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Outlier Detection for Temporal Data

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SYNTHESIS LECTURES ON
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Outlier Detection For Temporal Data Jing Gao

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Outlier Detection for Temporal Data Manish Gupta,Jing Gao,Charu Aggarwal,Jiawei Han,2022-06-01 Outlier or anomaly detection is a very broad field which has been studied in the context of a large number of research areas like statistics data mining sensor networks environmental science distributed systems spatio temporal mining etc Initial research in outlier detection focused on time series based outliers in statistics Since then outlier detection has been studied on a large variety of data types including high dimensional data uncertain data stream data network data time series data spatial data and spatio temporal data While there have been many tutorials and surveys for general outlier detection we focus on outlier detection for temporal data in this book A large number of applications generate temporal datasets For example in our everyday life various kinds of records like credit personnel financial judicial medical etc are all temporal This stresses the need for an organized and detailed study of outliers with respect to such temporal data In the past decade there has been a lot of research on various forms of temporal data including consecutive data snapshots series of data snapshots and data streams Besides the initial work on time series researchers have focused on rich forms of data including multiple data streams spatio temporal data network data community distribution data etc Compared to general outlier detection techniques for temporal outlier detection are very different In this book we will present an organized picture of both recent and past research in temporal outlier detection We start with the basics and then ramp up the reader to the main ideas in state of the art outlier detection techniques We motivate the importance of temporal outlier detection and brief the challenges beyond usual outlier detection Then we list down a taxonomy of proposed techniques for temporal outlier detection Such techniques broadly include statistical techniques like AR models Markov models histograms neural networks distance and density based approaches grouping based approaches clustering community detection network based approaches and spatio temporal outlier detection approaches We summarize by presenting a wide collection of applications where temporal outlier detection techniques have been applied to discover interesting outliers Table of Contents Preface Acknowledgments Figure Credits Introduction and Challenges Outlier Detection for Time Series and Data Sequences Outlier Detection for Data Streams Outlier Detection for Distributed Data Streams Outlier Detection for Spatio Temporal Data Outlier Detection for Temporal Network Data Applications of Outlier Detection for Temporal Data Conclusions and Research Directions Bibliography Authors Biographies **Exploratory Causal Analysis with Time Series Data** James M. McCracken,2022-06-01 Many scientific disciplines rely on observational data of systems for which it is difficult or impossible to implement controlled experiments Data analysis techniques are required for identifying causal information and relationships directly from such observational data This need has led to the development of many different time series causality approaches and tools including transfer entropy convergent cross mapping CCM and Granger causality statistics A practicing analyst can explore the literature to find many proposals for identifying drivers and causal connections in time series data sets Exploratory causal analysis ECA

provides a framework for exploring potential causal structures in time series data sets and is characterized by a myopic goal to determine which data series from a given set of series might be seen as the primary driver In this work ECA is used on several synthetic and empirical data sets and it is found that all of the tested time series causality tools agree with each other and intuitive notions of causality for many simple systems but can provide conflicting causal inferences for more complicated systems It is proposed that such disagreements between different time series causality tools during ECA might provide deeper insight into the data than could be found otherwise **Mining Human Mobility in Location-Based Social Networks** Huiji Gao,Huan Liu,2022-06-01 In recent years there has been a rapid growth of location based social networking services such as Foursquare and Facebook Places which have attracted an increasing number of users and greatly enriched their urban experience Typical location based social networking sites allow a user to check in at a real world POI point of interest e g a hotel restaurant theater etc leave tips toward the POI and share the check in with their online friends The check in action bridges the gap between real world and online social networks resulting in a new type of social networks namely location based social networks LBSNs Compared to traditional GPS data location based social networks data contains unique properties with abundant heterogeneous information to reveal human mobility i e when and where a user who has been to for what corresponding to an unprecedented opportunity to better understand human mobility from spatial temporal social and content aspects The mining and understanding of human mobility can further lead to effective approaches to improve current location based services from mobile marketing to recommender systems providing users more convenient life experience than before This book takes a data mining perspective to offer an overview of studying human mobility in location based social networks and illuminate a wide range of related computational tasks It introduces basic concepts elaborates associated challenges reviews state of the art algorithms with illustrative examples and real world LBSN datasets and discusses effective evaluation methods in mining human mobility In particular we illustrate unique characteristics and research opportunities of LBSN data present representative tasks of mining human mobility on location based social networks including capturing user mobility patterns to understand when and where a user commonly goes location prediction and exploiting user preferences and location profiles to investigate where and when a user wants to explore location recommendation along with studying a user s check in activity in terms of why a user goes to a certain location

Multidimensional Mining of Massive Text Data Chao Zhang,Jiawei Han,2022-06-01 Unstructured text as one of the most important data forms plays a crucial role in data driven decision making in domains ranging from social networking and information retrieval to scientific research and healthcare informatics In many emerging applications people s information need from text data is becoming multidimensional they demand useful insights along multiple aspects from a text corpus However acquiring such multidimensional knowledge from massive text data remains a challenging task This book presents data mining techniques that turn unstructured text data into multidimensional knowledge We investigate two core questions

1 How does one identify task relevant text data with declarative queries in multiple dimensions 2 How does one distill knowledge from text data in a multidimensional space To address the above questions we develop a text cube framework First we develop a cube construction module that organizes unstructured data into a cube structure by discovering latent multidimensional and multi granular structure from the unstructured text corpus and allocating documents into the structure Second we develop a cube exploitation module that models multiple dimensions in the cube space thereby distilling from user selected data multidimensional knowledge Together these two modules constitute an integrated pipeline leveraging the cube structure users can perform multidimensional multigranular data selection with declarative queries and with cube exploitation algorithms users can extract multidimensional patterns from the selected data for decision making The proposed framework has two distinctive advantages when turning text data into multidimensional knowledge flexibility and label efficiency First it enables acquiring multidimensional knowledge flexibly as the cube structure allows users to easily identify task relevant data along multiple dimensions at varied granularities and further distill multidimensional knowledge Second the algorithms for cube construction and exploitation require little supervision this makes the framework appealing for many applications where labeled data are expensive to obtain **Exploiting the Power of Group Differences** Guozhu Dong,2022-05-31 This book presents pattern based problem solving methods for a variety of machine learning and data analysis problems The methods are all based on techniques that exploit the power of group differences They make use of group differences represented using emerging patterns aka contrast patterns which are patterns that match significantly different numbers of instances in different data groups A large number of applications outside of the computing discipline are also included Emerging patterns EPs are useful in many ways EPs can be used as features as simple classifiers as subpopulation signatures characterizations and as triggering conditions for alerts EPs can be used in gene ranking for complex diseases since they capture multi factor interactions The length of EPs can be used to detect anomalies outliers and novelties Emerging contrast pattern based methods for clustering analysis and outlier detection do not need distance metrics avoiding pitfalls of the latter in exploratory analysis of high dimensional data EP based classifiers can achieve good accuracy even when the training datasets are tiny making them useful for exploratory compound selection in drug design EPs can serve as opportunities in opportunity focused boosting and are useful for constructing powerful conditional ensembles EP based methods often produce interpretable models and results In general EPs are useful for classification clustering outlier detection gene ranking for complex diseases prediction model analysis and improvement and so on EPs are useful for many tasks because they represent group differences which have extraordinary power Moreover EPs represent multi factor interactions whose effective handling is of vital importance and is a major challenge in many disciplines Based on the results presented in this book one can clearly say that patterns are useful especially when they are linked to issues of interest We believe that many effective ways to exploit group differences power still remain to be discovered Hopefully this book will

inspire readers to discover such new ways besides showing them existing ways to solve various challenging problems

Detecting Fake News on Social Media Kai Shu,Huan Liu,2022-05-31 In the past decade social media has become increasingly popular for news consumption due to its easy access fast dissemination and low cost However social media also enables the wide propagation of fake news i e news with intentionally false information Fake news on social media can have significant negative societal effects Therefore fake news detection on social media has recently become an emerging research area that is attracting tremendous attention This book from a data mining perspective introduces the basic concepts and characteristics of fake news across disciplines reviews representative fake news detection methods in a principled way and illustrates challenging issues of fake news detection on social media In particular we discussed the value of news content and social context and important extensions to handle early detection weakly supervised detection and explainable detection The concepts algorithms and methods described in this lecture can help harness the power of social media to build effective and intelligent fake news detection systems This book is an accessible introduction to the study of detecting fake news on social media It is an essential reading for students researchers and practitioners to understand manage and excel in this area This book is supported by additional materials including lecture slides the complete set of figures key references datasets tools used in this book and the source code of representative algorithms The readers are encouraged to visit the book website for the latest information http dmml asu edu dfn **Data Science and Big Data Analytics in Smart Environments** Marta Chinnici,Florin Pop,Catalin Negru,2021-07-28 Most applications generate large datasets like social networking and social influence programs smart cities applications smart house environments Cloud applications public web sites scientific experiments and simulations data warehouse monitoring platforms and e government services Data grows rapidly since applications produce continuously increasing volumes of both unstructured and structured data Large scale interconnected systems aim to aggregate and efficiently exploit the power of widely distributed resources In this context major solutions for scalability mobility reliability fault tolerance and security are required to achieve high performance and to create a smart environment The impact on data processing transfer and storage is the need to re evaluate the approaches and solutions to better answer the user needs A variety of solutions for specific applications and platforms exist so a thorough and systematic analysis of existing solutions for data science data analytics methods and algorithms used in Big Data processing and storage environments is significant in designing and implementing a smart environment Fundamental issues pertaining to smart environments smart cities ambient assisted leaving smart houses green houses cyber physical systems etc are reviewed Most of the current efforts still do not adequately address the heterogeneity of different distributed systems the interoperability between them and the systems resilience This book will primarily encompass practical approaches that promote research in all aspects of data processing data analytics data processing in different type of systems Cluster Computing Grid Computing Peer to Peer Cloud Edge Fog Computing all involving elements of heterogeneity having a

large variety of tools and software to manage them The main role of resource management techniques in this domain is to create the suitable frameworks for development of applications and deployment in smart environments with respect to high performance The book focuses on topics covering algorithms architectures management models high performance computing techniques and large scale distributed systems **Probabilistic Approaches to Recommendations** Nicola Barbieri,Giuseppe Manco,Ettore Ritacco,2022-05-31 The importance of accurate recommender systems has been widely recognized by academia and industry and recommendation is rapidly becoming one of the most successful applications of data mining and machine learning Understanding and predicting the choices and preferences of users is a challenging task real world scenarios involve users behaving in complex situations where prior beliefs specific tendencies and reciprocal influences jointly contribute to determining the preferences of users toward huge amounts of information services and products Probabilistic modeling represents a robust formal mathematical framework to model these assumptions and study their effects in the recommendation process This book starts with a brief summary of the recommendation problem and its challenges and a review of some widely used techniques Next we introduce and discuss probabilistic approaches for modeling preference data We focus our attention on methods based on latent factors such as mixture models probabilistic matrix factorization and topic models for explicit and implicit preference data These methods represent a significant advance in the research and technology of recommendation The resulting models allow us to identify complex patterns in preference data which can be exploited to predict future purchases effectively The extreme sparsity of preference data poses serious challenges to the modeling of user preferences especially in the cases where few observations are available Bayesian inference techniques elegantly address the need for regularization and their integration with latent factor modeling helps to boost the performances of the basic techniques We summarize the strengths and weakness of several approaches by considering two different but related evaluation perspectives namely rating prediction and recommendation accuracy Furthermore we describe how probabilistic methods based on latent factors enable the exploitation of preference patterns in novel applications beyond rating prediction or recommendation accuracy We finally discuss the application of probabilistic techniques in two additional scenarios characterized by the availability of side information besides preference data In summary the book categorizes the myriad probabilistic approaches to recommendations and provides guidelines for their adoption in real world situations **Mining Latent Entity Structures** Chi Wang,Jiawei Han,2022-05-31 The big data era is characterized by an explosion of information in the form of digital data collections ranging from scientific knowledge to social media news and everyone s daily life Examples of such collections include scientific publications enterprise logs news articles social media and general web pages Valuable knowledge about multi typed entities is often hidden in the unstructured or loosely structured interconnected data Mining latent structures around entities uncovers hidden knowledge such as implicit topics phrases entity roles and relationships In this monograph we investigate the principles and methodologies of mining

latent entity structures from massive unstructured and interconnected data We propose a text rich information network model for modeling data in many different domains This leads to a series of new principles and powerful methodologies for mining latent structures including 1 latent topical hierarchy 2 quality topical phrases 3 entity roles in hierarchical topical communities and 4 entity relations This book also introduces applications enabled by the mined structures and points out some promising research directions Correlation Clustering Francesco Bonchi,David García-Soriano,Francesco Gullo,2022-05-31 Given a set of objects and a pairwise similarity measure between them the goal of correlation clustering is to partition the objects in a set of clusters to maximize the similarity of the objects within the same cluster and minimize the similarity of the objects in different clusters In most of the variants of correlation clustering the number of clusters is not a given parameter instead the optimal number of clusters is automatically determined Correlation clustering is perhaps the most natural formulation of clustering as it just needs a definition of similarity its broad generality makes it applicable to a wide range of problems in different contexts and particularly makes it naturally suitable to clustering structured objects for which feature vectors can be difficult to obtain Despite its simplicity generality and wide applicability correlation clustering has so far received much more attention from an algorithmic theory perspective than from the data mining community The goal of this lecture is to show how correlation clustering can be a powerful addition to the toolkit of a data mining researcher and practitioner and to encourage further research in the area

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products, taking process waste and ... The Mass Balance Approach in Feedstock Substitution An established method to foster sustainability in existing infrastructure · Benefits of the Mass Balance Approach · Biomass balance and ChemCycling · ChemCycling ... 8. Mass Balance Mass-balance analysis may also be referred to as. “Material Flow Analysis” or “Substance Flow Analysis.” Table 8.1 provides several examples of possible inputs,. Mass Balance Approach in the Chemical Industry The mass balance Approach (MBA) is a process for determining the use of chemically recycled or bio-based feedstock in a final product when both recycled and ... BRC 3.9.2 Trace Exercise Sample Procedure to conduct a mass balance check · 1. Select a raw material lot number used in a finished product made within the last 6 months. · 2. Review storage ... UNDERSTANDING VULNERABILITY ASSESSMENT Table 6 provides examples of PRNs for different raw materials. Table 6 Priority ... Mass balance exercises at critical points in the supply chain – the mass ... ISSUE 8 FOOD SAFETY - Frequently Asked Questions - a worked example from the raw material supplier, which ... to conduct a mass balance test every 6 months for each claim or a single mass balance test every. Advanced Accounting Chapter 2 Advanced Accounting 12th edition Hoyle, Schaefer, & Doupnik McGraw Hill Education ISBN 978-0-07-786222-0 Solution Manual for Chapter 2 chapter 02 consolidation. Advanced Accounting Chapter 2 - Solution Manual SOLUTIONS TO CASES It is important to recognize that the notes to the consolidated financial statements are regarded as an integral part of the financial ... Advanced Accounting - Chapter 2 Flashcards Study with Quizlet and memorize flashcards containing terms like • The acquisition method embraces the, A business combination is the formation of a single ... Advanced Accounting Chapter 2 Comprehensive Problem Advanced Accounting Chapter 2 Comprehensive Problem - Free download as PDF File (.pdf), Text File (.txt) or read online for free. Advanced Accounting 12e by ... Chapter 2 Solutions | Advanced Accounting 12th Edition Access Advanced Accounting 12th Edition Chapter 2 solutions now. Our solutions are written by Chegg experts so you can be assured of the highest quality! Solutions Manual for Advanced Accounting 11th Edition by ... ... Accounting 11th Edition by Beams, Advanced Accounting;Beams;Solutions ... Chapter 2 STOCK INVESTMENTS — INVESTOR ACCOUNTING AND REPORTING Answers to Questions 1. Advanced Accounting Homework Answers - Chapter 2 ... Problem 1 ANSWER: a.Investment in Supernova (75,000 $20) 1,500,000 Common Stock (75,000 x $3)225,000 Paid-in Capital in Excess of Par1,275,000 Acquisition ... Ch. 2 solutions Advanced - Studylib CHAPTER 2 SOLUTIONS TO MULTIPLE CHOICE QUESTIONS, EXERCISES AND PROBLEMS MULTIPLE CHOICE QUESTIONS 1. b Only the advanced production technology and customer ... Advanced Accounting - Chapter 2 - Part 2 - Acquisition when ... (PDF) Chapter 2 STOCK INVESTMENTS — INVESTOR ... This paper reviews fair value accounting method relative to historical cost accounting. Although both methods are widely used by entities in computing their ... More Than a Carpenter by Josh McDowell Josh McDowell's timeless examination of the true nature of Christ and his impact on our lives is one of the best-selling Christian books ever. Written by a ... More Than a Carpenter From the Publisher. The true story of Jesus and his sacrifice on the cross can change your life forever ... More Than a

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