of the Hanson-Wright concentration inequality. Covers cutting-edge statistical methods including model selection, sparsity and the Lasso, iterative hard thresholding, aggregation, support vector machines, and learning theory. Provides detailed exercises at the end of every chapter with collaborative solutions on a wiki site. Illustrates concepts with simple but clear practical examples.

This book, first published in 2005, offers an introduction to the application of algebraic statistics to computational biology.
Finally there is a book that presents real applications of graph theory in a unified format. This book is the only source for an extended, concentrated focus on the theory and techniques common to various types of intersection graphs. It is a concise treatment of the aspects of intersection graphs that interconnect many standard concepts and form the foundation of a surprising array of applications to biology, computing, psychology, matrices, and statistics.
Introduction to High-Dimensional Statistics
Bilinear Regression Analysis
Handbook of Graphical Models
Statistical Models and Causal Inference
Graphical Models
Applied Quantum Cryptography

David A. Freedman presents a definitive synthesis of his approach to statistical modeling and causal inference in the social sciences.

This book constitutes the refereed proceedings of the 23rd Conference on Artificial Intelligence, Canadian AI 2010, held in Ottawa, Canada, in May/June 2010. The 22 revised full papers presented together with 26 revised short papers, 12 papers from the graduate student symposium and the abstracts of 3 keynote presentations were carefully reviewed and selected from 90 submissions. The papers are organized

in topical sections on text classification; text summarization and IR; reasoning and e-commerce; probabilistic machine learning; neural networks and swarm optimization; machine learning and data mining; natural language processing; text analytics; reasoning and planning; e-commerce; semantic web; machine learning; and data mining.

This book expands on the classical statistical multivariate analysis theory by focusing on bilinear regression models, a class of models comprising the classical growth curve model and its extensions. In order to analyze the bilinear regression models in an interpretable way, concepts from linear models are extended and applied to tensor spaces. Further, the book considers decompositions of tensor products into natural subspaces, and addresses maximum likelihood estimation, residual analysis, influential observation analysis and testing hypotheses, where properties of estimators such as moments, asymptotic distributions or approximations of distributions are also studied. Throughout the text, examples and several analyzed data sets illustrate the different approaches, and fresh insights into classical multivariate analysis are provided. This monograph is of interest to researchers and Ph.D. students in mathematical statistics, signal processing and other fields where statistical multivariate analysis is utilized. It can also be used as a text for second graduate-level courses on multivariate analysis.

The purpose of this book is to provide an overview of AI research, ranging from basic work to interfaces and applications, with as much emphasis on results as on current issues. It is aimed at an audience of master students and Ph.D. students, and can be of interest as well for researchers and engineers who want to know more about AI. The book is split into three volumes: - the first volume brings together twenty-three chapters dealing with the foundations of knowledge representation and the formalization of reasoning

and learning (Volume 1. Knowledge representation, reasoning and learning) - the second volume offers a view of AI, in fourteen chapters, from the side of the algorithms (Volume 2. AI Algorithms) - the third volume, composed of sixteen chapters, describes the main interfaces and applications of AI (Volume 3. Interfaces and applications of AI). This second volume presents the main families of algorithms developed or used in AI to learn, to infer, to decide. Generic approaches to problem solving are presented: ordered heuristic search, as well as metaheuristics are considered. Algorithms for processing logic-based representations of various types (first-order formulae, propositional formulae, logic programs, etc.) and graphical models of various types (standard constraint networks, valued ones, Bayes nets, Markov random fields, etc.) are presented. The volume also focuses on algorithms which have been developed to simulate specific 'intelligent" processes such as planning, playing, learning, and extracting knowledge from data. Finally, an afterword draws a parallel between algorithmic problems in operation research and in AI.

Innovations in Bayesian Networks

Algorithms for Uncertainty and Defeasible Reasoning

An Introduction

Handbook of Spatial Statistics

Health Econometrics

A First Course in Bayesian Statistical Methods

A graphical model is a statistical model that is represented by a graph. The factorization properties underlying graphical models facilitate tractable computation with multivariate distributions, making the models a valuable tool with a plethora of applications. Furthermore, directed

graphical models allow intuitive causal interpretations and have become a cornerstone for causal inference. While there exist a number of excellent books on graphical models, the field has grown so much that individual authors can hardly cover its entire scope. Moreover, the field is interdisciplinary by nature. Through chapters by leading researchers from different areas, this handbook provides a broad and accessible overview of the state of the art. Key features: * Contributions by leading researchers from a range of disciplines * Structured in five parts, covering foundations, computational aspects, statistical inference, causal inference, and applications * Balanced coverage of concepts, theory, methods, examples, and applications * Chapters can be read mostly independently, while cross-references highlight connections The handbook is targeted at a wide audience, including graduate students, applied researchers, and experts in graphical models.

This volume contains presentations by eminent researchers: Statistical Inference for Spatial Processes; Image Analysis; Applications of Spatial Statistics in Earth, Environmental, and Health Sciences; and Statistics of Brain Mapping. They range

from asymptotic considerations for spatial processes to practical considerations related to particular applications including important methodological aspects. Many contributions concern image analysis, mainly images related to brain mapping. Nowadays, graph theory is an important analysis tool in mathematics and computer science. Because of the inherent simplicity of graph theory, it can be used to model many different physical and abstract systems such as transportation and communication networks, models for business administration, political science, and psychology and so on. The purpose of this book is not only to present the latest state and development tendencies of graph theory, but to bring the reader far enough along the way to enable him to embark on the research problems of his own. Taking into account the large amount of knowledge about graph theory and practice presented in the book, it has two major parts: theoretical researches and applications. The book is also intended for both graduate and postgraduate students in fields such as mathematics, computer science, system sciences, biology, engineering, cybernetics, and social sciences, and as a reference for software professionals and practitioners. This volume contains the papers which were

selected for presentation at the second Bio-formatics Research and Development (BIRD) conference held in Vienna, Austria during July 7–9, 2008. BIRD covers a wide range of topics related to bioinformatics. This year sequence analysis and alignment, pathways, networks, systems biology, protein and RNA structure and function, gene expression/regulation and microarrays, databases and data integration, machine learning and data analysis were the subjects of main interest. The decisions of the Program Committee are based on the recommendations of at least three, up to five, reviews for each paper. As a result, 30 of the 61 submitted c- tributions could be accepted for the conference. We were happy to have three invited talks presented by experienced researchers providing visitors with a good overview but also some very important insights into the fascinating domain of bioinformatics. Abstracts and more information on these talks are provided in the conference program as well as at the conference site. In the second part of this volume the selected contributions of the two workshops which were held in parallel to the main conference are presented: Workshop on - namical Aspects of Perturbation, Intervention and Transition in Biological Systems – PETRIN

2008 and Workshop on Algorithms in Molecular Biology – ALBIO 2008 Poster presentations of the BIRD conference are in the companion proceedings published by the Trauner Verlag, Linz.

Bayesian Inference

Nonparametric Bayesian Inference in Biostatistics

14th International Conference, Marseille, France, September 3-5, 2003, Proceedings

Evolutionary Computation, Machine Learning and Data Mining in Bioinformatics

Advances in Artificial Intelligence

Using the quantum properties of single photons to exchange binary keys between two partners for subsequent encryption of secret data is an absolutely novel te- nology. Only a few years ago quantum cryptography – or better Quantum Key Distribution – was the domain of basic research laboratories at universities. But during the last few years things changed. Quantum Key Distribution or QKD left the laboratories and was picked up by more practical-oriented teams that worked hard to develop a practically applicable technology out of the astonishing results of basic research. One major milestone toward a QKD technology was a large research and dev- opment project funded by the European Commission that aimed at combining qu- tum physics with complementary technologies that are necessary to create a tech- cal solution: electronics, software, and network components were added within the project SECOQC (Development of a Global Network for Secure Communication based on Quantum Cryptography) that teamed up all expertise on European level to get a technology for future cryptography.

This book constitutes the refereed proceedings of the 14th

International Conference on Concurrency Theory, CONCUR 2003, held in Marseille, France in September 2003. The 29 revised full papers presented together with 4 invited papers were carefully reviewed and selected from 107 submissions. The papers are organized in topical sections on partial orders and asynchronous systems, process algebras, games, infinite systems, probabilistic automata, model checking, model checking and HMSC, security, mobility, compositional methods and real time, and probabilistic models.