

10 Challenging Problems in Data Mining Research

prepared for ICDM 2005

1. Developing a Unifying Theory of Data Mining

- ☐ The current state of the art of data-mining research is too “ad-hoc”
 - techniques are designed for individual problems
 - no unifying theory
- ☐ Needs unifying research
 - Exploration vs explanation
- ☐ Long standing theoretical issues
 - How to avoid spurious correlations?
- ☐ Deep research
 - Knowledge discovery on hidden causes?
 - Similar to discovery of Newton's Law?

An Example (from Tutorial Slides by [Andrew Moore](#)):

- ☐ VC dimension. If you've got a learning algorithm in one hand and a dataset in the other hand, to what extent can you decide whether the learning algorithm is in danger of overfitting or underfitting?
 - formal analysis into the fascinating question of how overfitting can happen,
 - estimating how well an algorithm will perform on future data that is solely based on its training set error,
 - a property (VC dimension) of the learning algorithm. VC-dimension thus gives an alternative to cross-validation, called Structural Risk Minimization (SRM), for choosing classifiers.
 - CV, SRM, AIC and BIC.

2. Scaling Up for High Dimensional Data and High Speed Streams

- ☐ Scaling up is needed
 - ultra-high dimensional classification problems (millions or billions of features, e.g., bio data)
 - Ultra-high speed data streams

10 Challenging Problems In Data Mining Research

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10 Challenging Problems In Data Mining Research:

The Top Ten Algorithms in Data Mining Xindong Wu, Vipin Kumar, 2009-04-09 Identifying some of the most influential algorithms that are widely used in the data mining community The Top Ten Algorithms in Data Mining provides a description of each algorithm discusses its impact and reviews current and future research Thoroughly evaluated by independent reviewers each chapter focuses on a particular algorithm and is written by either the original authors of the algorithm or world class researchers who have extensively studied the respective algorithm The book concentrates on the following important algorithms C4 5 k Means SVM Apriori EM PageRank AdaBoost kNN Naive Bayes and CART Examples illustrate how each algorithm works and highlight its overall performance in a real world application The text covers key topics including classification clustering statistical learning association analysis and link mining in data mining research and development as well as in data mining machine learning and artificial intelligence courses By naming the leading algorithms in this field this book encourages the use of data mining techniques in a broader realm of real world applications It should inspire more data mining researchers to further explore the impact and novel research issues of these algorithms

Foundations of Intelligent Systems Aijun An, Stan Matwin, Zbigniew W Ras, Dominik Slezak, 2008-05-08 This volume contains the papers selected for presentation at the 17th International Symposium on Methodologies for Intelligent Systems ISMIS 2008 held in York University Toronto Canada May 21 23 2008 ISMIS is a conference series started in 1986 Held twice every three years ISMIS provides an international forum for exchanging scientific research and technological achievements in building intelligent systems Its goal is to achieve a vibrant interchange between researchers and practitioners on fundamental and advanced issues related to intelligent systems ISMIS 2008 featured a selection of latest research work and applications from the following areas related to intelligent systems active media human computer interaction autonomic and evolutionary computation digital libraries intelligent agent technology intelligent information retrieval intelligent information systems intelligent language processing knowledge representation and integration knowledge discovery and data mining knowledge visualization logic for artificial intelligence soft computing Web intelligence and Web services searchers and developers from 29 countries submitted more than 100 full papers to the conference Each paper was rigorously reviewed by three committee members and external reviewers Out of these submissions 40% were selected as regular papers and 22% as short papers ISMIS 2008 also featured three plenary talks given by John Mylopoulos Jiawei Han and Michael Lowry They spoke on their recent research in age oriented software engineering information network mining and intelligent software engineering tools respectively

Intelligent Systems and Smart Infrastructure Brijesh Mishra, Rakesh Kumar Singh, Subodh Wairya, Manish Tiwari, 2023-02-16 This book covers the proceedings of ICISSI 2022 International Conference on Intelligent Systems and Smart Infrastructure held at Prayagraj Uttar Pradesh during April 21 22 2022 The conference was jointly organised by Shambhunath Institute of Engineering and Technology Prayagraj UP India Institute of Engineering and

Technology IET Lucknow U P India and Manipal University Jaipur Rajasthan India with an aim to provide a platform for researchers scientists technocrats academicians and engineers to exchange their innovative ideas and new challenges being faced in the field of emerging technologies The papers presented in the conference have been compiled in form of chapters to focus on the core technological developments in the emerging fields like machine learning intelligence systems smart infrastructure advanced power technology etc Advances in Computing and Information Technology Natarajan Meghanathan,Dhinaharan Nagamalai,Nabendu Chaki,2012-06-30 The international conference on Advances in Computing and Information technology ACITY 2012 provides an excellent international forum for both academics and professionals for sharing knowledge and results in theory methodology and applications of Computer Science and Information Technology The Second International Conference on Advances in Computing and Information technology ACITY 2012 held in Chennai India during July 13 15 2012 covered a number of topics in all major fields of Computer Science and Information Technology including networking and communications network security and applications web and internet computing ubiquitous computing algorithms bioinformatics digital image processing and pattern recognition artificial intelligence soft computing and applications Upon a strength review process a number of high quality presenting not only innovative ideas but also a founded evaluation and a strong argumentation of the same were selected and collected in the present proceedings that is composed of three different volumes *Recent Advances in Artificial Intelligence and Smart Applications* Jyotsna K. Mandal,Mike Hinchey,Satyajit Chakrabarti,2025-10-01 This book includes original unpublished contributions presented in the Second International Conference on Recent Advances in Artificial Intelligence and Smart Applications RAAISA 2024 organized by the Department of CSE University of Engineering and Management Kolkata India during December 14 15 2024 The topics covered are progression of artificial intelligence techniques like smart agent based systems human computer interaction technologies reinforcement learning sentiment analysis recurrent neural networks and its applications genetic algorithms and neural networks Modeling Decisions for Artificial Intelligence Vicenç Torra,Yasuo Narukawa,Guillermo Navarro-Arribas,Cristina Yañez,2016-09-12 This book constitutes the proceedings of the 13th International Conference on Modeling Decisions for Artificial Intelligence MDAI 2016 held in Sant Juli de L ria Andorra in September 2016 The 22 revised full papers presented together with three invited talks were carefully reviewed and selected from 36 submissions Providing a forum for researchers to discuss models for decision and information fusion aggregation operators and their applications to AI the papers address topics such as decision making information fusion social networks data mining and related subjects Applications to data science and privacy technologies as well as to real world problems are also discussed Proceedings of International Conference on Computational Intelligence and Data Engineering Nabendu Chaki,Jerzy Pejas,Nagaraju Devarakonda,Ram Mohan Rao Kovvur,2020-12-20 This book is a collection of high quality research work on cutting edge technologies and the most happening areas of computational intelligence and data engineering It includes selected papers

from the International Conference on Computational Intelligence and Data Engineering ICCIDE 2020 It covers various topics including collective intelligence intelligent transportation systems fuzzy systems Bayesian network ant colony optimization data privacy and security data mining data warehousing big data analytics cloud computing natural language processing swarm intelligence and speech processing

Foundations of Intelligent Systems Marzena Kryszkiewics, Henryk Rybinski, Andrzej Skowron, Zbigniew W. Raś, 2011-06-24 This book constitutes the refereed proceedings of the 19th International Symposium on Methodologies for Intelligent Systems ISMIS 2011 held in Warsaw Poland in June 2011 The 71 revised papers presented together with 3 invited papers were carefully reviewed and selected from 131 submissions The papers are organized in topical sections on rough sets in memoriam Zdzisław Pawlik challenges in knowledge discovery and data mining in memoriam Jan Ytkov social networks multi agent systems theoretical backgrounds of AI machine learning data mining mining in databases and warehouses text mining theoretical issues and applications of intelligent web application of intelligent systems in sound processing intelligent applications in biology and medicine fuzzy sets theory and applications intelligent systems tools and applications and contest on music information retrieval

Transactions of Computational Collective Intelligence IV Ngoc-Thanh Nguyen, 2011-06-18 These Transactions publish research in computer based methods of computational collective intelligence CCI and their applications in a wide range of fields such as the Semantic Web social networks and multi agent systems TCCI strives to cover new methodological theoretical and practical aspects of CCI understood as the form of intelligence that emerges from the collaboration and competition of many individuals artificial and or natural The application of multiple computational intelligence technologies such as fuzzy systems evolutionary computation neural systems consensus theory etc aims to support human and other collective intelligence and to create new forms of CCI in natural and or artificial systems This fourth issue contains a collection of 6 articles selected from high quality submissions The first paper of Ireneusz Czarnowski entitled Distributed Learning with Data Reduction consists of 120 pages and has a monograph character The second part consists of five regular papers addressing advances in the foundations and applications of computational collective intelligence

Integration Challenges for Analytics, Business Intelligence, and Data Mining Azevedo, Ana, Santos, Manuel Filipe, 2020-12-11 As technology continues to advance it is critical for businesses to implement systems that can support the transformation of data into information that is crucial for the success of the company Without the integration of data both structured and unstructured mining in business intelligence systems invaluable knowledge is lost However there are currently many different models and approaches that must be explored to determine the best method of integration Integration Challenges for Analytics Business Intelligence and Data Mining is a relevant academic book that provides empirical research findings on increasing the understanding of using data mining in the context of business intelligence and analytics systems Covering topics that include big data artificial intelligence and decision making this book is an ideal reference source for professionals working in the areas of data mining business intelligence and

analytics data scientists IT specialists managers researchers academicians practitioners and graduate students *Discovery Science* Johannes Fürnkranz, Eyke Hüllermeier, Tomoyuki Higuchi, 2013-09-30 This book constitutes the proceedings of the 16th International Conference on Discovery Science DS 2013 held in Singapore in October 2013 and co located with the International Conference on Algorithmic Learning Theory ALT 2013 The 23 papers presented in this volume were carefully reviewed and selected from 52 submissions They cover recent advances in the development and analysis of methods of automatic scientific knowledge discovery machine learning intelligent data analysis and their application to knowledge discovery **Knowledge Science, Engineering and Management** Hui Xiong, W.B. Lee, 2012-02-24 This book constitutes the proceedings of the 5th International Conference on Knowledge Science Engineering and Management KSEM 2011 held in Irvine CA USA in December 2011 The 34 revised full papers presented together with 7 short papers were carefully reviewed and selected from numerous submissions **Knowledge and Systems Engineering** Van Nam Huynh, Thierry Denoeux, Dang Hung Tran, Anh Cuong Le, Son Bao Pham, 2013-10-01 The field of Knowledge and Systems Engineering KSE has experienced rapid development and inspired many applications in the world of information technology during the last decade The KSE conference aims at providing an open international forum for presentation discussion and exchange of the latest advances and challenges in research of the field These proceedings contain papers presented at the Fifth International Conference on Knowledge and Systems Engineering KSE 2013 which was held in Hanoi Vietnam during 17 19 October 2013 Besides the main track of contributed papers which are compiled into the first volume the conference also featured several special sessions focusing on specific topics of interest as well as included one workshop of which the papers form the second volume of these proceedings The book gathers a total of 68 papers describing recent advances and development on various topics including knowledge discovery and data mining natural language processing expert systems intelligent decision making computational biology computational modeling optimization algorithms and industrial applications

Observational Calculi and Association Rules Jan Rauch, 2012-12-25 Observational calculi were introduced in the 1960 s as a tool of logic of discovery Formulas of observational calculi correspond to assertions on analysed data Truthfulness of suitable assertions can lead to acceptance of new scientific hypotheses The general goal was to automate the process of discovery of scientific knowledge using mathematical logic and statistics The GUHA method for producing true formulas of observational calculi relevant to the given problem of scientific discovery was developed Theoretically interesting and practically important results on observational calculi were achieved Special attention was paid to formulas couples of Boolean attributes derived from columns of the analysed data matrix Association rules introduced in the 1990 s can be seen as a special case of such formulas New results on logical calculi and association rules were achieved They can be seen as a logic of association rules This can contribute to solving contemporary challenging problems of data mining research and practice The book covers thoroughly the logic of association rules and puts it into the context of current research in data

mining Examples of applications of theoretical results to real problems are presented New open problems and challenges are listed Overall the book is a valuable source of information for researchers as well as for teachers and students interested in data mining

IOT with Smart Systems Jyoti Choudrie,Parikshit N. Mahalle,Thinagaran Perumal,Amit Joshi,2023-08-30 This book gathers papers addressing state of the art research in all areas of information and communication technologies and their applications in intelligent computing cloud storage data mining and software analysis It presents the outcomes of the Seventh International Conference on Information and Communication Technology for Intelligent Systems ICTIS 2023 held in Ahmedabad India The book is divided into two volumes It discusses the fundamentals of various data analysis techniques and algorithms making it a valuable resource for researchers and practitioners alike

Proceedings of Seventh International Conference on Bio-Inspired Computing: Theories and Applications (BIC-TA 2012) Jagdish C. Bansal,Pramod Kumar Singh,Kusum Deep,Millie Pant,Atulya K. Nagar,2012-12-04 The book is a collection of high quality peer reviewed research papers presented in Seventh International Conference on Bio Inspired Computing BIC TA 2012 held at ABV IITM Gwalior India These research papers provide the latest developments in the broad area of Computational Intelligence The book discusses wide variety of industrial engineering and scientific applications of nature bio inspired computing and presents invited papers from the inventors originators of novel computational techniques

Business Intelligence and Information Technology Aboul Ella Hassanien,Dequan Zheng,Zhijie Zhao,Zhipeng Fan,2024-08-29 This book constitutes the refereed proceedings of the 2023 International Conference on Business Intelligence and Information Technology BIIT 2023 held in Harbin China during December 16 17 2023 BIIT 2023 is organized by the School of Computer and Information Engineering Harbin University of Commerce and supported by Scientific Research Group in Egypt SRGE Egypt The papers cover current research in electronic commerce technology and application business intelligence and decision making digital economy accounting informatization intelligent information processing image processing and multimedia technology signal detection and processing communication engineering and technology information security automatic control technique data mining software development and design blockchain technology big data technology and artificial intelligence technology

Data Science Pallavi Vijay Chavan,Parikshit N Mahalle,Ramchandra Mangrulkar,Idongesit Williams,2022-08-15 This book covers the topic of data science in a comprehensive manner and synthesizes both fundamental and advanced topics of a research area that has now reached its maturity The book starts with the basic concepts of data science It highlights the types of data and their use and importance followed by a discussion on a wide range of applications of data science and widely used techniques in data science Key Features Provides an internationally respected collection of scientific research methods technologies and applications in the area of data science Presents predictive outcomes by applying data science techniques to real life applications Provides readers with the tools techniques and cases required to excel with modern artificial intelligence methods Gives the reader a variety of intelligent applications that can be designed using data science

and its allied fields The book is aimed primarily at advanced undergraduates and graduates studying machine learning and data science Researchers and professionals will also find this book useful *Intelligent and Cloud Computing* Debahuti Mishra,Rajkumar Buyya,Prasant Mohapatra,Srikanta Patnaik,2020-10-30 This book features a collection of high quality research papers presented at the International Conference on Intelligent and Cloud Computing ICICC 2019 held at Siksha O Anusandhan Deemed to be University Bhubaneswar India on December 20 2019 Including contributions on system and network design that can support existing and future applications and services it covers topics such as cloud computing system and network design optimization for cloud computing networking and applications green cloud system design cloud storage design and networking storage security cloud system models big data storage intra cloud computing mobile cloud system design real time resource reporting and monitoring for cloud management machine learning data mining for cloud computing data driven methodology and architecture and networking for machine learning systems **Advances and Trends in Artificial Intelligence. From Theory to Practice** Hamido Fujita,Ali Selamat,Jerry Chun-Wei Lin,Moonis Ali,2021-07-19 This two volume set of LNAI 12798 and 12799 constitutes the thoroughly refereed proceedings of the 34th International Conference on Industrial Engineering and Other Applications of Applied Intelligent Systems IEA AIE 2021 held virtually and in Kuala Lumpur Malaysia in July 2021 The 87 full papers and 19 short papers presented were carefully reviewed and selected from 145 submissions The IEA AIE 2021 conference will continue the tradition of emphasizing on applications of applied intelligent systems to solve real life problems in all areas These areas include the following Part I Artificial Intelligence Practices Knowledge discovery and pattern mining artificial intelligence and machine learning semantic topology and ontology models medical and health related applications graphic and social network analysis signal and bioinformatics processing evolutionary computation attack security natural language and text processing fuzzy inference and theory and sensor and communication networks Part II From Theory to Practice Prediction and recommendation data management clustering and classification robotics knowledge based and decision support systems multimedia applications innovative applications of intelligent systems CPS and industrial applications defect anomaly and intrusion detection financial and supply chain applications Bayesian networks BigData and time series processing and information retrieval and relation extraction

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