KSS 2018

The 19th International Symposium on Knowledge and Systems Sciences

25-27 NOVEMBER 2018
University of Tsukuba, Tokyo Campus, Japan

ABSTRACT BOOK

Abstract Booklet

The 19th International Symposium on
Knowledge and Systems Sciences
(KSS2018)

About This Publication

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Welcome Message from Conference Committee of KSS 2018

The annual International Symposium on Knowledge and Systems Sciences aims to promote the exchange and interaction of knowledge across disciplines and borders to explore the new territories and new frontiers. With over 18 years of continuous endeavors, at-tempts to strictly define the knowledge science may be still ambitious, but a very tolerant, broad-based, and open-minded approach to the discipline can be taken. Knowledge science and systems science can complement and benefit each other methodologically.

The First International Symposium on Knowledge and Systems Sciences (KSS2000) was initiated and organized by Japan Advanced Institute of Science and Technology (JAIST) in September of 2000. Since then, KSS2001 (Dalian), KSS2002 (Shanghai), KSS2003 (Guangzhou), KSS2004 (JAIST), KSS2005 (Vienna), KSS2006 (Beijing), KSS2007 (JAIST), KSS2008 (Guangzhou), KSS2009 (Hong Kong), KSS2010 (Xi'an), KSS2011 (Hull), KSS2012 (JAIST), KSS2013 (Ningbo), KSS2014 (Sapporo), KSS2015 (Xi'an), KSS2016 (Kobe) and KSS2017 (Bangkok) have been held successfully, with contributions by many scientists and researchers from different countries. During the past 18 years, people interested in knowledge and systems sciences have become a community, and an international academic society has existed for 15 years. This year KSS is held in Tokyo, Japan to provide opportunities for presenting interesting new research results, facilitating interdisciplinary discussions, and leading to knowledge transfer under the theme of "Knowledge Acquisition from Structured and Unstructured Data for Effective Social Implementation" during November 25-27, 2018. Four distinguished scholars deliver the keynote speeches which reflect those diverse features of KSS topics,

- Chonghui Guo (Dalian University of Technology, China), "Big Data Analytics in Healthcare: Data-driven Methods for Typical Diagnosis and Treatment Pattern Mining"
- Setsuya Kurahashi (University of Tsukuba, Japan), "Model-based Policy Making: Urban dynamics, Collaborative Learning and Family Strategy"
- Yoichi Motomura (Artificial Intelligence Research Center, National Institute of Advanced Industrial Science and Technology, Japan), "Toward Cyber Physical Innovation: Probabilistic Modeling for Real Field AI Applications"
- Thanaruk Theeramunkong (Sirindhorn International Institute of Technology, Thammasat University, Thailand), "Text Mining from Public Hearing Databases and Automatic Profile Generation from Online Resources"

KSS2018 received 54 submissions from Belgium, China, India, Indonesia, Japan, Sri Lanka, Thailand and Russia, and finally 20 submissions were selected for publication in the proceedings after a rigorous review process. The co-chairs of International Program Committee made the final decision for each submission based on the review

reports from the referees, who came from China, Japan, New Zealand, Thailand and USA. Besides the main track of KSS2018, we include special tracks; (1) 17 papers for KSS2018 Abstract Track / JSSI Special Track for Journal of Systems Science and Information, and (2) 5 papers for the special session "Knowledge and Risk Management for Electricity Trading Market".

The International Symposium on Knowledge and Systems Sciences (KSS2018): November 25-27, 2018. We received a lot of support and help from many people and organizations for KSS2018. We would like to express our sincere thanks to the authors for their remarkable contributions, all the Technical Program Committee members for their time and expertise review with the papers under a very tight schedule, and the Springer for their professional help in the publication. This is the third time that KSS proceedings are published as a CCIS volume by Springer after success of the 2016 publication. We greatly appreciate our four distinguished scholars for accepting our invitation to deliver keynote speeches at the symposium. Last but not least, we are very indebted to the local organizers for their hard work.

We were happy to experience the thought-provoking and lively scientific exchanges in the fields of knowledge and systems sciences during the symposium.

November 2018

Jian Chen, Tsinghua University, China
Yuji Yamada, University of Tsukuba, Japan
Mina Ryoke, University of Tsukuba, Japan
Xijin Tang, CAS Academy of Mathematics and Systems Science, China
Jiangning Wu, Dalian University of Technology, China

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Keynotes

Text Mining from Public Hearing Databases and Automatic Profile Generation from Online Resources

Professor Thanaruk Theeramunkong

Sirindhorn International Institute of Technology, Thammasat University, Thailand; Artificial Intelligence Association of Thailand

Abstract. Analyzing natural language texts helps us to obtain information or knowledge for various purposes. This talk firstly provides a short summary of the state of the art on research and development in natural language processing, including language characteristics, rule-based and statistical methodologies, as well as difficulties and challenges. Secondly, with the growing availability of fact-oriented and/or opinion-rich online textual contents, I present new opportunities and challenges of using text mining techniques to seek out and understand the facts and the opinions in our society. Thirdly, along with this trend, electronic public hearing information, incident information and personal activity logs are described and the potentials towards knowledge discovery are enumerated and two applications of social monitoring and personal profile generation are discussed. For the first task, from 2014 to 2015, during the National Reform Council, there have been an activity of reform-related public hearing in Thailand. The information was applied for analyzing Thai opinion on the country's reform process and topics for reforming. The second task is to gather online information related to individual activities/events for generating personal profiles. Such information can be used for characterizing individuals for expert recruiting or seeking. In the talk, I report the progress of our research works on these two tasks, including their potential use in the future.

Bibliography. Thanaruk Theeramunkong is currently a professor at School of Information, Computer and Communication Technology at Sirindhorn International Institute of Technology (SIIT) at Thammasat University, Bangkok, Thailand. He is the Program Director of Information and Communication Technology for Embedded Systems (ICTES) at TAIST Tokyo Tech, National Science and Technology Development Agency (NSTDA). He is also an Associate Fellow, Academy of Science, the Royal Society of Thailand. As a professional society, He is the president of Artificial Intelligence Association of Thailand. He serves as an academic committee to the Industrial Section, National Research Council of Thailand (NRCT).

He received his bachelor degree in Electric and Electronics Engineering, master and doctoral degrees in Computer Science from Tokyo Institute of Technology. He was a research associate at Japan Advanced Institute of Science and Technology in Japan and a MIS manager at C.P. Seven Eleven Public Co., Ltd. in Thailand. He got several awards, including the Very Good Research Award in engineering field from Thammasat University in 2008, 2009 and 2010. Recently, in 2014, he has received the National Outstanding Researcher Award in the field of Information Technology and Communication Arts. He also got several best paper awards from conferences and societies, including the Japanese Society for Artificial Intelligence, PAKDD workshops, and KICSS. In 2015, he also got a Gold Medal with the Congratulations of the Jury from the 43rd International Exhibition of Inventions of Geneva for the inventions of automatic semantic-based multi-document summarization and application to public hearing. His research interests are natural language processing, data mining, text mining, machine learning and applications to service science. He was an associate editor of the Institute of Electronics, Information and Communication Engineers (IEICE). He is a member of the Steering Committee of the Pacific-Asia Conferences on Knowledge Discovery and Data Mining (PAKDD) and a member of the Steering Committee of the Pacific Rim International Conferences on Artificial Intelligence (PRICAI). He is the author of more than 45 papers in a number of journals with impact factors and more than 130 conference papers.

Model-based Policy Making: Urban dynamics, Collaborative Learning and Family Strategy

Professor Setsuya Kurahashi

Chair of Doctoral Course Program in Systems Management Course, Faculty of Business Sciences, University of Tsukuba; Vice Chair of IEEE SMC Japan Chapter

Abstract. Many significant policies of our society and economy are determined by someone day after day. However, most of the plans have been discussed and decided based on past experiences and data. Many of them estimate policy effects by analyzing actual phenomena and data using statistical methods. For this method called evidence-based policymaking (EBP), this lecture proposes model-based policymaking (MBP). The MBP is designed with an agent-based model and data science techniques, and it also called as social simulation. The model-based approach enables to design realistic phenomena as a model and predict the effect on unfolding future events due to hypotheses or activities that are difficult to experiment using computer experiments. In the field of business and sociology, data analysis as an induction method and strategy planning as a deductive method are connected. In the lecture, I will introduce urban dynamics model, teaching model at school, analysis of education in a family using a genealogy in China during 500 years.

Bibliography. Setsuya Kurahashi is a professor at Graduate School of Business Sciences in University of Tsukuba. He received Ph.D. degree from University of Tsukuba, Japan, in 2001. In 2006, he joined University of Tsukuba. His research interests include social simulation, artificial intelligence, evolutionary computing, and

cultural anthropology. He is a member of IEEE, ESSA (European Social Simulation Association), SICE(The Society of Instrument and Control Engineers), JSAI(the Japanese Society for Artificial Intelligence) and so on. He was a guest researcher of University of Surrey (UK) in 2009, and University of Groningen (The Netherlands) in 2009, 2015.

Big Data Analytics in Healthcare: Data-driven Methods for Typical Diagnosis and Treatment Pattern Mining

Professor Chonghui Guo

Dalian University of Technology, China

Abstract. A huge volume of digitized clinical data is generated and accumulated rapidly since the widespread adoption of Electronic Medical Records (EMRs). These massive quantities of data hold the promise of propelling healthcare evolving from a proficiency-based art to a data-driven science, from a reactive mode to a proactive mode, from one-size-fits-all medicine to personalized medicine. Personalized medicine refers to tailoring medical diagnosis and treatment to the individual characteristics of each patient, which literally means the ability to classify individuals into subpopulations that differ in their susceptibility to a disease or their response to a specific treatment. While EMRs contain rich temporal and heterogeneous medical information that can be used for typical diagnosis and treatment pattern mining by big data analytics. Hence, this study will analyze different data types of EMRs in depth and design data-driven EMRs mining method, including data-driven typical diagnosis pattern extraction from multi-type data of EMRs, and data-driven typical treatment pattern extraction from multi-view of doctor orders. Specifically, for typical diagnosis pattern extraction, we first design three similarity measure methods for patient demographic, symptom, and laboratory examination information, then adopt similarity fusion method to generate a unified similarity and construct similarity network of patient hospital admission, next propose a patient diagnostic information similarity method by integrating patient hospital admission information, and finally

perform clustering algorithm to extract typical diagnosis patterns. For typical treatment pattern extraction, we first study automatic treatment regimen development and recommendation from the content view of doctor orders, then study typical treatment process extraction and evaluation from the sequence view of doctor orders, next study typical drug use pattern extraction and evaluation from the duration view of doctor orders, and finally propose a fusion framework for typical treatment pattern extraction from multi-view of doctor orders. Furthermore, all proposed methods have been validated on real-world EMRs of cerebral infarction dataset and MIMIC-III dataset.

Bibliography. Chonghui Guo is a professor at the Institute of Systems Engineering in Dalian University of Technology. He received his PhD at Management Science and Engineering in Dalian University of Technology in 2002. His research interests are data mining, knowledge management and business intelligence. He has been published more than 100 papers in academic journals such as IEEE Transactions on Knowledge and Data Engineering, IEEE Transactions on Systems, Man, and Cybernetics, International Journal of Production Economics, International Journal of Systems Science, Knowledge-Based Systems, and Expert Systems with Applications.

Toward Cyber Physical Innovation: Probabilistic Modeling for Real Field AI Applications

Professor Yoichi Motomura

Prime senior researcher, Artificial Intelligence Research Center, National Institute of Advanced Industrial Science and Technology, Japan

Abstract. Currently, the practical application of artificial intelligence is dramatically advanced by machine learning using real world big data. Industrial structure reform and the smart society called Society 5.0 are also expected to be realized. In this talk, real world application and the research projects on AI are introduced. Our social system is changing into a Cyber Physical System by AI and real world big data. For example, point of sales data (POS-data) is linked to the customer ID by the common point card system. Moreover, sensors in a store can capture a customer's behavior during shopping process. From phenomena of real world big data with high temporal and spatial resolution, phenomena can be represented by a probabilistic model that can be calculated, predicting risk, cost, benefit and making it possible to simulate. In our system, this computational process is realized by PLSA (Probabilistic Latent Semantic Analysis) and Bayesian networks.

We developed interactive digital signage systems and interactive vending machines driven by AI. These systems are being investigated in the use cases such as improvement of productivity of services such as management support and logistics optimization. The same framework can be utilized also child care and health promotion activities for local community support.

Bibliography. Dr. Yoichi Motomura is a prime senior researcher of Artificial Intelligence Research Center of the National Institute of Industrial Advanced Science and Technology.

He has expertise in machine learning, probabilistic inference algorithms on Bayesian networks, and their applications to user modeling and human behavior understanding and prediction from big data. He also conducts the national research projects on Artificial Intelligence as the leader. He is also a visiting professor at Tokyo Institute of Technology, Kobe University and the Institute of Statistical Mathematics.

Conference Overall Schedule

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10:40-11:10	Coffee/Tea Break (Room: 118)	
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15:10-15:40	Coffee/Tea Break	
15:40-16:40	Session 3: Modeling for Social Implementation (1)	Session 4: Knowledge Discovery in Business Applications
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16:50-17:50	Session 5: Modeling for Social Implementation (2)	Session 6: Knowldege Management in Health Field

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Tuesday, November 27, 2018 (Day 3)	
9:00-12:00	Scientific Visit

Detailed Schedule

Sunday, November 25, 2018 (Day 1)		
8:30-9:30	Registration	
9:30-9:40	Opening	
9:40-10:40	Keynote Speaker 1: Chonghui Guo	
10:40-11:10	Coffee/Tea Break (Room: 118)	
11:10-12:10	Keynote Speaker 2: Setsuya Kurahashi	
12:10-13:30	Lunch (Room: 116, 118)	
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	Consensus Model and Selection Process based on Trust Relationship	**Predictions for Electricity Trading Markets Using Nonparametric Techniques**
	Cuiping Wei, Shengli Li	Yuji Yamada, Setsuya Kurahashi, Nobuyuki Yamaguchi
	Some q-Rung Orthopair Fuzzy Dual Maclaurin Symmetric Mean Operators with Their Application to Multiple Criteria Decision Making	**Supply and Demand Balance Prediction Model of Electricity Futures Market**
	Jun Wang, Runtong Zhang, Li Li, Xiaopu Shang, Wezi Li and Yuan Xu	Setsuya Kurahashi, Yuji Yamada, Nobuyuki Yamaguchi
	Partner-seeking of Internet Car Enterprise based on Hesitant Fuzzy Linguistic Sets	**Supply-demand Balancing Experiment using Artificial Power Generator and Load Systems**
	Jie Wu, Lu Chen, Peng Li, Yongxiang Sheng, Qinfen Shi	Nobuyuki Yamaguchi, Yuji Yamada, Setsuya Kurahashi
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Sunday, November 25, 2018 (Day 1)

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	Yinxing Li and Nobuhiko Terui	Masako Murakami, Yuji Yamada
	Modeling the Heterogeneous Mental Accounting Impacts of Inter-shopping Duration	**Comparison Analysis of Corporate Governance for Japanese Institution between 2014 and 2016**
	Kazuhiro Miyatsu and Tadahiko Sato	Hiroaki Namiki
	The Impact of Online Reviews on Product Sales: What's Role of Supplemental Reviews	**A Methodology to Position Universities, Scientific Research Institutions and Enterprises' Efforts in a Technology Domain with a Patent Network Analysis: Case of the Electric Vehicle Domain**
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	Ruiqi Li	Yuan Xu, Xiaopu Shang, Hongmei Zhao, Runtong Zhang and Jun Wang
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Monday, November 26, 2018 (Day 2)	
8:30-9:30	Registration
9:30-10:30	Keynote Speaker 3: Yoichi Motomura
10:30-11:00	Coffee/Tea Break (Room 118)
11:00-12:00	Keynote Speaker 4: Thanaruk Theeramunkong
12:00-13:30	Lunch (Room 122)

	Parallel Sessions	
	Room: 119	Room: 120
13:30-15:10	**Session 7: Knowledge in Online Systems** **Chair: Jiang Wu**	**Session 8: Societal and Emergency Management** **Chair: Xijin Tang**
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	The Combination Feature of External Knowledge Components with Organizational Knowledge Base--A Patent-based Analysis on Global Top 100 Innovators	**The Improved Social Force Model and Its Simulation Research Considering Guiding Behavior of crowd evacuation**
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	Consumers' Social Learning about Videogame Consoles through Multiple Website Browsing	**The Use of Event-Based Modeling and System-Dynamics Modeling in Accident and Disaster Investigation**
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Monday, November 26, 2018 (Day 2)

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	Identifying Factors that Impact on the Learning Process of Sewing Workers on an Assembly Line	**Research on Forest Fire Processing Scheme Generation Method based on Belief Rule-Base**
	Thanh Quynh Le and Van Nam Huynh	Yan Xu, Ning Wang, Xuehua Wang, Zijian Ni, Huaiming Li and Xuelong Chen
	How Do You Reduce Waiting Time?	**Using Machine Learning Approaches to Identify the Core Technology Combinations in Rehabilitation Robot Area**
	Keiichi Ueda and Setsuya Kurahashi	Ming Li, Hongbin Yan
	A Risk Management Tool for Solar Power Businesses using Prediction Error Weather Derivatives	**CluMA-RP: A Novel Approach to Rating Prediction Based on Clustered Matrix Approximation**
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	Kansei Knowledge Extraction as Measure of Structural Heterogeneity	**An improved Short Pause based Voice Activity Detection using Long Short-Term Memory Recurrent Neural Network**
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17:30-17:50	**Closing session**	
18:00-20:00	**Banquet (La Croce)**	

Tuesday, November 27, 2018 (Day 3)

9:00-12:00	**Scientific Visit**

Abstract

Aiding First Incident Responders using a Decision Support System based on Live Drone Feeds.

Jerico Moeyersons[1], Pieter-Jan Maenhaut[2], Filip De Turck[3], Bruno Volckaert[4]

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Abstract: In case of a dangerous incident, such as a fire, a collision or an earthquake, a lot of contextual data is available for the first incident responders when handling this incident. Based on this data, a commander on scene or dispatchers need to make split-second decisions to get a good overview on the situation and to avoid further injuries or risks. Therefore, we propose a decision support system that can aid incident responders on scene in prioritizing the rescue efforts that need to be addressed. The system collects relevant data from a custom designed drone by detecting objects such as firefighters, fires, victims, fuel tanks, etc. The drone autonomously observes the incident area, and based on the detected information it proposes a prioritized based action list on e.g. urgency or danger to incident responders.

This paper presents the architecture of the framework and a prototype implementation and evaluation of a decision support system, responsible for digesting and prioritizing the large amount of contextual data captured at an incident site. The evaluation of the decision support system shows that the proposed solution works accurately in supporting incident responders in providing a sorted overview of the actions needed in real-time, with an average response time of 334ms on a less powerful device and 263ms on a powerful device equipped with a GPU.

Keywords: Disaster Management, Recommendation Systems, Decision Analysis and Decision Support Systems

Consensus Model and Selection Process based on Trust Relationship

Cuiping Wei[1], Shengli Li[2]

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Abstract: This paper focuses on a consensus approach and a selection process for the group decision making problems with fuzzy complement comparison matrices under the social network environment. Firstly, we build a trust relationship between decision makers by fusing the information from three aspects: social relation among decision makers, the decision maker' status, and his/her knowledge ability. Then a consensus model based on the trust relationship is investigated, and the feasibility of the model is proved theoretically.At last, the trust relationship is used to determinate the weights of experts, which is incorporated into aggregating the individual preference values and ranking alternatives. The effectiveness of the proposed method is further verified by a numerical example.

Keywords: Group decision making, consensus, trust relationship, fuzzy complement comparison matrix

Some q-Rung Orthopair Fuzzy Dual Maclaurin Symmetric Mean Operators with Their Application to Multiple Criteria Decision Making

Jun Wang[1], Runtong Zhang[1], Li Li[1], Xiaopu Shang[1], Wezi Li[2], Yuan Xu[1]

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Abstract: This paper investigates multiple criteria decision making (MCDM) with q-rung orthopair fuzzy information. Recently, some aggregation operators have been developed for q-rung orthopair fuzzy sets (q-ROFSs). However, the main flaw of these operators is that they fail to capture the interrelationship among multiple input arguments. The dual Maclaurin symmetric mean (DMSM) is an efficient aggregation function which can reflect the interrela-tionship among multiple input variables. Motivated by the dual Maclaurin symmetric mean (DMSM), we extend DMSM to q-ROFSs and propose some q-rung orthopair fuzzy dual Maclaurin symmetric mean operators. We also investigate the properties and special cases of these operators. Further, a novel approach to multiple criteria decision making (MCDM) is introduced. We apply the proposed method in a best paper selection problem to demon-strate its effectiveness and advantages.

Keywords: q-Rung Orthopair Fuzzy Set, Dual Maclaurin Symmetric Mean, q-Rung Orthopair fuzzy Dual Maclaurin Symmetric Mean, Multiple Criteria Decision Making

Partner-seeking of Internet Car Enterprise based on Hesitant Fuzzy Linguistic Sets

Jie Wu[1], Lu Chen[2], Peng Li[3], Yongxiang Sheng[4], Qinfen Shi[5]

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Abstract: Seeking an optimal partner is significant for enterprises, this is especially true in green-car, in which enterprises depend on one another to collectively complement each other's strengths and create more value. With the development of green-car technologies, intellectual property of core techniques, especially patents, play a vital role in the intensely competitive world. This research tries to apply an approach of HFLSs in order to assist Internet car enterprise in selecting its optimal partner. Through evaluating the patent value of five traditional car enterprises in China's green-car by HFLSs, we rank the enterprises and select the optimal partner for NIO. The result indicates that CHANA is the optimal partner for NIO. Overall, this study contributes to research on the choice of partners in Internet car enterprises, crystallize the significance of cooperation with the traditional car enterprise, evaluate the patent value of traditional car enterprises, and select the optimal partner for Internet car enterprises.

Keywords:

DEA Model for Two-Stage Networks with Feedback: An Improvement

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Abstract: Data envelopment analysis (DEA) is an approach for measuring relative performance of peer decision making units (DMUs) when multiple inputs and outputs are present. Network DEA has been developed to consider internal structures of DMUs. There are several network DEA modeling techniques, including non-cooperative and leader-follower approaches, and bi-level optimization in two-stage networks with feedbacks. Some network DEA models requires to solve a parametric linear program by a heuristic search over the parameter. Following the logic of Stackelberg game, we develop an improved the leader-follower models for two-stage network with feedbacks. The current study shows that the bi-level model with feedback in Liang, et al. (2011) can be directly solved by using two linear models, avoiding repeated computation and the precision problem caused by the iterative step size in the heuristic search of Liang, et al. (2011). Moreover, the leader-follower models in Liang, Cook, and Zhu (2008) can also be improved in a similar manner by removing the feedback variables from our models.

Constructions of Forecast based Strategies and Real-time Experiment Systems for Electricity Trading Market

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Abstract: The role of electric power exchanges is to offer platforms of meeting sell and buy orders for delivering fixed amount of electricity to cover the actual demand of end-users during a given time interval. In such an environment, it is important to predict the amount of demand and supply between end-users and power generation resources as accurate as possible, since electricity cannot be stored and has to be consumed at the same time as its generation. If prediction error exists and is large, there may be a significant gap between the scheduled power output and the actual demand, leading to the difficulty of applying balancing control to stabilize the power frequency and voltage. The objective of this project is to investigate knowledge and risk management techniques for electricity trading market based on mathematical modeling, statistical and optimization techniques, agent-based simulations and supply and demand balancing experiment with artificial power generator and load system. Note that this project is supported by Grant-in-Aid for Scientific Research (A) 16H01833 from Japan Society for the Promotion of Science (JSPS).

Keywords: Knowledge and risk management, Electricity trading, Spot and forward markets, Agent-based simulations, Power generator and load system experiment, Capacity market

Predictions for Electricity Trading Markets Using Nonparametric Techniques

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Abstract: Accelerated by liberalization of retail electricity markets, the trading volumes of electric power-exchanges have been increasing. Using such power exchange market, electricity retailers can buy electricity for end-users (i.e., consumers) from power generation companies, whereas they may suffer from uncertainty of, e.g., fluctuations of spot prices and future demand of end-users. In this work, we propose a prediction method for electricity price traded in the exchange market using nonparametric techniques. To the end, we decompose the log-price process of electricity spot price into the trend function and its residual using a nonparametric regression and a state space representation, where we apply the so-called generalized additive model (GAM) to take seasonal, long-term, and day-of the week effects into account. Then, we estimate a predicted value of the electricity price based on conditional expectation of residual process. Also, we apply the same technique for estimating the future demand of end-users for electricity retailers. We illustrate our proposed methodology based on the empirical data and discuss the accuracy for predicted values of electricity prices and consumptions.

Keywords: Knowledge and risk management, Electricity trading, Predictions of spot electricity price and consumptions, Non-parametric techniques, Supply and demand

Supply and Demand Balance Prediction Model of Electricity Futures Market

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Abstract: In this research, we propose a model for analysing the effect and impact of introducing the electricity futures market in the liberalised electricity market. Total liberalisation of electricity retailing in Japan has begun since 2016. It is expected that the market principle will promote price trading by trading electricity on the market and cheaper power supply will be possible. On the other hand, a long-term sales contract is required in order to supply electricity at a stable price. Therefore, in order to clarify how the electricity futures market will affect the spot market traded at the Japan Electric Power Exchange, we have constructed an artificial electricity market that modelled both. Based on the experimental results, the impact on price due to the introduction of the futures market was recognized in the Forward market, but it was minor. On the other hand, it was confirmed that the impact on the quantity exists both in the Spot market and in the Forward market. According to the annual transaction trend observation, we can see the tendency to anticipate and absorb the seasonal variation in the futures market. As a result, it became clear that the influence of the seasonal fluctuation component to the market before time was reduced.

Keywords: Electricity trading, electricity future market, electricity price, artificial electricity market

Supply-demand Balancing Experiment using Artificial Power Generator and Load Systems

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Abstract: In the wholesale electricity market, market participants consider the electric power transactions determined in the power exchange, and prepare the operation plan of the own power plants. The General Transmission and Distribution Operators aggregates these power supply operation plans and secures power supply and demand. Therefore, at the previous day, it is impossible to set up an accurate power operation plan using the contract results in the market. As a result, there is no choice but to rely on securing the supply capacity of that day. This causes raising the procurement cost or deteriorating the accuracy of frequency adjustment.
Therefore, this research examines how the results of wholesale power trading will affect the operation of electric power system through experiments using simulated power plants and simulated load devices. The procurement cost is determined from the cost calculation of the power operation plan, and the result of the frequency adjustment is obtained by actual machine experiment.

Mathematical Modeling of Investment Strategy in Electricity Markets with Capacity Mechanism

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Abstract: We present an optimization problem of investment strategy in electric power generation that incorporates capacity payment mechanism and stochastic fluctuation of electricity prices. A firm tries to optimize the timing of investment, and at the same time, the firm sells a part of the capacity in the capacity market to reduce future uncertainty of revenues obtained from electricity markets. When the price dynamics follows geometric Brownian motion as in standard real option analysis and the firm maximizes the mean-variance utility, we show that the optimal strategy is to invest when the electricity price first reaches certain threshold price. We also argue the impact that model parameters have on the threshold price and the optimal size of selling capacity. When the price volatility and risk averseness of the firm are high, the firm sells more capacity in the capacity market to reduce revenue uncertainty. On the other hand, the firm does not use capacity market at all when the above parameters are low enough. These findings provide useful knowledge to resolve the missing money and the missing market problems.

Keywords: Electricity market, Capacity mechanism, Missing money, Optimal investment, Risk aversion

Social Media and the Diffusion of an Information Technology Product

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Abstract: The expansion of the Internet has led to a huge amount of information posted by consumers online through social media platforms such as forums, blogs, and product reviews. This study proposes a diffusion model that accommodates pre-launch social media information and combines it with post-launch sales infor-mation in the Bass model to improve the accuracy of sales forecasts. The model is characterized as the extended Bass model, with time varying parameters whose evolutions are affected by the consumer's communications in social media. Specifically, we construct variables from social media by using sentiment analy-sis and topic analysis. These variables are fed as key parameters in the diffusion model's evolution process for the purpose of plugging the gap between the time-invariant key parameter model and that of observed sales. An empirical study of the first-generation iPhone during 2006 and 2007 shows that the model using additional variables extracted from sentiment and topic anal-ysis on BBS performs best based on several criteria, including DIC (Deviance Information Criteria), marginal likelihood, and forecasting errors of holdout sam-ples. We discuss the role of social media information in the diffusion process for this study.

Keywords: Hierarchical Bayes Model, Social Media Data, Text Analysis, Time Varying Parameter, Topic Model

Modeling the Heterogeneous Mental Accounting Impacts of Inter-shopping Duration

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Abstract: Unlike the principles of traditional economics that substitution possibility holds for goods with monetary equivalency, mental accounting elaborates these goods would have different criteria values to consumers depending on purposes of its use and circumstances at purchase. Based on modeling of inter-shopping duration that accommodates mental condition changes captured by newly formulated latent variable, i.e. mental loading, our research primarily intends to reveal how consumer's mental factor impacts purchase behavior. Viewing from behavioral economics, the research attempts to model consumer purchase behaviors that are seemingly irrational from traditional economics viewpoints. The model is derived from the threshold-based modeling framework that incorporates consumer heterogeneity in a hierarchical Bayesian manner, and modeling parameters are estimated using Markov Chain Monte Carlo (MCMC) method. Empirical studies have been exploited with scanner panel data of a retailer store, and results indicate our model outperforms by having consumer mental condition changes into consideration at purchase.

Keywords: Mental accounting, Inter-shopping duration, Threshold-based model

The Impact of Online Reviews on Product Sales: What's Role of Supplemental Reviews

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Abstract: As the new form of online reviews, supplemental reviews have attracted the attention of many scholars. Considering current studies do not take full consideration on the content of reviews, the study goes better maturely and thoroughly on all information in supplemental reviews. In detail, sentiments of supplemental reviews in terms of different features corresponding to product, service and logistics are quantitatively analyzed. Except for the sentiments of reviews, other important factors including the volume of supplemental reviews, price, and ratings are introduced into the designed log-linear regression model for estimation. To explore the impact of supplemental reviews on product sales, an empirical study is conducted. The selected product with high involvement is mobile phone covering 32 products. The related sales as well as initial reviews and supplemental reviews are crawled from tmall. com for experiments. The period of data is from July 5, 2018 to July 24, 2018. By regression analysis, the results show that the sentiments of product features in both initial reviews and supplemental reviews and the sentiments of logistics features in supplemental reviews have significant positive impact on product sales. The volume of supplemental reviews has a negative impact on product sales. Compared with initial reviews, the impact of sentiments of product features on sales in supplemental reviews is greater.

Keywords: Online reviews, Supplemental reviews, Sales, Sentiment analysis

Influence of Financial Capital on Strategic Acquisitions

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Abstract: In this research, we will clarify the influence of acquisition method on fund acquisition procurement results. In order to control the growth possessed by the companies to be analyzed, we propose a method to analyze the Propensity Score Matching(PSM) and the Difference-in-difference (DD) to compare the group of companies (treatment group) who conducted accounting treatment on acquisitions from March 2000 to December 2016 in accordance with Japan Standards, US Standards, International Financial Reporting Standards with the group of companies (control group) that did not acquire during the same period using the average treatment effect (ATE) as an indicator. The results of these analysis did not show continuous profitability improvement as the acquisition achievement. The reason why profitability improvement did not appear was caused by the debt for corporate economic activity, not by the financing for acquisition. It was contained originality that we found the trend that borrowing dependence increased after acquisitions. As the debt ratio raised, the corporate value raised because the capital cost decreased. However, if the liability ratio became too large, it would be necessary to add financial risks such as not being able to repay the loan due to decline in business. In this research, because the debt ratio did not show significant changing before the acquisition, there was no outstanding results neither the corporate value nor the financial risk.

Keywords: Knowledge management on strategic acquisition, Financing, Debt ratio, Propensity score matching, Difference-in-difference

Comparison Analysis of Corporate Governance for Japanese Institution between 2014 and 2016

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Abstract: The Japanese Stewardship code established in 2014 and Japanese Corporate Governance code established in 2015, sets out the rules regarding whistle-blowing, disclosures, and stakeholders' rights and many other initiatives. With this, the recent changes in the structural changes of management became the focus with various initiatives and the need to explore if this structural changes are catalyst for higher performance and enhancing corporate value for the firm. One focus of the corporate governance code is the company's board of directors, including its composition and responsibilities. According to the code, "the board should be well balanced in knowledge, experience and skills in order to fulfil its roles and responsibilities, and it should be constituted in a manner to achieve both diversity and appropriate size". Furthermore, "the independent directors should fulfil their roles and responsibilities with the aim of contributing to substantial growth of the company and increasing corporate value over the medium to long term. Company should, therefore, appoint at least two outside independent directors who sufficiently have such qualities". In addition to this, the appointment of the female outside independent director had become the focus with view point from diversity in the management structure especially traditional Japanese firm hardly had any female appointed as director. This paper analyzes the Japanese firm performance using Tobin's Q between 2014 and 2016 to understand the effect of setting up the corporate governance actually improve firm performance and corporate value or not.

Keywords: Corporate Governance, Outside independent director owing stock, Female member on the board, Medium term outside independent director reside period, Small board size

A Methodology to Position Universities, Scientific Research Institutions and Enterprises' Efforts in a Technology Domain with a Patent Network Analysis: Case of the Electric Vehicle Domain

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Abstract: The patent activities of universities, scientific research institutions and enterprises have become an important part of the national technology strategy. Some nations invest heavily in a technology domain and offer many subsidies, it makes sense to know where the nation's universities, scientific research institutions and enterprises are currently in the domain and to know where other nations' are as well. This paper presents a method to position universities, scientific research institutions and enterprises' efforts in a technology domain, and to identify their roles in EV patentees' cooperation. The method builds two networks, one is a network of International Patent Classifications (IPCs) based on their co-occurrence in patent applications, another is a network of patentee cooperation based on their co-occurrence in patent applications. We applied the proposed method to position the efforts that have been spent in the electric vehicle (EV) technology domain by universities, scientific research institutions and enterprises in four important nations (i.e., mainland China, Germany, Japan, and the United States), and to identify their roles in EV patentees' cooperation.

Keywords: Patent network analysis, University, Scientific research institution, Enterprise, Technology domain, Electric vehicles

The Effect of Cognitive Trust on Team Performance: A Deep Computational Experiment

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Abstract: This paper's purpose is to investigate the formation patterns of cognitive trust, the mechanisms by which it functions, and the characteristics of its influence on team performance. Toward this end, we present herein a deep computational experi-ment. We argue that a knowledge-intensive team is a complex adaptive system and that knowledge transfer in interpersonal interaction mediates between cogni-tive trust and team performance. Agent-based artificial teams, as a possible alter-native form of real teams, are built in a computer, which acts as an experimental laboratory for investigating team activities. In particular, the modeling deeply penetrates internal psychological activities. A deep computational experiment is conducted under different internal and external conditions for the artificial team, yielding the following results. (1) Cognitive trust contributes to better team per-formance, while negative cognitive trust leads to worse team performance. (2) Simple and moderate tasks improve the formation of positive cognitive trust, while difficult tasks increase the formation of negative cognitive trust. The study method and findings presented herein are appropriate for other studies focusing on psychological effects on team, laying the foundations for new ideas for study-ing team building and team development.

Keywords: Cognitive trust, Team Performance, Deep Computational Experiment, Knowledge Transfer, Interpersonal Interaction

Simple Spatial Scaling Rules behind Complex Cities

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Abstract: Although most of wealth and innovation have been the result of human interaction and cooperation, we are not yet able to quantitatively predict the spatial distributions of three main elements of cities: population, roads, and socioeconomic interactions. By a simple model mainly based on spatial attraction and matching growth mechanisms, we reveal that the spatial scaling rules of these three elements are in a consistent framework, which allows us to use any single observation to infer the others. All numerical and theoretical results are consistent with empirical data from ten representative cities. In addition, our model can also provide a general explanation of the origins of the universal super- and sub-linear aggregate scaling laws and accurately predict kilometre-level socioeconomic activity. And the theoretical analysis method is original which is based on growth instead of mean-field assumptions. The active population (AP) concept proposed by us is another contribution, which is a mixture of residential and working populations according to the duration of their activities in the region. AP is a more appropriate proxy than simply residential population for estimating socioeconomic activities. The density distribution of AP is $\rho(r) \propto r^{\wedge}(-\beta)\ (R\_t^{\wedge}(1+\beta) - r^{\wedge}(1+\beta)) \sim r^{\wedge}(-\beta)$ which can also reconcile the conflict between area-size allometry and the exponential decay of population from city centre to urban fringe found in the literature. Our work opens a new avenue for uncovering the evolution of cities in terms of the interplay among urban elements, and it has a broad range of applications.

Keywords: spatial scaling, urban system, scaling law, dynamic model, active population

How Commission-based Reward System Affects the Unethical Behavior of Salesperson?

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Abstract: Unethical behavior in various fields becomes the society. There are various definitions of the unethical behavior. In this paper, the definition of unethical behavior proposed by Kurland (1995) is used since her research examined the impact of commission reward system on unethical behaviors. This study examines the relationships between unethical salespersons' behavior and the organizational factors, the environmental factors, product factors in the life insurance industry. In order to explore the relationships between those factors, the agency theory and self-regulation theory and personal characteristics related to unethical behaviors and Machiavellianism are employed. The developed model consists of hypothesizes between the latent variables, which is presented as a confirmatory factor analysis. We conducted questionnaire surveys to salespersons who are working at the Japanese insurance companies or the foreign-owned company. Hypothesis testing by the proposed model is performed and the result provides as fit to the whole data or even better fit to data using multiple samples by the demographic, and show us how commission-based reward system affects the unethical behavior of salesperson.

Keywords: Unethical behavior, performance-based reward system, Agency Theory, Self-regulation theory, Machiavellianism, Structual Equation Modeling

Mining Typical Drug Use Patterns based on Patient Similarity from Electronic Medical Records

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Abstract: Drug use is an important part of patient treatment process to cure and prevent dis-ease, following the strict application guidelines of clinical drugs. The availability of free and massive patient electronic medical records (EMRs) provides a new chance to mine drug use patterns by designing automatic discovery methods. In this paper, we propose a data-driven method to mine typical drug use patterns from EMRs. Firstly, we use a set of quintuple to define drug use distribution fea-ture (DUDF) for each drug and represent patient treatment record with DUDF vector (DUDFV). Then we design a similarity measure method to compute the similarity between pairwise patient treatment records. Next we adopt affinity propagation (AP) clustering algorithm to cluster all patient treatment records, ex-tract typical drug use patterns including typical drug use set, typical drug use day set, and the DUDF of each typical drug, and further evaluate and label typical drug use patterns with demographic and diagnostic information. Finally, experi-mental results on a real-world EMR data of sepsis patients show that our ap-proach can effectively extract typical drug use patterns and develop standard treatments for patients based on their demographic and diagnostic information.

Keywords: Medical data miming, Typical drug use patterns, Similarity measure, Electronic medical records

The Characteristics of Service Efficiency and Patient Flow in Heavy Load Outpatient Service System

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Abstract: In China's heavy load hospitals, the number of patients is far exceeding the hospital's service resources, and the hospital's outpatient system is usually much more complicated so that patients need to go through multiple stages to see doctors. In this study, based on the exploratory data analysis, we analyze the relationship among physician's service efficiency, the length of patient queue and the patient waiting time. The result indicates that the physicians' service efficiency has a positive correlation with the length of patient queue. The study also reveals that there is a certain correlation among the number of registered patients, the trend of change in the efficiency of doctor services, and the queue length of patients' wait in a day, and there is an effect of time lag among them, which could affect the efficiency of the treatment of the following stages by adjusting the treatment efficiency of the former stages. This work is aimed at the research of heavily loaded hospital outpatient systems. It is a result of exploratory data analysis on a large amount of real data and the relationship among the three variables mentioned above can assist the hospital in making decisions to some extent.

Keywords: Large Hospital, Outpatient System, Service Efficiency, Patient Flow, Data Driven

Modeling Wicked Problems in Healthcare using Interactive Qualitative Analysis: The Case of Patients' Internet Usage

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Abstract: Wicked problems are embedded with attributes such as lack of understanding, 1 multiple stakeholders' involvement in solution implementation and the lack of opportunity of undoing the solution implemented. Hence, a robust methodology is required to understand its nature. Interactive Qualitative Analysis (IQA) is a systems method that caters to the need of understanding the phenomenon while also provisioning means to understand different stakeholders' perceptions of the phenomenon. This study demonstrates the use of IQA in understanding a wicked problem in healthcare sector dealing with patients' internet usage. Our analysis reveals that patients elicit the need of the internet in three new realms, namely, hospital choice, physician choice, and online support services, which were not apparent in previous studies on the same context. The study's findings provide insights that could lead to development of strategies for meta-services within healthcare sector involving information dissemination for patients through the internet.

Keywords: Wicked problems, Interactive Qualitative Analysis, Patients' internet usage, Healthcare

When We Talk About Medical Service, What Do We Concern? A Text Analysis of Weibo Data

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Abstract: In the information age, people are spending increasing time and energy to search and involve in health topics. And processes in social network offer new ways of investigating public opinion on this topic. However, when we are talking about medical service, what do we concern? The deterioration of doctor-patient relationship? The medical insurance policy? Or the medical achievements we have got? Understanding hot topics of medical issues and its dynamic changes help us to guide a healthy doctor-patient relationship and maintain a stable online public opinion environment. In order to figure out the question, we collected the Weibo tweets about medical information and then extracted the subjects by LDA model. Due to the feature sparsity and semantic fuzziness of short texts, this paper extended the features by using Word2vec. Finally, we summarized 14 hot subjects of medical service and analyzed the dynamic change of subjects' frequency and emotion. We find that most of the subjects are related to the medical system reform and the doctor-patient relationship. What's more, public's attitude to medical issues is gradually becoming growing positive.

Keywords: Medical Service, Subject Extraction, Feature Extension, Weibo

How individuals' Activity Influence Opinion dynamics in online social network

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Abstract: In many social systems the interactions among the individuals are rapidly changing and are characterized with timing. The dynamic nature of social interaction has great impacts on the development of the participants' opinions. To cope with the intrinsic dynamics of the underlying interactive network, in this paper we investigate a bounded-confidence-based opinion-dynamic model on such activity-driven social networks, to examine how the different types of activity distributions may affect the dynamics of public opinions. Simulative results reveal that the transition point of the confidence bound between the polarization and the consensus would be 0.6 when the distribution of the individuals' activities complies with the power-law, while it becomes 0.4 if the activities obey a normal distribution. In the process of opinion formation, the distribution of opinion clusters' scales approximates the power-law distribution. Especially, under the power-law distribution the opinion disparity of the two clusters in the polarization state is lower than that under other distributions, indicating that the burstiness of the activities propels the convergence of opinion clusters. Finally, we show that the speed to reach the stationary state is influenced by the type of activity distribution.

Keywords: Activity-driven Network, Temporal Network, Opinion Dynamics

The Combination Feature of External Knowledge Components with Organizational Knowledge Base--A Patent-based Analysis on Global Top 100 Innovators

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Abstract: Invention can be regarded as the recombination of knowledge components. For organizations, rational utilization of knowledge components from the outside of organizational existing knowledge base has been a matter of concern. Different from prior studies that focused on attributes of external knowledge components, this study aims to find out if there are some common features of the combination between external knowledge components and existing organizational knowledge base of. The organizational knowledge base was regarded as a network in which each node represents for one knowledge component, and lines between nodes means that the corresponding knowledge components have been once combined to make the invention. The attachment behavior of network new nodes shows exactly how organizations combine external new knowledge with existing knowledge base. And patent data was used to structure the knowledge network where each classification code presents for one network node and nodes are connected once they appear in one patent. We chose the Global Top 100 Innovators as research objective. Three combination features of newly adopted knowledge components were found: (1) Some newly-adopted external components don't have combination with existing ones. And the rate of this kind knowledge decrease with the enterprise develops; (2) Components with combination to existing ones have a preferential attachment to core knowledge components; (3) New components combining with non-core components are better utilized in subsequent research and development than those combining with core components.

Keywords: Recombinant invention, Organizational knowledge base, Patent Data, Complex network

Consumers' Social Learning about Videogame Consoles through Multiple Website Browsing

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Abstract: This research examines the micro-level correlation between traditional marketing actions (TV ads and public relations) and consumers' social learning about newly launched videogame consoles (Wii and PS3 in 2006). We propose consumers' learning processes via perusal of information in online communities, by using "pageview" data of multiple websites from a clickstream panel as indicators. We propose a bivariate Bayesian learning model combined with complementary purchase choices. The proposed model enables simpler estimation of parameters and allows for detailed information about interaction between social and personal learning processes. From results we find empirical evidence that companies' traditional marketing actions have a larger impact on social learning than on regular personal learning, during the pre-launch period. When consumers make purchase decisions, their social beliefs of product quality are weighted at least three times more than their personal beliefs. Counterfactual simulations suggest that by optimizing marketing actions, firms can enhance consumers' learning and promote higher engagement of the products.

Keywords: On-line Social Learning, Videogame, Bivariate Learning, Complementary Choice, Clickstream Data

The Role of Peripheral Participants in Online Knowledge Collaboration

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Abstract: Knowledge collaboration in online communities often involves a significant proportion of peripheral participants who make only scant contributions to their communities. This has become a pervasive characteristic of collaborative work organized through this new form. However, there is ambiguity regarding the role of peripheral participants in knowledge collaboration in online communities. In this study, we probe the indirect influence of peripheral participants' contributing behaviors on the quality of knowledge collaboration. We propose the following two-step causal path: 1) peripheral participants' participation causes core members to increase contributions and 2) the additional contributions of core members that result from peripheral participants' participation substantively improves the quality of knowledge collaboration. Using the edit data of featured articles in the Chinese Wikipedia, we examine the proposed causal path. The main findings of this study are as follows: the productivity of core members of a Wikipedia article increases when they are triggered by peripheral participants' editing activities; the additional edits of core members triggered by peripheral participants can improve the quality of an article; and peripheral participants play a major role in reviving the editing work of dormant articles. These findings reveal that peripheral participants play a substantial role in knowledge collaboration in online communities, as their contributing behaviors sustain collaborative work and eventually improve the quality of outputs.

Keywords: Knowledge collaboration, Online community, Peripheral participants, Roles, Organizing form, Chinese Wikipedia, Featured articles

Generating Risk Maps for Evolution Analysis of Societal Risk Events

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Abstract: The development of societal risk events has been heavily concerned by the government and pubic. Faced with ever-increasing information, people struggle to follow the evolution of societal risk events. In order to identify the evolution of societal risk events, this paper presents an improved algorithm based on the method of generating information maps. One real-world case is illustrated and the evaluation is given to demonstrate the effectiveness of our improved method. Research on the evolution analysis of societal risk events is meaningful, which could be used for post-operation analysis, decision-making process for government management.

Keywords: Risk maps, evolution analysis, HNSW, societal risk events

Modeling Method of Concurrent Emergency Chain based on Bayesian Network

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Abstract: In realistic circumstances, because of the similarities between the hazard factors and their affected objects in different emergencies, the occurrence of initial emergencies is likely to trigger the concurrence and coupling of multiple secondary emergencies, which makes the evolution of emergencies more uncertain. However, the existing emergency chain evolution analyses mostly used serial emergency chains, which is less applicable to concurrent emergencies. In view of the above problems, this paper presents a modeling method of concurrent emergency chain based on Bayesian Network to model the parallel evolution of concurrent emergencies. Firstly, emergency is described as a complex system composed of input, state, output attributes and the mutual influence relationships between them. And the causality and coupling relationships between emergencies are analyzed and defined on attribute level. Secondly, Bayesian network is applied to represent a single emergency formally. Based on the defined causality and coupling relationships between emergencies, the identification method of the causality and coupling relationships between single emergency Bayesian networks, the association method of concurrent emergency Bayesian networks, and the concrete construction method of the Bayesian network on concurrent emergency chain are put forward. Thirdly, the reasoning algorithm and its complexity and feasibility of the constructed concurrent emergencies Bayesian network are discussed. Through the Bayesian network reasoning process, the evolution analysis of concurrency emergencies can be realized in case of the prior probabilities between network nodes are obtained based on historical data analysis. Finally, an example is taken to verify the scientificalness and effectiveness of the proposed methods.

Keywords: Emergency Chain, Concurrent Emergencies, Coupling Effect, Bayesian, Network

The Improved Social Force Model and Its Simulation Research Considering Guiding Behavior of crowd evacuation

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Abstract: In a densely populated area, if the crowd cannot be effectively evacuated when an emergency occurs, it may cause a mass casualty and a serious accident. Based on the Helbing social force model research, considering the influence of crowd evacuation under pedestrians panic psychological and small group phenomenon, and add guiding behavior to simulate and analysis evacuation results. Experimental results show that the pedestrian of fear on the evacuation time and evacuation efficiency has a significant effect and is not a simple linear system; After adding small group, evacuation efficiency reduce; The panic factor and small groups work together, the result of the experiment found that the influence of both is opposite the actual speed of pedestrians, and has a certain corresponding relationship. On this basis and add the human intervention, in the congestion area guide pedestrians can sharply reduce the congestion area density, analyze various exit density and guide pedestrians, it can make the whole evacuation efficiency always keep a higher level, and reduce the overall evacuation time.

Keywords: Emergency, The crowd evacuation, Social force model, Guiding behavior, Simulation

The Use of Event-Based Modeling and System-Dynamics Modeling in Accident and Disaster Investigation

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Abstract: The classical accident and disaster investigation process is centered around modeling the sequence of events that lead to failure. In the Big Data Era, such event-based analyses benefit from the diverse sources of accident-related data and powerful data analytics techniques. However, it is argued that a system- dynamics perspective is also crucial in understanding the dynamic evolution of complex accident and disaster systems. In this paper, the Integrated Event-Based Modeling and System-Dynamics Modeling (EBSD) Framework for Accident In- vestigation using Big Data Analytics is proposed, and a case study of the 2015 Tianjin Port Fire and Explosion is presented to demonstrate its potential applica- tion. The EBSD Framework provides assistance to investigators in extracting the key factors in the disaster and accident system through modeling and simulation, and thus have further implication in disaster and accident management.

Keywords: Disaster and Accident Management, System Dynamics Modeling, Complex System Modeling, Tianjin Port Fire and Explosion

Model and Method for Emergency Knowledge Management based on Knowledge-unit Model

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Abstract: As the important role in emergency management, emergency decision-making is typically characterized by time limitations, partial or incomplete information, limited expertise and decision pressure resulting from potentially serious outcomes. Knowledge is the foundation of decision-making, a well-performed emergency response depends on the accurate and timely emergency knowledge. In order to facilitate the knowledge management, a model was developed based on the basis knowledge-unit model. The emergency knowledge is described by the frame model, which consists of attribute set, value set and relations set. The attribute measure model further describes the measure characteristics, measure dimension and dimension normalization of attributes. Aiming at the differences in measure dimension of attribute, this paper had proposed a measure fusion model, which can manage the transformation between different measures. Meanwhile, we have further expanded some transformation methods between different measure dimensions. In particular, if there are relations among attributes, they can be managed through relational model. Finally, the proposed model was applied to an illustrative example, and the results show the proposed model can provide a tool to collective emergency knowledge from different knowledge source, and can manage emergency knowledge for emergency decision-making.

Keywords: Knowledge representation, Emergency decision-making, Knowledge-unit model, Knowledge management

A Study on Constructing KM System for Laboratories Based on the Three-stage EDIS Spiral

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Abstract: With development of information technology, knowledge management has become an indispensable matter in the field of academia. Colleges and universities have plenty of opportunities to use knowledge management to support their tasks. Knowledge management not only manages the knowledge and information technology inside and outside the organization, but also needs to carry out knowledge management on the organization, such as on organizational structure, human resources, organizational culture and other aspects, in order to achieve the established knowledge management objectives. Knowledge management is multifaceted. A knowledge management system is required to integrate multifaceted knowledge management. Based on the questionnaire collected, students' implicit barriers and special requirements in their self-learning were analyzed and found. Specifically according to the three-stage EDIS spiral model proposed by Sun et al. in 2018, there are three stages, which are development of research plan, implementation of research and dissemination of research results, and then we designed the function module for every stage. Combined the relationships among members of the organization, including teacherstudent relationship and classmate relationship, with the users' specific needs, we designed this scientific and reasonable KM system which is suitable for science and engineering laboratory. The results show that our system can help laboratory members to use knowledge resources efficiently and improve the level of knowledge management of personal and laboratory in a certain extent.

Keywords: knowledge management, the three-stage EDIS spiral, laboratory management system

Identifying Factors that Impact on the Learning Process of Sewing Workers on an Assembly Line

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Abstract: Today, the economic environment offers many opportunities due to the Open-Economy Policy. Most apparel companies are engaged in mass customization production and are working towards shorter product cycle times and production runs. A better understanding of the learning process of sewing workers will allow the clothing industry to improve productivity in its manufacturing process. This article indicates the factors that have an effect on the learning process of sewing employees and examines the statistical significance of test results based on empirical data. The results indicate that three factors significantly affect the learning rates of sewing workers: previous experience, the structure of the task, and job complexity. Specific knowledge about these factors could form a basis for developing worker assignment methods, the calibration of cross-training programs, and determining productivity.

Keywords: Learning of worker, Learning rate, Worker assignment

How Do You Reduce Waiting Time ?

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Abstract: Numerous studies have been investigating influencing factors of decision-making. Questionnaire survey has played a key role in verifying the statistical significance of the conceptual model in these studies. It is very important that not only observable facts but also records of memories evoked by surveys accurately describe the judgment process of individuals. However, it is also a fact that subjective memory is not always correct objectively, as there are indications that the marketing research method itself to understand consumers will change their memory. In general, the data of individual decision-making in a service operation does not remain in the record. In this research, we examine whether unstructured data through gaming can effectively contribute to improve services by using a consumer's decision-making model of service selection. The agent-based decision-making model is expanded to gaming framework. We examine that the clues, obtained by the cooperative games based on this model, effectively lead to service improvement. Players discuss what they experienced throughout the game and in the debriefing. The extracted strategy utilizing the unstructured data, such as their awareness and discussion outcome, is examined by computer simulation.

Keywords: Self-service Technology, Agent-based Modeling, Airport, Game, Simulation, Service, Knowledge

A Risk Management Tool for Solar Power Businesses using Prediction Error Weather Derivatives

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Abstract: Predicting future solar conditions is important for electricity industries with solar power generators to quote a next-day sales contract in the electricity market. If a prediction error exists, the market-monitoring agent has to prepare another power generation resource to immediately compensate for the shortage, resulting in an additional cost. In this context, a penalty may be required depending on the size of the prediction error, which may lead to a significant loss for solar power producers. Because the main source of such losses is from prediction errors of solar conditions, they can instead effectively utilize a derivative contract based on solar prediction errors. The objective of this work is to provide such a derivative contract, namely, a prediction error weather derivative.

First, defining a certain loss function, we measure the hedge effect of the derivative on solar radiation prediction error, thereby verifying that the existing design method for wind power derivatives can also be applied to hedging prediction error losses for solar power. By introducing the temperature derivative on the absolute prediction error, we also propose a cross-hedging method, where we demonstrate not only a further variance reduction effect when used with solar radiation derivatives, but also a certain hedge effect obtained even when only the temperature derivative is used. For optimal contract volume estimation of temperature derivative, we propose a method using a tensor-product spline function that simultaneously incorporates the smoothing conditions of both the direction of intraday time trend and seasonal trend, and consequently verify its effectiveness.

Keywords: Cross hedge, Knowledge management on solar power generation industries, Non-parametric regression, Minimum variance hedge, Prediction errors, Weather derivatives

Kansei Knowledge Extraction as Measure of Structural Heterogeneity

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Abstract: Representative measurements way of affective attributes is the Semantic Differential (SD) method in Kansei evaluation experiments. Structural heterogeneity of the subjective evaluations indicates the heterogeneous evaluation structure of each evaluator, which is presented individually by the specific selected factors. The objective of the structural heterogeneity modeling is not only to extract the general trends but also to identify the diverse individual evaluation structure. In this paper, we propose a Hierarchical Bayes Regression model with Heterogeneous Variable Selection (HBRwHVS), which simultaneously analyses the individual models and identifies the influential explanatory variables based on the framework of the Hierarchical Bayes Regression Modeling. The results offer the relational data between the evaluators and the selected items as carefully chosen explanatory variables. We apply the proposed method to the analysis of sensibility subjective evaluation data on traditional craft and show its effectiveness. After obtaining the estimated values of model parameters, cluster analysis is performed on subjects with the similar evaluation structures as another example of its applications.

Keywords: Structural Heterogeneity, HBRwHVS, Clustering, Traditional Craft

Link Prediction based on Supernetwork Model and Attention Mechanism

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Abstract: To make full use of various types of data in link prediction, we proposed a link prediction method (SA, the abbreviation of supernetwork and attention mechanism) with two parts: information extraction and similarity measurement. Information is extracted on the basis of supernetwork for its multilayered, aggregative and other characteristics. In this part, we defined the operating unit for the flexibility and depth of information extraction. With the help of information extraction, we can get different types of subnetworks, which can be used in the similarity measurement. The similarity measurement part is inspired by the idea of attention mechanism: the allocation of attention might be different according to the difference of both subnetworks and nodes. After studying three types of relationships in the supernetwork, we proposed a similarity index (SimSA) combined three relationship types. To test the new method, we compared SA with famous CN and RA in the real data set of Douban, a popular social network site, and verified the application value of the new method.

Keywords: link prediction, supernetwork, attention mechanism

Research on Forest Fire Processing Scheme Generation Method based on Belief Rule-Base

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Abstract: In order to gain better experience and knowledge from historical disaster response and improve the ability of decision support in emergency management, a method of mining processing schemes based on belief rule-base is proposed based on forest fire history cases. Combined with the historical data of American forest fires in 2014 provided by the National Fire Incident Reporting System (NFIRS), the data extraction of fire status and coping strategies was realized, and the rules were mined by Apriori algorithm to form the forest fire processing rule-base. The reasoning model of belief rule-base for practical business is constructed to realize the optimal selection of fire processing scheme and to provide a supporting scheme for forest fire response decision.

Keywords: Belief Rule-Base, RIMER, Forest Fire, Emergency Management

Using Machine Learning Approaches to Identify the Core Technology Combinations in Rehabilitation Robot Area

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Abstract: Technological innovation has become an important driving force and source for promoting the society evolution. Most of the technological innovations are driven by the recombination of the existing different technology elements. Therefore, how to find the useful recombination of the vast technology elements is an important activity in the process of innovation. Moreover, it is well accepted that the ultimate goal of technological innovation is to achieve certain product functionalities and further achieve certain needs. Thus this paper aims to use machine learning based methods to identify the core technology combinations by taking functionalities into consideration. Firstly, the text mining techniques are used to extract the functionality information from a large amount of patent documents. Then a method of kernel-based classification is applied to investigate the relationships between technology combinations and functionalities. Finally, an optimization model is established to find the core technology combinations that can maximize the functionalities and genetic algorithm is used to solve this combinatorial optimization problem. Furthermore, a real case study with sufficient patent data of rehabilitation robots is put forward to validate the proposed model. By the analysis of the obtained technology combinations and the interviews with some relevant experts, we discuss a number of implications of the results in this paper for the industry management as well as for policy makers in rehabilitation robots area.

Keywords: recombinative   innovation, core technology combinations, machine learning, combinatorial optimization, rehabilitation robots

CluMA-RP: A Novel Approach to Rating Prediction Based on Clustered Matrix Approximation

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Abstract: In collaborative filtering, rating prediction aims to predict the rating of an item that a given user would rate and it is fundamental for successful recommendation. Traditional MF (Matrix Factorization) methods take a global view on the user-item ratings matrix to conduct matrix decomposition for rating approximation. However, there is an inherent structure in the user-item rating matrix and a local correspondence between user clusters and item clusters as the users induce the items and the items imply the users in a recommendation system. Based on this idea, this paper proposes a novel rating prediction approach called CluMA-RP (Clustered MAtrix Based Rating Prediction) based on clustered matrix approximation by making use of the local correspondence between user clusters and item clusters. The CluMA-RP approach comprises two components. The first component is to partition the user-item rating matrix into dense block matrices by spectral graph partitioning to co-cluster its rows (users) and columns (items) simultaneously. The second component is to approximate the original user-item rating matrix by singular value decomposition (SVD) on the dense blocks with Schimidt orthogonalization on singular vectors. The ratings are thus predicted by the approximated matrix that not only reduce the data sparsity but also increase the computation scalability. Experiments on the EachMovie dataset demonstrate that the proposed CluMA-RP approach performs better than state-of-the-art rating prediction methods based on MF in terms of recommendation accuracy and computational complexity.

Keywords: Rating Prediction, Spectral Graph Partitioning, Matrix Approximation, Data Sparsity, Computation Complexity

An improved Short Pause based Voice Activity Detection using Long Short-Term Memory Recurrent Neural Network

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Abstract: Generally, voice activity detection (VAD) commonly uses a silence over 100-millisecond as an endpoint of speech. Previously, the short pause based VAD is proposed to reduce the waiting time of caption result in automatic captioned relay service. This technique reduces the waiting time of caption result well. However, an accuracy of caption result is not maintained as it should be. The problem inherits to short-time energy feature which difficult and inaccurate to search the smallest characteristic like short pause or unvoiced sounds. Therefore, we propose the new technique that combines a Mel Frequency Cepstral Coefficient and Long Short-term Memory Recurrent Neural Network. This technique is called a pause classifier, which is able to capture the smallest characteristic like the short pause or unvoiced sounds. The experimental result shows an effective to reduce the waiting time while maintaining WER of caption result. The average waiting time reduced, the automatic speech recognition results are more continuous and constant. This will directly affect the user experience in automatic captioned relay service.

Keywords: short pause, voice activity detection, long short-term memory, recurrent neural network