Advanced Information and Knowledge Processing

Series editors

Lakhmi C. Jain
Bournemouth University, Poole, UK, and
University of South Australia, Adelaide, Australia

Xindong Wu
University of Vermont

Information systems and intelligent knowledge processing are playing an increasing role in business, science and technology. Recently, advanced information systems have evolved to facilitate the co-evolution of human and information networks within communities. These advanced information systems use various paradigms including artificial intelligence, knowledge management, and neural science as well as conventional information processing paradigms. The aim of this series is to publish books on new designs and applications of advanced information and knowledge processing paradigms in areas including but not limited to aviation, business, security, education, engineering, health, management, and science. Books in the series should have a strong focus on information processing—preferably combined with, or extended by, new results from adjacent sciences. Proposals for research monographs, reference books, coherently integrated multi-author edited books, and handbooks will be considered for the series and each proposal will be reviewed by the Series Editors, with additional reviews from the editorial board and independent reviewers where appropriate. Titles published within the Advanced Information and Knowledge Processing series are included in Thomson Reuters' Book Citation Index.

More information about this series at http://www.springer.com/series/4738

Zhengming Ding · Handong Zhao
Yun Fu

Learning Representation for Multi-View Data Analysis

Models and Applications

Springer

Zhengming Ding
Indiana University-Purdue
University Indianapolis
Indianapolis, IN, USA

Yun Fu
Northeastern University
Boston, MA, USA

Handong Zhao
Adobe Research
San Jose, CA, USA

ISSN 1610-3947 ISSN 2197-8441 (electronic)
Advanced Information and Knowledge Processing
ISBN 978-3-030-00733-1 ISBN 978-3-030-00734-8 (eBook)
https://doi.org/10.1007/978-3-030-00734-8

Library of Congress Control Number: 2018961715

This Springer imprint is published by the registered company Springer Nature Switzerland AG
The registered company address is: Gewerbestrasse 11, 6330 Cham, Switzerland

Preface

This book equips readers to handle complex multi-view data representation, centered around several major visual applications, sharing many tips and insights through a unified learning framework. This framework is able to model most existing multi-view learning and domain adaptation, enriching readers' understanding from their similarity and differences based on data organization and problem settings, as well as the research goal.

A comprehensive review exhaustively provides the key recent research on multi-view data analysis, i.e., multi-view clustering, multi-view classification, zero-shot learning, and domain adaption. More practical challenges in multi-view data analysis are discussed including incomplete, unbalanced, and large-scale multi-view learning. Learning representation for multi-view data analysis covers a wide range of applications in the research fields of big data, human-centered computing, pattern recognition, digital marketing, Web mining, and computer vision.

This book consists of ten chapters. Chapter 1 introduces the background and unified model of multi-view data representations. Part I, which includes Chaps. 2–4, introduces the unsupervised learning for multi-view data analysis. Chapter 2 presents the unsupervised representation learning methods for two multi-view scenarios. One is considering various data sources as multiple views. The other is considering different splits of one source data as multiple views. Chapter 3 addresses the more challenging and practical incomplete multi-view clustering problem. Chapter 4 introduces a novel outlier detection problem in multi-view setting and correspondingly proposes a multi-view outlier detection framework.

Part II, which includes Chaps. 5 and 6, presents the multi-view data analysis for supervised multi-view classification. Chapter 5 presents two multi-view classification models—one is dual low-rank decomposition multi-view subspace and the other is cross-view auto-encoder. Chapter 6 shows an adaptive latent semantic representation model in a sparse dictionary learning scheme for zero-shot learning (a special case of multi-view classification problem). Part III, which includes Chaps. 7–10, presents the multi-view data analysis for domain adaptation. Chapter 7 lists the missing modality transfer learning model to solve the problem when target modality is not available in the training stage. Chapter 8 discusses the multi-source transfer learning problem when all the sources are incomplete. Chapter 9 proposes three deep domain adaptation models to address the challenge where target data has limited or no label. Following this, Chap. 10 provides a deep domain generalization model aiming to deal with the target domain that is not available in the training stage while only with multiple related sources at hand.

In particular, this book can be used by these audiences in the background of computer science, information systems, data science, statistics, and mathematics. Other potential audiences can be attracted from broad fields of science and engineering since this topic has potential applications in many disciplines.

We would like to thank our collaborators Ming Shao, Hongfu Liu, and Shuyang Wang. We would also like to thank editor Helen Desmond from Springer for the help and support.

Indianapolis, IN, USA — Zhengming Ding
San Jose, CA, USA — Handong Zhao
Boston, MA, USA — Yun Fu
September 2018

Contents