

SpringerBriefs in Computer Science

Series Editors

Stan Zdonik, Brown University, Providence, RI, USA

Shashi Shekhar, University of Minnesota, Minneapolis, MN, USA

Xindong Wu, University of Vermont, Burlington, VT, USA

Lakshmi C. Jain, University of South Australia, Adelaide, SA, Australia

David Padua, University of Illinois Urbana-Champaign, Urbana, IL, USA

Xuemin Sherman Shen, University of Waterloo, Waterloo, ON, Canada

Borko Furht, Florida Atlantic University, Boca Raton, FL, USA

V. S. Subrahmanian, University of Maryland, College Park, MD, USA

Martial Hebert, Carnegie Mellon University, Pittsburgh, PA, USA

Katsushi Ikeuchi, University of Tokyo, Tokyo, Japan

Bruno Siciliano, Università di Napoli Federico II, Napoli, Italy

Sushil Jajodia, George Mason University, Fairfax, VA, USA

Newton Lee, Institute for Education, Research and Scholarships, Los Angeles, CA, USA

SpringerBriefs present concise summaries of cutting-edge research and practical applications across a wide spectrum of fields. Featuring compact volumes of 50 to 125 pages, the series covers a range of content from professional to academic.

Typical topics might include:

- A timely report of state-of-the art analytical techniques
- A bridge between new research results, as published in journal articles, and a contextual literature review
- A snapshot of a hot or emerging topic
- An in-depth case study or clinical example
- A presentation of core concepts that students must understand in order to make independent contributions

Briefs allow authors to present their ideas and readers to absorb them with minimal time investment. Briefs will be published as part of Springer's eBook collection, with millions of users worldwide. In addition, Briefs will be available for individual print and electronic purchase. Briefs are characterized by fast, global electronic dissemination, standard publishing contracts, easy-to-use manuscript preparation and formatting guidelines, and expedited production schedules. We aim for publication 8–12 weeks after acceptance. Both solicited and unsolicited manuscripts are considered for publication in this series.

**Indexing: This series is indexed in Scopus, Ei-Compendex, and zbMATH **

More information about this series at <http://www.springer.com/series/10028>

Chung-Chi Chen · Hen-Hsen Huang ·
Hsin-Hsi Chen

From Opinion Mining to Financial Argument Mining

 Springer

Chung-Chi Chen 
Department of Computer Science
and Information Engineering
National Taiwan University
Taipei, Taiwan

Hen-Hsen Huang 
Department of Computer Science
National Chengchi University
Taipei, Taiwan

Hsin-Hsi Chen 
Department of Computer Science
and Information Engineering
National Taiwan University
Taipei, Taiwan



ISSN 2191-5768 ISSN 2191-5776 (electronic)
SpringerBriefs in Computer Science
ISBN 978-981-16-2880-1 ISBN 978-981-16-2881-8 (eBook)
<https://doi.org/10.1007/978-981-16-2881-8>

© The Author(s) 2021. This book is an open access publication.

Open Access This book is licensed under the terms of the Creative Commons Attribution 4.0 International License (<http://creativecommons.org/licenses/by/4.0/>), which permits use, sharing, adaptation, distribution and reproduction in any medium or format, as long as you give appropriate credit to the original author(s) and the source, provide a link to the Creative Commons license and indicate if changes were made.

The images or other third party material in this book are included in the book's Creative Commons license, unless indicated otherwise in a credit line to the material. If material is not included in the book's Creative Commons license and your intended use is not permitted by statutory regulation or exceeds the permitted use, you will need to obtain permission directly from the copyright holder.

The use of general descriptive names, registered names, trademarks, service marks, etc. in this publication does not imply, even in the absence of a specific statement, that such names are exempt from the relevant protective laws and regulations and therefore free for general use.

The publisher, the authors and the editors are safe to assume that the advice and information in this book are believed to be true and accurate at the date of publication. Neither the publisher nor the authors or the editors give a warranty, expressed or implied, with respect to the material contained herein or for any errors or omissions that may have been made. The publisher remains neutral with regard to jurisdictional claims in published maps and institutional affiliations.

This Springer imprint is published by the registered company Springer Nature Singapore Pte Ltd.
The registered company address is: 152 Beach Road, #21-01/04 Gateway East, Singapore 189721, Singapore

*This book is dedicated to all contributors in
this field.*

Preface

Human being's behaviors are led by personal opinions and others' views. To explain and predict their behaviors, capturing the opinions is one of the possible approaches. As one of the important topics in the natural language processing (NLP) community, opinion mining, aka sentiment analysis, has attracted much attention in the past decade. Argument mining, an extension of opinion mining, has rapidly emerged as a hot research topic in recent years. Not only to capture someone's opinion, but also argument mining aims to investigate the reason behind the opinion. In the financial domain, argument mining can be applied to understand the public's expectations for the market, providing valuable information for investment and other close applications. However, no single silver bullet for opinion and argument mining can deal with all domain-specific challenges because each domain has its own characteristics, especially the highly specialized financial domain. To facilitate the development of the technologies and applications in the financial domain, this book gives an overview from coarse-grained sentiment analysis to fine-grained financial argument mining.

This book provides a foundation for newcomers to understand the challenges and methods in financial opinion mining and to indicate the road map for researchers to achieve professional-level financial opinion understanding. Because the financial market changes with the participants' behaviors (e.g., buying or selling), the opinions of market participants become a crucial clue when analyzing the movement of financial instruments' prices. In this book, we adopt the notions of argument mining for an in-depth analysis of the opinions of financial market participants. We first define financial opinion in terms of basic components, and then determine the structures within an opinion and among opinions. A survey shows where we are now with the introductions of both classical approaches in general opinion mining and the latest works in financial opinion mining. In particular, the recent advances in the deep learning approach have led to substantial progress in many areas of artificial intelligence such as NLP and FinTech. This book will cover the related cutting-edge technologies including numeracy understanding, argument mining and financial document processing. Several unexplored research questions and potential application scenarios are also presented in the research agenda, pointing out where we are going. We hope the insights of this book can inspire researchers in

both academics and industry, and further prompt them to join the field of financial argument mining.

Although this book is absorbed in financial opinions, the proposed concepts, which merge opinion mining and argument mining, can also be applied to other domains. We look forward to seeing new findings and more novel extensions based on the proposed ideas.

Taipei, Taiwan
April 2021

Chung-Chi Chen
Hen-Hsen Huang
Hsin-Hsi Chen

Acknowledgments This book was supported partially by the Ministry of Science and Technology, Taiwan, under grants Most 109-2218-E-009-014, MOST 109-2634-F-002-034 and MOST 110-2634-F-002-028.

Contents

1	Introduction	1
1.1	Opinion Mining and Sentiment Analysis	1
1.2	Financial Opinion Mining	3
1.3	Why Study Financial Opinion Mining?	5
1.4	Overview of the Book	6
	References	7
2	Modeling Financial Opinions	9
2.1	Opinion Components	9
2.1.1	Target Entity	9
2.1.2	Market Sentiment	10
2.1.3	Opinion Holder	11
2.1.4	Publishing Time and Validity Period	12
2.1.5	Market Information	12
2.1.6	Aspect	12
2.1.7	Elementary Argumentative Units	13
2.1.8	Opinion Quality	14
2.1.9	Influence	14
2.2	Argumentation Structure in Opinions	15
2.3	Argumentation Structure Among Opinions	16
2.4	Relations Among Opinions and Target Entities	18
2.5	Summary	20
	References	20
3	Sources and Corpora	21
3.1	Insiders	21
3.2	Professionals	25
3.3	Social Media Users	27
3.4	Journalists	29
3.5	Summary	29
	References	30

- 4 Organizing Financial Opinions** 35
 - 4.1 Component Extraction 35
 - 4.1.1 Target Entity and Opinion Holder 35
 - 4.1.2 Market Sentiment and Aspect 38
 - 4.1.3 Temporal Information 39
 - 4.1.4 Elementary Argumentative Units 41
 - 4.2 Relation Linking and Quality Evaluation 42
 - 4.3 Influence Power Estimation and Implicit Information Inference 46
 - 4.4 Summary 48
 - References 49

- 5 Numerals in Financial Narratives** 55
 - 5.1 Numeral Understanding 55
 - 5.2 Numeral Attachment 61
 - 5.3 Improving Financial Opinion Mining via Numeral-Related Tasks ... 65
 - 5.4 Summary 69
 - References 70

- 6 FinTech Applications** 73
 - 6.1 Information Provision 73
 - 6.2 Personalized Recommendation 79
 - 6.3 Improving Employee Efficiency 81
 - 6.4 Summary 83
 - References 84

- 7 Perspectives and Conclusion** 89
 - 7.1 Future Directions 89
 - 7.2 Conclusion 93
 - References 94