# Spectral Clustering and Biclustering

Learning Large Graphs and Contingency Tables



Marianna Bolla

WILEY

Alessandra Rogato, Valeria Zazzu, Mario Guarracino

Spectral Clustering and Biclustering Marianna Bolla, 2013-06-27 Explores regular structures in graphs and contingency tables by spectral theory and statistical methods This book bridges the gap between graph theory and statistics by giving answers to the demanding questions which arise when statisticians are confronted with large weighted graphs or rectangular arrays Classical and modern statistical methods applicable to biological social communication networks or microarrays are presented together with the theoretical background and proofs This book is suitable for a one semester course for graduate students in data mining multivariate statistics or applied graph theory but by skipping the proofs the algorithms can also be used by specialists who just want to retrieve information from their data when analysing communication social or biological networks Spectral Clustering and Biclustering Provides a unified treatment for edge weighted graphs and contingency tables via methods of multivariate statistical analysis factoring clustering and biclustering Uses spectral embedding and relaxation to estimate multiway cuts of edge weighted graphs and bicuts of contingency tables Goes beyond the expanders by describing the structure of dense graphs with a small spectral gap via the structural eigenvalues and eigen subspaces of the normalized modularity matrix Treats graphs like statistical data by combining methods of graph theory and statistics Establishes a common outline structure for the contents of each algorithm applicable to networks and microarrays with Data Clustering: Theory, Algorithms, and Applications, Second Edition Guojun unified notions and principles Gan, Chaogun Ma, Jianhong Wu, 2020-11-10 Data clustering also known as cluster analysis is an unsupervised process that divides a set of objects into homogeneous groups Since the publication of the first edition of this monograph in 2007 development in the area has exploded especially in clustering algorithms for big data and open source software for cluster analysis This second edition reflects these new developments covers the basics of data clustering includes a list of popular clustering algorithms and provides program code that helps users implement clustering algorithms Data Clustering Theory Algorithms and Applications Second Edition will be of interest to researchers practitioners and data scientists as well as undergraduate and graduate students **Dynamics of Mathematical Models in Biology** Alessandra Rogato, Valeria Zazzu, Mario Guarracino, 2016-11-03 This volume focuses on contributions from both the mathematics and life science community surrounding the concepts of time and dynamicity of nature two significant elements which are often overlooked in modeling process to avoid exponential computations The book is divided into three distinct parts dynamics of genomes and genetic variation dynamics of motifs and dynamics of biological networks Chapters included in dynamics of genomes and genetic variation analyze the molecular mechanisms and evolutionary processes that shape the structure and function of genomes and those that govern genome dynamics The dynamics of motifs portion of the volume provides an overview of current methods for motif searching in DNA RNA and proteins a key process to discover emergent properties of cells tissues and organisms The part devoted to the dynamics of biological networks covers networks aptly discusses networks in complex

biological functions and activities that interpret processes in cells Moreover chapters in this section examine several mathematical models and algorithms available for integration analysis and characterization Once life scientists began to produce experimental data at an unprecedented pace it become clear that mathematical models were necessary to interpret data to structure information with the aim to unveil biological mechanisms discover results and make predictions The second annual Bringing Maths to Life workshop held in Naples Italy October 2015 enabled a bi directional flow of ideas from and international group of mathematicians and biologists The venue allowed mathematicians to introduce novel algorithms methods and software that may be useful to model aspects of life science and life scientists posed new challenges for Machine Learning Advanced Dynamic Omics Data Analysis for Precision Medicine Tao Zeng, Tao Huang, Chuan Lu, 2020-03-30 Multidimensional Stationary Time Series Marianna Bolla, Tamás Szabados, 2021-04-29 This book gives a brief survey of the theory of multidimensional multivariate weakly stationary time series with emphasis on dimension reduction and prediction Understanding the covered material requires a certain mathematical maturity a degree of knowledge in probability theory linear algebra and also in real complex and functional analysis For this the cited literature and the Appendix contain all necessary material The main tools of the book include harmonic analysis some abstract algebra and state space methods linear time invariant filters factorization of rational spectral densities and methods that reduce the rank of the spectral density matrix Serves to find analogies between classical results Cramer Wold Kolmogorov Wiener K lm n Rozanov and up to date methods for dimension reduction in multidimensional time series Provides a unified treatment for time and frequency domain inferences by using machinery of complex and harmonic analysis spectral and Smith McMillan decompositions Establishes analogies between the time and frequency domain notions and calculations Discusses the Wold s decomposition and the Kolmogorov's classification together by distinguishing between different types of singularities Understanding the remote past helps us to characterize the ideal situation where there is a regular part at present Examples and constructions are also given Establishes a common outline structure for the state space models prediction and innovation algorithms with unified notions and principles which is applicable to real life high frequency time series It is an ideal companion for graduate students studying the theory of multivariate time series and researchers working in this field

Clustering Graphs and Contingency Tables with Spectral Methods Marianna Bolla,2016 Ross and Wilson's Anatomy and Physiology Colouring and Workbook Janet S. Ross,Anne Waugh,Allison Wynn Grant,2006 Ross and Wilson Anatomy and Physiology in Health is a well established core text for students of anatomy and physiology This companion text will assist the student by providing activities to facilitate and reinforce learning Clustering Boris Mirkin,2016-04-19 Often considered more of an art than a science books on clustering have been dominated by learning through example with techniques chosen almost through trial and error Even the two most popular and most related clustering methods K Means for partitioning and Ward's method for hierarchical clustering have lacked the theoretical underpinning req Learning

Graphs from Data and Spectral Clustering with Applications to Finance Josep Maria Gallegos Saliner, 2019 In this bachelor s thesis we give a survey of methods to learn meaningful graphs from time series and study different spectral clustering algorithms Finally as a practical application we use these algorithms to study the stock market Clustering Boris Mirkin, 2012-10-17 Often considered more of an art than a science books on clustering have been dominated by learning through example with techniques chosen almost through trial and error Even the two most popular and most related clustering methods K Means for partitioning and Ward's method for hierarchical clustering have lacked the theoretical underpinning required to establish a firm relationship between the two methods and relevant interpretation aids Other approaches such as spectral clustering or consensus clustering are considered absolutely unrelated to each other or to the two above mentioned methods Clustering A Data Recovery Approach Second Edition presents a unified modeling approach for the most popular clustering methods the K Means and hierarchical techniques especially for divisive clustering It significantly expands coverage of the mathematics of data recovery and includes a new chapter covering more recent popular network clustering approaches spectral modularity and uniform additive and consensus treated within the same data recovery approach Another added chapter covers cluster validation and interpretation including recent developments for ontology driven interpretation of clusters Altogether the insertions added a hundred pages to the book even in spite of the fact that fragments unrelated to the main topics were removed Illustrated using a set of small real world datasets and more than a hundred examples the book is oriented towards students practitioners and theoreticians of cluster analysis Covering topics that are beyond the scope of most texts the author's explanations of data recovery methods theory based advice pre and post processing issues and his clear practical instructions for real world data mining make this book ideally suited for teaching self study and professional reference

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