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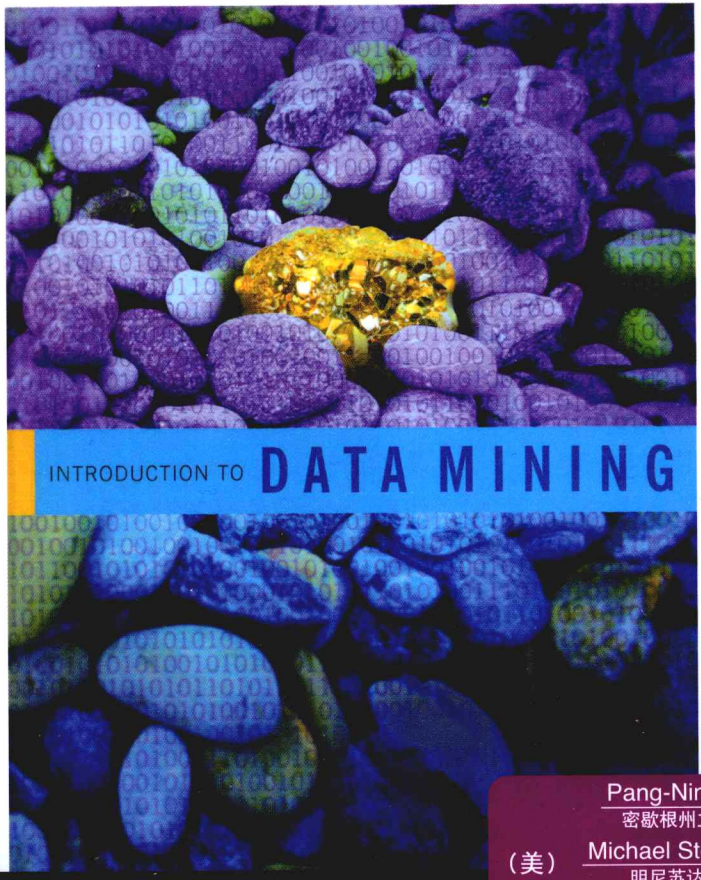
（英文版）



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出版者的话

文艺复兴以降，源远流长的科学精神和逐步形成的学术规范，使西方国家在自然科学的各个领域取得了垄断性的优势；也正是这样的传统，使美国在信息技术发展的六十多年间名家辈出、独领风骚。在商业化的进程中，美国的产业界与教育界越来越紧密地结合，计算机学科中的许多泰山北斗同时身处科研和教学的最前线，由此而产生的经典科学著作，不仅擘划了研究的范畴，还揭示了学术的源变，既遵循学术规范，又自有学者个性，其价值并不会因年月的流逝而减退。

近年，在全球信息化大潮的推动下，我国的计算机产业发展迅猛，对专业人才的需求日益迫切。这对计算机教育界和出版界都既是机遇，也是挑战；而专业教材的建设在教育战略上显得举足轻重。在我国信息技术发展时间较短的现状下，美国等发达国家在其计算机科学发展的几十年间积淀和发展的经典教材仍有许多值得借鉴之处。因此，引进一批国外优秀计算机教材将对我国计算机教育事业的发展起到积极的推动作用，也是与世界接轨、建设真正的世界一流大学的必由之路。

机械工业出版社华章公司较早意识到“出版要为教育服务”。自1998年开始，我们就将工作重点放在了遴选、移译国外优秀教材上。经过多年的不懈努力，我们与Pearson，McGraw-Hill，Elsevier，MIT，John Wiley & Sons，Cengage等世界著名出版公司建立了良好的合作关系，从他们现有的数百种教材中甄选出Andrew S. Tanenbaum，Bjarne Stroustrup，Brain W. Kernighan，Dennis Ritchie，Jim Gray，Afred V. Aho，John E. Hopcroft，Jeffrey D. Ullman，Abraham Silberschatz，William Stallings，Donald E. Knuth，John L. Hennessy，Larry L. Peterson等大师名家的一批经典作品，以“计算机科学丛书”为总称出版，供读者学习、研究及珍藏。大理石纹理的封面，也正体现了这套丛书的品位和格调。

“计算机科学丛书”的出版工作得到了国内外学者的鼎力襄助，国内的专家不仅提供了中肯的选题指导，还不辞劳苦地担任了翻译和审校的工作；而原书的作者也相当关注其作品在中国的传播，有的还专程为其书的中译本作序。迄今，“计算机科学丛书”已经出版了近两百个品种，这些书籍在读者中树立了良好的口碑，并被许多高校采用为正式教材和参考书籍。其影印版“经典原版书库”作为姊妹篇也被越来越多实施双语教学的学校所采用。

权威的作者、经典的教材、一流的译者、严格的审校、精细的编辑，这些因素使我们的图书有了质量的保证。随着计算机科学与技术专业学科建设的不断完善和教材改革的逐渐深化，教育界对国外计算机教材的需求和应用都将步入一个新的阶段，我们的目标是尽善尽美，而反馈的意见正是我们达到这一终极目标的重要帮助。华章公司欢迎老师和读者对我们的工作提出建议或给予指正，我们的联系方法如下：

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Preface

Advances in data generation and collection are producing data sets of massive size in commerce and a variety of scientific disciplines. Data warehouses store details of the sales and operations of businesses, Earth-orbiting satellites beam high-resolution images and sensor data back to Earth, and genomics experiments generate sequence, structural, and functional data for an increasing number of organisms. The ease with which data can now be gathered and stored has created a new attitude toward data analysis: Gather whatever data you can whenever and wherever possible. It has become an article of faith that the gathered data will have value, either for the purpose that initially motivated its collection or for purposes not yet envisioned.

The field of data mining grew out of the limitations of current data analysis techniques in handling the challenges posed by these new types of data sets. Data mining does not replace other areas of data analysis, but rather takes them as the foundation for much of its work. While some areas of data mining, such as association analysis, are unique to the field, other areas, such as clustering, classification, and anomaly detection, build upon a long history of work on these topics in other fields. Indeed, the willingness of data mining researchers to draw upon existing techniques has contributed to the strength and breadth of the field, as well as to its rapid growth.

Another strength of the field has been its emphasis on collaboration with researchers in other areas. The challenges of analyzing new types of data cannot be met by simply applying data analysis techniques in isolation from those who understand the data and the domain in which it resides. Often, skill in building multidisciplinary teams has been as responsible for the success of data mining projects as the creation of new and innovative algorithms. Just as, historically, many developments in statistics were driven by the needs of agriculture, industry, medicine, and business, many of the developments in data mining are being driven by the needs of those same fields.

This book began as a set of notes and lecture slides for a data mining course that has been offered at the University of Minnesota since Spring 1998 to upper-division undergraduate and graduate students. Presentation slides

and notes developed in these offerings grew with time and served as a basis for the book. A survey of clustering techniques in data mining, originally written in preparation for research in the area, served as a starting point for one of the chapters in the book. Over time, the clustering chapter was joined by chapters on data, classification, association analysis, and anomaly detection. The book in its current form has been class tested at the home institutions of the authors—the University of Minnesota and Michigan State University—as well as several other universities.

A number of data mining books appeared in the meantime, but were not completely satisfactory for our students—primarily graduate and undergraduate students in computer science, but including students from industry and a wide variety of other disciplines. Their mathematical and computer backgrounds varied considerably, but they shared a common goal: to learn about data mining as directly as possible in order to quickly apply it to problems in their own domains. Thus, texts with extensive mathematical or statistical prerequisites were unappealing to many of them, as were texts that required a substantial database background. The book that evolved in response to these students' needs focuses as directly as possible on the key concepts of data mining by illustrating them with examples, simple descriptions of key algorithms, and exercises.

Overview Specifically, this book provides a comprehensive introduction to data mining and is designed to be accessible and useful to students, instructors, researchers, and professionals. Areas covered include data preprocessing, visualization, predictive modeling, association analysis, clustering, and anomaly detection. The goal is to present fundamental concepts and algorithms for each topic, thus providing the reader with the necessary background for the application of data mining to real problems. In addition, this book also provides a starting point for those readers who are interested in pursuing research in data mining or related fields.

The book covers five main topics: data, classification, association analysis, clustering, and anomaly detection. Except for anomaly detection, each of these areas is covered in a pair of chapters. For classification, association analysis, and clustering, the introductory chapter covers basic concepts, representative algorithms, and evaluation techniques, while the more advanced chapter discusses advanced concepts and algorithms. The objective is to provide the reader with a sound understanding of the foundations of data mining, while still covering many important advanced topics. Because of this approach, the book is useful both as a learning tool and as a reference.

To help the readers better understand the concepts that have been presented, we provide an extensive set of examples, figures, and exercises. Bibliographic notes are included at the end of each chapter for readers who are interested in more advanced topics, historically important papers, and recent trends. The book also contains a comprehensive subject and author index.

To the Instructor As a textbook, this book is suitable for a wide range of students at the advanced undergraduate or graduate level. Since students come to this subject with diverse backgrounds that may not include extensive knowledge of statistics or databases, our book requires minimal prerequisites—no database knowledge is needed and we assume only a modest background in statistics or mathematics. To this end, the book was designed to be as self-contained as possible. Necessary material from statistics, linear algebra, and machine learning is either integrated into the body of the text, or for some advanced topics, covered in the appendices.

Since the chapters covering major data mining topics are self-contained, the order in which topics can be covered is quite flexible. The core material is covered in Chapters 2, 4, 6, 8, and 10. Although the introductory data chapter (2) should be covered first, the basic classification, association analysis, and clustering chapters (4, 6, and 8, respectively) can be covered in any order. Because of the relationship of anomaly detection (10) to classification (4) and clustering (8), these chapters should precede Chapter 10. Various topics can be selected from the advanced classification, association analysis, and clustering chapters (5, 7, and 9, respectively) to fit the schedule and interests of the instructor and students. We also advise that the lectures be augmented by projects or practical exercises in data mining. Although they are time consuming, such hands-on assignments greatly enhance the value of the course.

Support Materials The supplements for the book are available at Addison-Wesley's Website `www.aw.com/cssupport`. Support materials available to all readers of this book include

- PowerPoint lecture slides
- Suggestions for student projects
- Data mining resources such as data mining algorithms and data sets
- On-line tutorials that give step-by-step examples for selected data mining techniques described in the book using actual data sets and data analysis software

Additional support materials, including solutions to exercises, are available only to instructors adopting this textbook for classroom use. Please contact your school's Addison-Wesley representative for information on obtaining access to this material. Comments and suggestions, as well as reports of errors, can be sent to the authors through dmbook@cs.unm.edu.

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