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# Databases Theory and Applications

29th Australasian Database Conference, ADC 2018  
Gold Coast, QLD, Australia, May 24–27, 2018  
Proceedings

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# Preface

It is our great pleasure to present the proceedings of the 29th Australasian Database Conference (ADC 2018). The Australasian Database Conference is an annual international forum for sharing the latest research advancements and novel applications of database systems, data-driven applications, and data analytics between researchers and practitioners from around the globe, particularly Australia and New Zealand. The mission of ADC is to share novel research solutions to problems of today's information society that fulfil the needs of heterogeneous applications and environments and to identify new issues and directions for future research. ADC seeks papers from academia and industry presenting research on all practical and theoretical aspects of advanced database theory and applications, as well as case studies and implementation experiences.

ADC 2018 was held during May 23–25, 2018, on the Gold Coast, Australia. As in previous years, ADC 2018 accepted all the papers that the Program Committee considered as being of ADC quality without setting any predefined quota. The conference received 53 submissions, each of which was carefully peer reviewed by at least three independent reviewers, and in some cases four or five reviewers. Based on the reviewer comments, we accepted 23 full research papers, six short papers, and three demo papers. The Program Committee that selected the papers comprised 52 members from around the world including Australia, China, USA, Finland, Denmark, Switzerland, Japan, New Zealand, and Singapore. The conference programme also includes keynote talks and invited tutorials for ADC's PhD school.

We are grateful to Professor Xiaofang Zhou (University of Queensland, ADC Steering Committee member) for his helpful advice, Professor Rui Zhang (University of Melbourne, ADC 2018 General Chair), and Dr. Sen Wang (Griffith University, ADC 2018 Local Organization Chair) for their tireless work in coordinating the conference activities. We would like to thank all members of the Organizing Committee, and the many volunteers, for their support in the conference organization. Special thanks go to the Program Committee members and the external reviewers who contributed their time and expertise in the paper review process. We would also like to thank the invited speakers, all authors who submitted their papers, and all conference attendees.

May 2018

Junhu Wang  
Gao Cong  
Jinjun Chen  
Jianzhong Qi

## General Chair's Welcome Message

Welcome to the proceedings of the 29th Australasian Database Conference (ADC 2018)! ADC is a leading Australia- and New Zealand-based international conference on research and applications of database systems, data-driven applications, and data analytics. In the past 10 years, ADC has been held in Brisbane (2017), Sydney (2016), Melbourne (2015), Brisbane (2014), Adelaide (2013), Melbourne (2012), Perth (2011), Brisbane (2010), Wellington (2009), and Wollongong (2008). This year, the ADC conference came to the Gold Coast.

In the past, the ADC conference series was held as part of the Australasian Computer Science Week (ACSW). Starting from 2014, the ADC conferences departed from ACSW as the database research community in Australasia has grown significantly larger. Now the new ADC conference has an expanded research program and focuses on community-building through a PhD School. ADC 2018 was the fifth of this new ADC conference series.

In addition to 23 full research papers, six short research papers, and three demo papers carefully selected by the Program Committee, we were also very fortunate to have five invited talks presented by world-leading researchers: Kyuseok Shim from Seoul National University, South Korea, Reynold Cheng from The University of Hong Kong, Hong Kong SAR, Shuai Ma from Beihang University, China, Lina Yao from The University of New South Wales, Australia, and Hongzhi Yin and Weiqing Wang from The University of Queensland, Australia. We had a two-day PhD School program as part of this year's ADC.

We wish to take this opportunity to thank all speakers, authors, and organizers. I would also especially like to thank our Organizing Committee members: Program Committee Chairs Junhu Wang, Gao Cong, and Jinjun Chen, for their dedication in ensuring a high-quality program, Proceedings Chair Jianzhong Qi, for his effort in delivering the conference proceedings timely, Local Organization Chairs Sen Wang and Sibow Wang, for their consideration in covering every detail of the conference logistics, and Publicity Chair Lijun Chang, for his efforts in disseminating our call for papers and attracting submissions. Without them, this year's ADC would not have been a success.

The Gold Coast is a coastal city and ADC 2018 was held at the Mantra On View Hotel in the heart of Surfers Paradise. We hope all ADC 2018 participants had a wonderful experience with the conference and the city.

Rui Zhang

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# **Invited Talks**

# MapReduce Algorithms for Big Data Analysis

Kyuseok Shim

Seoul National University

**Abstract.** There is a growing trend of applications that should handle big data. However, analyzing big data is very challenging today. For such applications, the MapReduce framework has recently attracted a lot of attention. MapReduce is a programming model that allows easy development of scalable parallel applications to process big data on large clusters of commodity machines. Google's MapReduce or its open-source equivalent Hadoop is a powerful tool for building such applications. In this tutorial, I will first introduce the MapReduce framework based on Hadoop system available to everyone to run distributed computing algorithms using MapReduce. I will next discuss how to design efficient MapReduce algorithms and present the state-of-the-art in MapReduce algorithms for big data analysis. Since Spark is recently developed to overcome the shortcomings of MapReduce which is not optimized for iterative algorithms and interactive data analysis, I will also present an outline of Spark as well as the differences between MapReduce and Spark. The intended audience of this tutorial is professionals who plan to develop efficient MapReduce algorithms and researchers who should be aware of the state-of-the-art in MapReduce algorithms available today for big data analysis.

**Short Biography.** Kyuseok Shim is currently a professor at electrical and computer engineering department in Seoul National University, Korea. Before that, he was an assistant professor at computer science department in KAIST and a member of technical staff for the Serendip Data Mining Project at Bell Laboratories. He was also a member of the Quest Data Mining Project at the IBM Almaden Research Center and visited Microsoft Research at Redmond several times as a visiting scientist. Kyuseok was named an ACM Fellow for his contributions to scalable data mining and query processing research in 2013. Kyuseok has been working in the area of databases focusing on data mining, search engines, recommendation systems, MapReduce algorithms, privacy preservation, query processing and query optimization. His writings have appeared in a number of professional conferences and journals including ACM, VLDB and IEEE publications. He served as a Program Committee member for SIGKDD, SIGMOD, ICDE, ICDM, ICDT, EDBT, PAKDD, VLDB and WWW conferences. He also served as a Program Committee Co-Chair for PAKDD 2003, WWW 2014, ICDE 2015 and APWeb 2016. Kyuseok was previously on the editorial board of VLDB as well as IEEE TKDE Journals and is currently a member of the VLDB Endowment Board of Trustees. He received the BS degree in electrical engineering from Seoul National University in 1986, and the MS and PhD degrees in computer science from the University of Maryland, College Park, in 1988 and 1993, respectively.

# Meta Paths and Meta Structures: Analysing Large Heterogeneous Information Networks

Reynold Cheng

University of Hong Kong

**Abstract.** A heterogeneous information network (HIN) is a graph model in which objects and edges are annotated with types. Large and complex databases, such as YAGO and DBLP, can be modeled as HINs. A fundamental problem in HINs is the computation of closeness, or relevance, between two HIN objects. Relevance measures, such as PCRW, PathSim, and HeteSim, can be used in various applications, including information retrieval, entity resolution, and product recommendation. These metrics are based on the use of meta paths, essentially a sequence of node classes and edge types between two nodes in a HIN. In this tutorial, we will give a detailed review of meta paths, as well as how they are used to define relevance. In a large and complex HIN, retrieving meta paths manually can be complex, expensive, and error-prone. Hence, we will explore systematic methods for finding meta paths. In particular, we will study a solution based on the Query-by-Example (QBE) paradigm, which allows us to discover meta paths in an effective and efficient manner.

We further generalise the notion of a meta path to “meta structure”, which is a directed acyclic graph of object types with edge types connecting them. Meta structure, which is more expressive than the meta path, can describe complex relationship between two HIN objects (e.g., two papers in DBLP share the same authors and topics). We develop three relevance measures based on meta structure. Due to the computational complexity of these measures, we also study an algorithm with data structures proposed to support their evaluation. Finally, we will examine solutions for performing query recommendation based on meta paths. We will also discuss future research directions in HINs.

**Short Biography.** Dr. Reynold Cheng is an Associate Professor of the Department of Computer Science in the University of Hong Kong. He was an Assistant Professor in HKU in 2008–2011. He received his BEng (Computer Engineering) in 1998, and MPhil (Computer Science and Information Systems) in 2000, from the Department of Computer Science in the University of Hong Kong. He then obtained his MSc and PhD from Department of Computer Science of Purdue University in 2003 and 2005 respectively. Dr. Cheng was an Assistant Professor in the Department of Computing of the Hong Kong Polytechnic University during 2005–08. He was a visiting scientist in the Institute of Parallel and Distributed Systems in the University of Stuttgart during the summer of 2006.

Dr. Cheng was granted an Outstanding Young Researcher Award 2011–2012 by HKU. He was the recipient of the 2010 Research Output Prize in the Department of Computer Science of HKU. He also received the U21 Fellowship in 2011. He received

the Performance Reward in years 2006 and 2007 awarded by the Hong Kong Polytechnic University. He is the Chair of the Department Research Postgraduate Committee, and was the Vice Chairperson of the ACM (Hong Kong Chapter) in 2013. He is a member of the IEEE, the ACM, the Special Interest Group on Management of Data (ACM SIGMOD), and the UPE (Upsilon Pi Epsilon Honor Society). He is an editorial board member of TKDE, DAPD and IS, and was a guest editor for TKDE, DAPD, and Geoinformatica. He is an area chair of ICDE 2017, a senior PC member for DASFAA 2015, PC co-chair of APWeb 2015, area chair for CIKM 2014, area chair for Encyclopedia of Database Systems, program co-chair of SSTD 2013, and a workshop co-chair of ICDE 2014. He received an Outstanding Service Award in the CIKM 2009 conference. He has served as PC members and reviewer for top conferences (e.g., SIGMOD, VLDB, ICDE, EDBT, KDD, ICDM, and CIKM) and journals (e.g., TODS, TKDE, VLDBJ, IS, and TMC).

# Approximate Computation for Big Data Analytics

Shuai Ma

Beihang University

**Abstract.** Over the past a few years, research and development has made significant progresses on big data analytics with the supports from both governments and industries all over the world, such as Spark, IBM Watson and Google AlphaGo. A fundamental issue for big data analytics is the efficiency, and various advances towards attacking these issues have been achieved recently, from theory to algorithms to systems. In this talk, we shall present the idea of approximate computation for efficient and effective big data analytics: query approximation and data approximation, based on our recent research experiences. Different from existing approximation techniques, the approximation computation that we are going to introduce does not necessarily ask for theoretically guaranteed approximation solutions, but asks for sufficiently efficient and effective solutions in practice.

**Short Biography.** Shuai Ma is a full professor in the School of Computer Science and Engineering, Beihang University, China. He obtained two PhD degrees: University of Edinburgh in 2010 and Peking University in 2004, respectively. His research interests include database theory and systems, and big data. He is a recipient of the best paper award of VLDB 2010, the best challenge paper award of WISE 2013, the National Science Fund of China for Excellent Young Scholars in 2013, and the special award of Chinese Institute of Electronics for progress in science and technology in 2017 (8/15). He is an Associate Editor of VLDB Journal since 2017.

# Understanding Human Behaviors via Learning Internet of Things Interactions

Lina Yao

The University of New South Wales

**Abstract.** Internet of Things (IoT) enables the connection and integration of physical world and virtual world. A vast amount of interactive data between human and the real world being created by diverse sensing sources can be readily collected. Such growing interconnections powered with intelligent approaches open up a new world of broader possibilities and innovations with a deeper understanding of human behaviors. In this tutorial, I will introduce the methodologies to learn actionable knowledge from the monitored environment, in order to take actions on the situations and improve decision-making process, present real-world application examples and discuss the future research directions.

**Short Biography.** Lina Yao is currently a lecturer in the School of Computer Science and Engineering, University of New South Wales. Her research interests lie in data mining and machine learning applications with the focuses on Internet of Things, recommender systems, human activity recognition and Brain-Computer Interface.

# Mining Geo-social Networks – Spatial Item Recommendation

Hongzhi Yin and Weiqing Wang

The University of Queensland

**Abstract.** The rapid development of Web 2.0, location acquisition and wireless communication technologies has fostered a profusion of geo-social networks (e.g., Foursquare, Yelp and Google Place). They provide users an online platform to check-in at points of interests (e.g., cinemas, galleries and hotels) and share their life experiences in the physical world via mobile devices. The new dimension of location implies extensive knowledge about an individual's behaviors and interests by bridging the gap between online social networks and the physical world. It is crucial to develop spatio-temporal recommendation services for mobile users to explore the new places, attend new events and find their potentially preferred spatial items from billions of candidate ones. Compared with traditional recommendation tasks, the spatio-temporal recommendation faces the following new challenges: Travel Locality, Spatial Dynamics of User Interests, Temporal Dynamics of User Interests, Sequential Influence of user mobility behaviors and Real-time Requirement. In this talk, I will present our recent advancement of spatio-temporal recommendation techniques and how to address these unique challenges.

**Short Biography.** Dr. Hongzhi Yin is now working as a lecturer in data science and an ARC DECRA Fellow (Australia Discovery Early Career Researcher Award) with The University of Queensland, Australia. He received his doctoral degree from Peking University in July 2014. After graduation, he joined the school of ITEE, the University of Queensland. He successfully won the ARC DECRA award in 2015 and obtained an ARC Discovery Project grant as a chief investigator in 2016. His current main research interests include social media analytic, user profiling, recommender system, especially spatial-temporal recommendation, topic discovery and event detection, deep learning, user linkage across social networks, knowledge graph mining and construction. He has published over 70 peer-reviewed papers in prestigious journals and top international conferences including ACM TOIS, VLDBJ, IEEE TKDE, ACM TKDD, ACM TIST, ACM SIGMOD, ACM SIGKDD, VLDB, IEEE ICDE, AAAI, SIGIR, WWW, ACM Multimedia, ICDM, WSDM and CIKM. He has been actively engaged in professional services by serving as conference organizers, conference PC members for PVLDB, SIGIR, ICDE, IJCAI, ICDM, CIKM, DASFAA, ASONAM, MDM, WISE, PAKDD and reviewer of more than 10 reputed journals such as VLDB Journal, TKDE, TOIS, TKDD, TWeb, IEEE Transactions on Cybernetics, WWW Journal, Knowledge-based system and etc.



Dr. Weiqing Wang is now working as a Research Fellow in the school of ITEE, the University of Queensland, where she also obtained her PhD in July on 2017. She will join Monash University as a lecturer in data science in this July. Her major research interests include user modelling and recommender systems, especially spatial-temporal recommender systems. She has published over ten peer-reviewed papers in prestigious journals and top conferences including IEEE TKDE, ACM TOIS, ACM TIST, ACM SIGKDD, ACM SIGIR, IEEE ICDE, ACM Multimedia, and CIKM.

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