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Computational Trust Models and Machine Learning

Edited by

Xin Liu, Anwitaman Datta, and Ee-Peng Lim

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Computational Trust Models and Machine Learning

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Computational Trust Models and Machine Learning

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To my parents and my wife
— Xin Liu

Preface

Trust has implicitly played a vital role in human societies for eons. With the advent of the digital age, and the bulk of our day-to-day activities and interactions shifting online, there is a natural need to devise mechanisms to infer trust in the brave new cyberworld. Unlike a physical interaction, online interactions have many distinctive aspects, some of these hinder the decision-making process, while others may be harnessed to improve it. For instance, for e-commerce, our physical senses to inspect the goods are not applicable, nor are mechanisms to redress problems in a face-to-face interaction feasible, since the interactions may happen among geographically dispersed people. At the same time, digital footprints (say, of people's activities) may provide access to insight that has hitherto been unavailable in the physical world.

Trust is also inherently multifaceted. One may be trustworthy for certain aspects, and yet not be trustworthy in other aspects. This brings about the need to be able to discern the aspect on which trust is being determined, or the ability to translate or project trust from one aspect into another.

There is also an interesting duality between the trust one can build, guided by credible information, and ascertaining the credibility and trustworthiness of information one may find in an open system.

Trust has long been a subject of qualitative study among sociologists, and the insights from social science are relevant even in the digital domain. However, such studies fall short in several ways. Foremost, often, such a study is not directly useful in decision making. Secondly, the traditional approach for determining the necessary evidence to carry out the study and draw conclusions is both ineffective and arguably unnecessary. A plethora of data is readily captured for all sorts of electronic activities. There are arguably many challenges and few concrete answers yet, and this is natural — we are at the infancy of the digital age.

Nevertheless, the digital age has forced us to think of trust in a quantitative manner and to do so by pursuing a data-driven methodology. That is the underpinning of computational trust. And even though the techniques are arguably in their nascence, we have come a long way from the point where trust could be talked about only qualitatively. Machine learning and data mining techniques are natural tools which are shaping the study of computational trust, and in this book, we have tried to capture a representative set of such studies from several groups worldwide. Each chapter is an independent contribution from distinct research groups. We have aimed to cover several

ideas, but this book is definitely not an exhaustive survey. This treatment of the topic is thus more suitable as companion reading material for established researchers and novice graduate students getting introduced to the field, who wish to get a quick flavor of several disparate ideas under a broad umbrella. It should not be used as a reference textbook which has synthesized all the ideas and structured them systematically. Accordingly, barring the introductory chapter, the material can be read more or less in any order, since each chapter is reasonably self-contained.

Xin Liu from École Polytechnique Fédérale de Lausanne, Switzerland, has provided an introductory survey of the traditional treatment of computational trust which does not apply machine learning techniques. This chapter also provides a critical summary of some of the drawbacks with those approaches, thus paving the way for the use of more sophisticated but robust machine learning techniques. The chapter also introduces some very basic ideas from machine learning.

In Chapter 2, Athirai Aravazhi Irissappane and Jie Zhang, both from Nanyang Technological University, Singapore, provide a broad overview of how reputation-based systems are used to determine trust in diverse kinds of online communities, and how machine learning techniques are employed to build robust reputation systems.

Chapter 3 is contributed by Jeff Pasternack from Facebook, Inc., and Dan Roth from the University of Illinois at Urbana-Champaign. Chapter 4 is contributed by researchers from the Polish-Japanese Institute of Information Technology, namely, Adam Wierzbicki, Andrzej Kostański, Bartłomiej Balcerzak, Dominik Deja, Grzegorz Kowalik, Katarzyna Gniadzik, Maria Rafalak, Marta Juźwin, Michał Kąkol and Wiesław Kopeć, in collaboration with Xin Liu from École Polytechnique Fédérale de Lausanne, Switzerland. Both of these chapters explore ways to determine the credibility of resources, typically articles, but do so following two distinctive approaches. The former studies an automated, iterative learning process where human role is implicit, while the latter leverages human input explicitly by embracing crowd-sourcing to determine content credibility.

Chapter 5 by Mohammad Ali Abbasi, Jiliang Tang and Huan Liu from Arizona State University demonstrates how decision support can be facilitated by computational trust models. To that end, they elaborate collaborative filtering-based trust-aware recommendation systems.

Arguably, all the trust models essentially incorporate explicit and/or implicit human feedback to carry out and quantify the resulting trust value(s). However, human inputs are an artifact of their personal biases. Thus, there is a need to filter out outlying opinions, even while making sure critical red flags are not ignored. We conclude the book with Chapter 6, where Hady Wirawan Lauw from Singapore Management University brings us back full circle and investigates the objectivity of this feedback itself, so that the trust model manages to leverage credible feedback, and yet filter out the noise therein.

This rich coverage made compiling this book an enjoyable enterprise for the editors. We hope it also makes a compelling read for the audience.

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About the Editors

Xin Liu is a postdoctoral researcher at the Distributed Information Systems Laboratory (LSIR) of École Polytechnique Fédérale de Lausanne (EPFL). He earned his BSc from the College of Computer Science and Technology, Jilin University, China, and his PhD from the School of Computer Engineering, Nanyang Technological University (NTU), Singapore. In April 2012, he joined EPFL and works on the project *RecONCILE: Robust Online Credibility Evaluation of Web Content*. He also collaborates on other European projects such as PlanetData and Wattalyst. His research interests include recommender systems, trust and reputation and social computing. His papers have been accepted at high quality conferences and journals including the International World Wide Web Conference (WWW), AAAI Conference on Artificial Intelligence (AAAI), International Joint Conference on Artificial Intelligence (IJCAI), International Conference on Information and Knowledge Management (CIKM), International Conference on Autonomous Agents and Multiagent Systems (AAMAS), Electronic Commerce Research and Applications (ECRA), Computational Intelligence, etc.

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Contents

List of Figures xiii

List of Tables xv

Preface xvii

About the Editors xxi

Contributors xxiii

1 Introduction 1

1.1 Overview 1
1.2 What Is Trust? 2
1.3 Computational Trust 4
1.3.1 Computational Trust Modeling: A Review 4
1.3.1.1 Summation and Average 6
1.3.1.2 Bayesian Inference 7
1.3.1.3 Web of Trust 8
1.3.1.4 Iterative Methods 10
1.3.2 Machine Learning for Trust Modeling 11
1.3.2.1 A Little Bit about Machine Learning 11
1.3.2.2 Machine Learning for Trust 12
1.4 Structure of the Book 17

2 Trust in Online Communities 19

2.1 Introduction 19
2.2 Trust in E-Commerce Environments 20
2.3 Trust in Search Engines 25
2.4 Trust in P2P Information Sharing Networks 27
2.5 Trust in Service-Oriented Environments 31
2.6 Trust in Social Networks 33
2.7 Discussion 36

3 Judging the Veracity of Claims and Reliability of Sources 39

3.1 Introduction . . . 40
3.2 Related Work . . . 43
3.2.1 Foundations of Trust . . . 43
3.2.2 Consistency in Information Extraction . . . 44
3.2.2.1 Local Consistency . . . 44
3.2.2.2 Global Consistency . . . 44
3.2.3 Source Dependence . . . 45
3.2.3.1 Comparison to Credibility Analysis . . . 45
3.2.4 Comparison to Other Trust Mechanisms . . . 46
3.3 Fact-Finding . . . 46
3.3.1 Priors . . . 47
3.3.2 Fact-Finding Algorithms . . . 48
3.3.2.1 Sums (Hubs and Authorities) . . . 48
3.3.2.2 Average·Log . . . 48
3.3.2.3 Investment . . . 48
3.3.2.4 PooledInvestment . . . 49
3.3.2.5 TruthFinder . . . 49
3.3.2.6 3-Estimates . . . 49
3.4 Generalized Constrained Fact-Finding . . . 50
3.5 Generalized Fact-Finding . . . 50
3.5.1 Rewriting Fact-Finders for Assertion Weights . . . 51
3.5.1.1 Generalized Sums (Hubs and Authorities) . . . 51
3.5.1.2 Generalized Average·Log . . . 51
3.5.1.3 Generalized Investment . . . 52
3.5.1.4 Generalized PooledInvestment . . . 52
3.5.1.5 Generalized TruthFinder . . . 52
3.5.1.6 Generalized 3-Estimates . . . 52
3.5.2 Encoding Information in Weighted Assertions . . . 53
3.5.2.1 Uncertainty in Information Extraction . . . 53
3.5.2.2 Uncertainty of the Source . . . 53
3.5.2.3 Similarity between Claims . . . 54
3.5.2.4 Group Membership via Weighted Assertions 54
3.5.3 Encoding Groups and Attributes as Layers of Graph Nodes . . . 55
3.5.3.1 Source Domain Expertise . . . 56
3.5.3.2 Additional Layers versus Weighted Edges . . . 58
3.6 Constrained Fact-Finding . . . 58
3.6.1 Propositional Linear Programming . . . 58
3.6.2 Cost Function . . . 59
3.6.3 Values → Votes → Belief . . . 60
3.6.4 LP Decomposition . . . 60
3.6.5 Tie Breaking . . . 61
3.6.6 "Unknown" Augmentation . . . 61

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