Lei Tang - Huan Liu

Community Detection and Mining in Social Media

Community Detection And Mining In Social Media Huan Liu

Jialu Liu,Jingbo Shang,Jiawei Han

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   Community detection and mining in social media Lei Tang,Huan Liu,2022-06-01 The past decade has witnessed the emergence of participatory Web and social media bringing people together in many creative ways Millions of users are playing tagging working and socializing online demonstrating new forms of collaboration communication and intelligence that were hardly imaginable just a short time ago Social media also helps reshape business models sway opinions and emotions and opens up numerous possibilities to study human interaction and collective behavior in an unparalleled scale This lecture from a data mining perspective introduces characteristics of social media reviews representative tasks of computing with social media and illustrates associated challenges It introduces basic concepts presents state of the art algorithms with easy to understand examples and recommends effective evaluation methods In particular we discuss graph based community detection techniques and many important extensions that handle dynamic heterogeneous networks in social media We also demonstrate how discovered patterns of communities can be used for social media mining The concepts algorithms and methods presented in this lecture can help harness the power of social media and support building socially intelligent systems This book is an accessible introduction to the study of emph community detection and mining in social media It is an essential reading for students researchers and practitioners in disciplines and applications where social media is a key source of data that piques our curiosity to understand manage innovate and excel This book is supported by additional materials including lecture slides the complete set of figures key references some toy data sets used in the book and the source code of representative algorithms The readers are encouraged to visit the book website for the latest information Table of Contents Social Media and Social Computing Nodes Ties and Influence Community Detection and Evaluation Communities in Heterogeneous Networks Social Media Mining   *Community Detection and Mining in Social Media* Lei Tang,Huan Liu,2010-05-05 The past decade has witnessed the emergence of participatory Web and social media bringing people together in many creative ways Millions of users are playing tagging working and socializing online demonstrating new forms of collaboration communication and intelligence that were hardly imaginable just a short time ago Social media also helps reshape business models sway opinions and emotions and opens up numerous possibilities to study human interaction and collective behavior in an unparalleled scale This lecture from a data mining perspective introduces characteristics of social media reviews representative tasks of computing with social media and illustrates associated challenges It introduces basic concepts presents state of the art algorithms with easy to understand examples and recommends effective evaluation methods In particular we discuss graph based community detection techniques and many important extensions that handle dynamic heterogeneous networks in social media We also demonstrate how discovered patterns of communities can be used for social media mining The concepts algorithms and methods presented in this lecture can help harness the power of social media and support building socially intelligent systems This book is an accessible

introduction to the study of emph community detection and mining in social media It is an essential reading for students researchers and practitioners in disciplines and applications where social media is a key source of data that piques our curiosity to understand manage innovate and excel This book is supported by additional materials including lecture slides the complete set of figures key references some toy data sets used in the book and the source code of representative algorithms The readers are encouraged to visit the book website for the latest information Table of Contents Social Media and Social Computing Nodes Ties and Influence Community Detection and Evaluation Communities in Heterogeneous Networks Social Media Mining **Social Media Mining** Reza Zafarani,Mohammad Ali Abbasi,Huan Liu,2014-04-28 The growth of social media over the last decade has revolutionized the way individuals interact and industries conduct business Individuals produce data at an unprecedented rate by interacting sharing and consuming content through social media Understanding and processing this new type of data to glean actionable patterns presents challenges and opportunities for interdisciplinary research novel algorithms and tool development Social Media Mining integrates social media social network analysis and data mining to provide a coherent platform to understand the basics and potentials of social media mining It introduces the unique problems arising from social media data and presents fundamental concepts emerging issues and effective algorithms for network analysis and data mining Suitable for use in advanced undergraduate and beginning graduate courses as well as professional short courses the text contains exercises of different degrees of difficulty that improve understanding and help apply concepts principles and methods for social media mining **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 *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   **Mining Structures of Factual Knowledge from Text** Xiang Ren,Jiawei Han,2022-05-31 The real world data though massive is largely unstructured in the form of natural language text It is challenging but highly desirable to mine structures from massive text data without extensive human annotation and labeling In this book we investigate the principles and methodologies of mining structures of factual knowledge e g entities and their relationships from massive unstructured text corpora Departing from many existing structure extraction methods that have heavy reliance on human annotated data for model training our effort light approach leverages human curated facts stored in external knowledge bases as distant supervision and exploits rich data redundancy in large text corpora for context understanding This effort light mining approach leads to a series of new principles and powerful methodologies for structuring text corpora including 1 entity recognition typing and synonym discovery 2 entity relation extraction and 3 open domain attribute valuemining and information extraction This book introduces this new research frontier and points out some promising research directions   *Modeling and Mining Ubiquitous Social Media* Martin Atzmueller,Alvin Chin,Denis Helic,Andreas Hotho,2012-09-10 This book constitutes the joint thoroughly refereed post proceedings of the Second International Workshop on Modeling Social Media MSM 2011 held in Boston MA USA in October 2011 and the Second

International Workshop on Mining Ubiquitous and Social Environments MUSE 2011 held in Athens Greece in September 2011 The 9 full papers included in the book are revised and significantly extended versions of papers submitted to the workshops They cover a wide range of topics organized in three main themes communities and networks in ubiquitous social media mining approaches and issues of user modeling privacy and security *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 **Phrase Mining from Massive Text and Its Applications** Jialu Liu,Jingbo Shang,Jiawei Han,2022-06-01 A lot of digital ink has been spilled on big data over the past few years Most of this surge owes its origin to the various types of unstructured data in the wild among which the proliferation of text heavy data is particularly overwhelming attributed to the daily use of web documents business reviews news social posts etc by so many people worldwide A core challenge presents itself How can one efficiently and effectively turn massive unstructured text into structured representation so as to further lay the foundation for many other downstream text mining applications In this book we investigated one promising paradigm for representing unstructured text that is through automatically identifying high quality phrases from innumerable documents In contrast to a list of frequent n grams without proper filtering users are often more interested in results based on variable length phrases with certain semantics such as scientific concepts organizations slogans and so on We propose new principles and powerful methodologies to achieve this goal from the scenario where a user can provide meaningful guidance to a fully automated setting through distant learning This book also introduces applications enabled by the mined phrases and points out some promising research directions **Provenance Data in Social Media** Geoffrey Barbier,Zhuo Feng,Pritam Gundecha,Huan Liu,2022-05-31 Social media shatters the barrier to communicate anytime anywhere for people of all walks of life The publicly available virtually free information in social media poses a new challenge to consumers who have to discern whether a piece of information published in social media is reliable For example it can be difficult to understand the motivations behind a statement passed from one user to another without knowing the person who originated the message Additionally false information can be propagated through social media resulting in embarrassment or irreversible damages Provenance data associated with a social media statement can help dispel rumors clarify opinions and confirm facts However provenance data about social media statements is not readily available to users today Currently providing this data to users requires

changing the social media infrastructure or offering subscription services Taking advantage of social media features research in this nascent field spearheads the search for a way to provide provenance data to social media users thus leveraging social media itself by mining it for the provenance data Searching for provenance data reveals an interesting problem space requiring the development and application of new metrics in order to provide meaningful provenance data to social media users This lecture reviews the current research on information provenance explores exciting research opportunities to address pressing needs and shows how data mining can enable a social media user to make informed judgements about statements published in social media Table of Contents Information Provenance in Social Media Provenance Attributes Provenance via Network Information Provenance Data   *Individual and Collective Graph Mining* Danai Koutra,Christos Faloutsos,2022-06-01 Graphs naturally represent information ranging from links between web pages to communication in email networks to connections between neurons in our brains These graphs often span billions of nodes and interactions between them Within this deluge of interconnected data how can we find the most important structures and summarize them How can we efficiently visualize them How can we detect anomalies that indicate critical events such as an attack on a computer system disease formation in the human brain or the fall of a company This book presents scalable principled discovery algorithms that combine globality with locality to make sense of one or more graphs In addition to fast algorithmic methodologies we also contribute graph theoretical ideas and models and real world applications in two main areas Individual Graph Mining We show how to interpretably summarize a single graph by identifying its important graph structures We complement summarization with inference which leverages information about few entities obtained via summarization or other methods and the network structure to efficiently and effectively learn information about the unknown entities Collective Graph Mining We extend the idea of individual graph summarization to time evolving graphs and show how to scalably discover temporal patterns Apart from summarization we claim that graph similarity is often the underlying problem in a host of applications where multiple graphs occur e g temporal anomaly detection discovery of behavioral patterns and we present principled scalable algorithms for aligning networks and measuring their similarity The methods that we present in this book leverage techniques from diverse areas such as matrix algebra graph theory optimization information theory machine learning finance and social science to solve real world problems We present applications of our exploration algorithms to massive datasets including a Web graph of 6 6 billion edges a Twitter graph of 1 8 billion edges brain graphs with up to 90 million edges collaboration peer to peer networks browser logs all spanning millions of users and interactions   *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 **Publications Combined: The Role of Social Media in Crisis - Data Collection By The Public And Private Sectors As A Strategic Asset And To Prevent Terrorism** ,2018-09-07 Over 1 800 total pages Included publications Social Media and the Policy Making Process a Traditional Novel Interaction Social Media Principles Applied to Critical Infrastructure Information Sharing Trolling New Media Violent Extremist Groups Recruiting Through Social Media An Initial Look at the Utility of Social Media as a Foreign Policy Tool Indicators of Suicide Found on Social Networks Phase 1 Validating the FOCUS Model Through an Analysis of Identity Fragmentation in Nigerian Social Media Providing Focus via a Social Media Exploitation Strategy Assessing the Use of Social Media in a Revolutionary Environment Social Media Integration into State Operated Fusion Centers and Local Law Enforcement Potential Uses and Challenges Using Social Media Tools to Enhance Tacit Knowledge Sharing Within the USMC Social Media Strategic Asset or Operational Vulnerability Tweeting Napoleon and Friending Clausewitz Social Media and the Military Strategist The U S Military and Social Media Balancing Social Media with Operations Security OPSEC in the 21st Century Division Level Social Media Understanding Violence Through Social Media The Investigation of Social Media Data Thresholds for Opinion Formation The Impact of Social Media on the Nature of Conflict and a Commander s Strategy for Social Media Provenance Data in Social Media Conflict Prediction Through Geo Spatial Interpolation of Radicalization in Syrian Social Media Social Media Effects on Operational Art Assessing the Potential of Societal Verification by Means of New Media Army Social Media Harnessing the Power of Networked Communications Analysis of Department of Defense Social Media Policy and Its Impact on Operational Security Social Media Valuable Tools in Today s Operational Environment Conflict Prediction Through Geo Spatial Interpolation of Radicalization in Syrian Social Media *Privacy in Social Networks* Elena Zheleva,Evimaria Terzi,Lise Getoor,2013-03-01 This synthesis lecture provides a survey of work on privacy in online social networks OSNs This work encompasses concerns of users as well as service providers and third parties Our goal is to approach such concerns from a computer science perspective and building upon existing work on privacy security statistical modeling and databases to provide an overview of the technical and algorithmic issues related to privacy in OSNs We start our survey by introducing a simple OSN data model and describe common statistical inference techniques that can be used to

infer potentially sensitive information Next we describe some privacy definitions and privacy mechanisms for data publishing Finally we describe a set of recent techniques for modeling evaluating and managing individual users privacy risk within the context of OSNs Table of Contents Introduction A Model for Online Social Networks Types of Privacy Disclosure Statistical Methods for Inferring Information in Networks Anonymity and Differential Privacy Attacks and Privacy preserving Mechanisms Models of Information Sharing Users Privacy Risk Management of Privacy Settings **Mining Heterogeneous Information Networks** Yizhou Sun,Jiawei Han,2022-05-31 Real world physical and abstract data objects are interconnected forming gigantic interconnected networks By structuring these data objects and interactions between these objects into multiple types such networks become semi structured heterogeneous information networks Most real world applications that handle big data including interconnected social media and social networks scientific engineering or medical information systems online e commerce systems and most database systems can be structured into heterogeneous information networks Therefore effective analysis of large scale heterogeneous information networks poses an interesting but critical challenge In this book we investigate the principles and methodologies of mining heterogeneous information networks Departing from many existing network models that view interconnected data as homogeneous graphs or networks our semi structured heterogeneous information network model leverages the rich semantics of typed nodes and links in a network and uncovers surprisingly rich knowledge from the network This semi structured heterogeneous network modeling leads to a series of new principles and powerful methodologies for mining interconnected data including 1 rank based clustering and classification 2 meta path based similarity search and mining 3 relation strength aware mining and many other potential developments This book introduces this new research frontier and points out some promising research directions Table of Contents Introduction Ranking Based Clustering Classification of Heterogeneous Information Networks Meta Path Based Similarity Search Meta Path Based Relationship Prediction Relation Strength Aware Clustering with Incomplete Attributes User Guided Clustering via Meta Path Selection Research Frontiers **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

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 *Link Mining: Models, Algorithms, and Applications* Philip S. Yu,Jiawei Han,Christos Faloutsos,2010-09-16 This book offers detailed surveys and systematic discussion of models algorithms and applications for link mining focusing on theory and technique and related applications text mining social network analysis collaborative filtering and bioinformatics **Big Data Analytics** Mrutyunjaya Panda,Ajith Abraham,Aboul Ella Hassanien,2018-12-12 Social networking has increased drastically in recent years resulting in an increased amount of data being created daily Furthermore diversity of issues and complexity of the social networks pose a challenge in social network mining Traditional

algorithm software cannot deal with such complex and vast amounts of data necessitating the development of novel analytic approaches and tools This reference work deals with social network aspects of big data analytics It covers theory practices and challenges in social networking The book spans numerous disciplines like neural networking deep learning artificial intelligence visualization e learning in higher education e healthcare security and intrusion detection

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