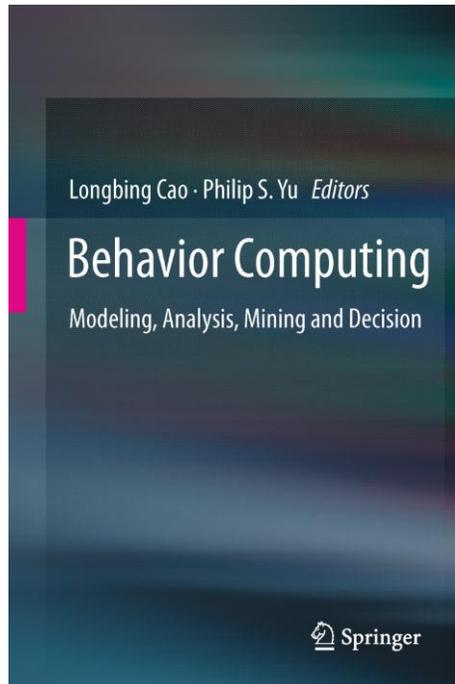# Behavior Computing: Modeling, Analysis, Mining and Decision

BY LONGBING CAO AND PHILIP YU (EDITORS) - ISBN: 978-1-4471-2968-4

REVIEWED BY SURESH SOOD

Erving Goffman, one of the most influential sociologists of the last century published the Presentation of Self in Everyday Life (PSEL;1959). This is the most definitive 20th century study of the patterns of human behavior in mundane social situations. If we look to psychology, sociology, anthropology, marketing or even organisational studies the representation of human behavior emerges from rich PSEL type "thick" qualitative descriptions. This approach is prevalent amongst the social sciences and does not provide a pathway to generalizable or predictive models of behavior. Furthermore, the availability of big data from social networks is pushing researchers and practitioners to undertake deep and dynamic behavioral analysis in the converging online and offline worlds.

Human behavior is made up of complex interdependencies not least of all because individuals convey actions using the multiple modes of voice, facial and eye movements, hand gesturing and body to interact on a social basis. The modeling and analysis of human behavior is giving rise to the new discipline of behavior computing integrating techniques from both computer science and social sciences. In this new field of behavior computing, a major distinction over previous behavioral research is a focus on online social networks and the Internet impacting behavior rather than the traditional experimental analysis of the behavior of animals and organisms. The field of behavior computing opens up the opportunity for breakthrough advances, discoveries and advanced knowledge to come from outside of social sciences.

"Behavior Computing" captures the transformation in the converging study of human behavior and computing. This book is a welcome addition alongside statistical, machine learning and cognitive neuroscience books. This book effectively contextualizes statistical
and machine learning tools in a series of 23 very interesting chapters embracing models, scenarios and case studies thematically connected with behavior computing. The end result is a highly presentable book for a wide-ranging audience inclusive of final year undergraduates or postgraduate students. However, the book requires familiarity with machine learning algorithms and analysis of large datasets and may just prove to be a catalyst for social scientists to leave behind existing pastures and embrace the field of behavior computing.

On a more descriptive basis, this book may aptly hold the title Behavior and Social Informatics Computing (BSIC) in line with the IEEE Computational Intelligence Society task force of the same name and chaired by Longbing Cao. This book covers similar ground with research methods sourced from a wide perspective. The book makes far less daunting the challenge of trying to make sense of writings from the different fields of social science, computer science, information systems and information science. Cao and Yu as editors have risen to the challenge of the diversity of studies captured by this book and make the ideas available to a wide community while trying to ensure somewhat a consistency in the different terminology by selecting studies capturing a body of research focusing on computing while taking into account human behavior.

While the book structure is in the four parts of behavior modeling, analysis, mining and applications, the reader likely benefits from starting with the last section (IV) focusing on decision making possibilities captured as six case studies of behavior applications and then cycling back to the beginning to gain a fundamental grounding in behavior representation. Each chapter contains a variety of references providing a springboard for further research in the field.

Before deep diving into the covers, Cao and Yu's book may well appeal to a wider audience than originally intended as the book offers new techniques for social media researchers. Consumers are generating big data in social media and researchers are seeking valuable insights amongst the oceans of noise. This book incorporates a variety of thinking on the capture of behavior characteristics in social media opening up the potential to harness social media big data by extracting valuable insights.

Behavior Computing recognizes the paucity of formal methods and techniques to represent behavior and commences with capturing the characteristics and dynamics of

modeling influential behavior in social media. Cao authors the SAPMAS (social activity process modeling and analysis system) ontology using a narrative knowledge representation language and user behavior representation. The contribution is clear, the formal modeling of social behaviors and model checking to analyze the social activity processes. This ontology chapter is a major first step towards the development of computer usable tools and predictive behavior models. A subsequent chapter contains learning from the capture of user behavior from a semi Markov model. Again, the importance of behavior representation is central using a model to display personalized information to a software package user.

Behavior analysis (section II) considers a personalized social event recommender system (P- SERS). This system uses social information in the community to model and give personal social recommendations to the target user. Again, the emphasis is clear and focus on behavior computing. The researchers incorporate the online group web buying website in Taiwan IHERGO for experimentation with 600,000 members to use personal social info for personal group buying recommendation. In contrast, academic database service providers benefit from the work using behavioral and psychological characteristics and adaptive learning mechanism of academics during information searching advice under situations of cognitive incompleteness. This research contributes to the creation of effective Q&A learning systems. The piece de resistance of this section if not the entire book is a chapter on scoring and predicting financial risk preferences. This chapter actually goes well beyond a focus on behavior analysis and provides the reader with a methodology for the development and implementation of a risk-scoring algorithm together with insight generation. The scoring algorithm generated with real data demographic attributes of individuals helps predict risk preference. The smarter decision making aspect of this work is we do have to ask risk related questions but instead by obtaining demographic information one can estimate if the individual is risk seeking

or risk averse. This is an important contribution as this eliminates the need to collect sensitive information online. Smart financial institutions are able to integrate the information directly into a CRM.

Behaviour mining (section III) sticks to the knitting commencing with a new trajectory pattern mining framework CCT (clustering clues of trajectories) using Foursquare or geo- tagged. The technique recognises the silent durations inherent within trajectories are clues of a movement behaviour reflected by spatial and temporal co located data points. Through clue aware trajectory similarity and a clue aware clustering algorithm to cluster similar trajectories into groups, CCT is able to discover trajectory patterns even if the trajectory captures only fragments of movement behavior. Overlapping with the work of CCT is individual movement behavior in secure environments with modeling and detection of suspicious activity. Patterns of suspicious behavior are captured from RFID tags and sensors. This chapter contains a typology of suspicious behavioral patterns. The method entails modeling the physical environment and applying suspicious patterns to the logs of RFID access. This data helps build a model of human activity and analyses the sequence of actions comprising harmful activity. Not unrelated in this section is the behavior modeling approach for unauthorized copying of large amounts of documents from digital library. In this context, anomaly detection builds on an understanding the simultaneous interest in a short space of time of the biographies of mathematicians, philosopher works and contemporary microbiology news is anomalous. In the context of the retail industry, the linking of behavioral patterns to personal attributes through re-mining of item associations provides the competitive retail industry with new marketing opportunities. This chapter provides a novel method for knowledge discovery from association mining. The contribution of this chapter goes well beyond an algorithm. The proof of concept enhances the research with a practical contribution while balancing with a theoretical contribution in terms of methodology. Retailers will

immediately benefit from policy implications e.g. caramel frappucino offered to male versus java chip chocolate. Furthermore, a retailer is able to test for the validity preferences of food items by time of day and nationality. A natural step for a retail chain is to use the technique to create stores and offers appealing to communities of different nationalities hidden within existing customers. Rounding out the body of knowledge is twitter user behaviour and data mining to discover or infer taxonomy from dynamic correlations in twitter user generated content.

Behavioral applications (section IV) are key to leveraging behavior intelligence and achieving smarter decision making across a variety of industries. Telecommunications and in particular mobile networks are a natural partner for behavior computing. Within mobile social networks, the mobile user interaction patterns change frequently and make the challenge of detecting changing patterns extremely difficult because humans have high degree of randomness in calling. To identify regularity in random behavior an initial chapter in this section presents a new method using network attributes to find periodicity in dynamic social networks. On a practical note, this work helps telcos develop business models and call plans in cellular comms based on behavior of mobile users. The total data set treated by the researchers is 5 million nodes and 400 million edges. Other useful aspects of this work inform an understanding of individuals within different time zones, bottlenecks, structural holes, and isolates. Another project mining the MIT Reality data set based on mobile call records provides assists with unwanted call detection. The same problem space is reviewed from a different perspective with the notion of the smart phone predicting the next call. The prediction of incoming calls has direct usage in call center workload prediction, social networks, calendar and voice spam. The smart phone researchers with just the context use a call prediction schedule based on caller behavior and history. The Holt-Winters method predict calls from frequent and periodic calls captured as a 5 tuple call record (date/start

time/type/caller id/talk-time) and use the call record for the next call. Other behavior computing applications are insightful covering handwriting recognition on mobile device, search behavior of medical students and software testing complete this book.

Currently, this book is the only dedicated book to explore behavior informatics and behavior computing on the bookshelf. The book is suitable reading for researchers, students and practitioners. The editors have managed to bring together a balance of theory and application in contemporary contexts. As the first of a kind in a newly emerging field, the book challenges others including early career researchers to develop and contribute deeper expertise in this inspiring area of behavior.

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