More information about this series at http://www.springer.com/series/7409
Yu Wang · Ge Yu
Yanyong Zhang · Zhu Han
Guoren Wang (Eds.)

Big Data Computing
and Communications

Second International Conference, BigCom 2016
Shenyang, China, July 29–31, 2016
Proceedings

Springer
Preface

It is a great pleasure for us to welcome you to the proceedings of the Second International Conference on Big Data Computing and Communication (BigCom 2016), which was held in Shenyang, China. BigCom is an international symposium dedicated to addressing the challenges emerging from big data-related computing and networking. This year, we were fortunate to receive many excellent papers covering a diverse set of research topics related to big data computing and communication. The event brought together numerous delegates from around the globe to discuss the latest advances in this vibrant and constantly evolving field.

BigCom 2016 received more than 90 submissions from Australia, Brazil, Canada, China, Finland, Hong Kong, Japan, Korea, Taiwan, and USA, out of which 39 were selected for publication as regular papers with an acceptance rate of 43%. Most submissions received two or more peer reviews from our Technical Program Committee and external reviewers. We were only able to accept papers that received broad support from the reviewers. The final technical program included three excellent keynote speeches (by Prof. Lixin Gao, Prof. Jianzhong Li, and Prof. Yunhao Liu) and ten technical sessions. We would like to thank our Program Committee members as well as external reviewers, consisting of eminent researchers, whose dedication and hard work made the selection of papers for the proceedings possible.

We also wish to thank everyone who contributed to the quality and success of BigCom 2016, from all the authors to all the student volunteers. We particularly appreciate the guidance and support from the Steering Committee chair, Prof. Xiang-Yang Li. Special thanks also go to the three track Chairs, Lan Zhang, Chenren Xu, and Lei Zou, for their outstanding job in handling the review process, to the publication co-chairs, Zenghua Zhao, Fan Li, and Yingjian Liu, for collecting the final versions of all accepted papers, and to the publicity co-chairs, Dan Tao, Yuanfang Chen, and Yao Liu, for promoting the conference and attracting great submissions. We would like to thank our local organizing team Lan Yao and Zhibin Zhao for their great job organizing the local arrangements and making the stay of every conference attendee a pleasant and memorable one. We also thank the other members of the Organizing Committee for their help and support. Finally, we thank Northeastern University (China) for its support and for contributing student volunteers, and Tsinghua University Press, Springer LNCS, Beijing University of Posts and Telecommunications, Ocean University of China, University of Science and Technology of China, Audaque Data Technology Ltd., Neusoft, Qihoo360, ZTE, and CERNET for their grants in supporting the conference.

In addition to the stimulating program of the conference, Shenyang, with its tourist attractions and the diversity and quality of its cuisine, is an unforgettable place to visit. Shenyang is the provincial capital and largest city of Liaoning Province, as well as the
largest city in northeast China. In the 17th century, Shenyang was conquered by the Manchu people and briefly used as the capital of the Qing dynasty. We hope you enjoy the technical program and have a great time in Shenyang.

June 2016

Yu Wang
Ge Yu
Yanyong Zhang
Zhu Han
Guoren Wang
Organization

Honorary Chair

Jinkuan Wang                        Northeastern University, China

General Co-chairs

Ge Yu                              Northeastern University, China
Yu Wang                            University of North Carolina at Charlotte, USA

TPC Co-chairs

Yanyong Zhang                      Rutgers University, USA
Zhu Han                            University of Houston, USA
Guoren Wang                        Northeastern University, China

TPC Track Chairs

Lei Zou                            Peking University, China
Chenren Xu                         Peking University, China
Lan Zhang                          Tsinghua University, China

Local Co-chairs

Zhibin Zhao                        Northeastern University, China
Lan Yao                            Northeastern University, China

Poster/Demo Co-chairs

Ye Yuan                            Northeastern University, China
Chunhong Zhang                     Beijing University of Posts and Telecommunications, China

Workshop Co-chairs

Lanchao Liu                        Cisco, USA
Mengshu Hou                        University of Electronic Science and Technology, China
Industry Co-chairs

Xu Zhang  
Beijing University of Posts and Telecommunications, China

Dazhe Zhao  
Northeastern University, China

Jiahao Wang  
University of Electronic Science and Technology, China

Publicity Co-chairs

Dan Tao  
Beijing Jiaotong University, China

Yuanfang Chen  
Pierre and Marie Curie University, France

Yao Liu  
University of South Florida, USA

Publication Co-chairs

Zenghua Zhao  
Tianjin University, China

Fan Li  
Beijing Institute of Technology, China

Yingjian Liu  
Ocean University of China, China

Finance Co-chairs

Lan Yao  
Northeastern University, China

Hongli Xu  
University of Science and Technology of China, China

Xufei Mao  
Tsinghua University, China

Shaojie Tang  
University of Texas at Dallas, USA

Web Chair

Lan Yao  
Northeastern University, China

Program Committee

Shlomo Argamon  
Illinois Institute of Technology, USA

Ashwin Ashok  
Carnegie Mellon University, USA

Gautam Bhanage  
WINLAB, Rutgers University, USA

Cheng Bo  
University of North Carolina at Charlotte, USA

Jiannong Cao  
Hong Kong Polytechnic University, SAR China

Marcelo Carvalho  
Universidade de Brasilia, Brazil

Guohui Chen  
Shanghai Jiaotong University, China

Hanhua Chen  
Huazhong University of Science and Technology, China

Thang Dinh  
Virginia Commonwealth University, USA

Wei Dong  
Zhejiang University, China

Xiaoyong Du  
Renmin University, China
Shuo Shang
China University of Petroleum, China

Stephan Sigg
Aalto University, Finland

Junggab Son
North Carolina Central University, USA

Guozhen Tan
Dalian University of Technology, China

Shaojie Tang
University of Texas at Dallas, USA

Dan Tao
Beijing Jiao Tong University, China

Yongxin Tong
Beihang University, China

Hoang Nguyen Tran
Kyung Hee University, South Korea

Hanli Wang
Tong Ji University, China

Guoren Wang
Northeastern University, China

Jie Wang
University of Massachusetts Lowell, USA

Jiliang Wang
Tsinghua University, China

Xinbing Wang
Shanghai Jiaotong University, China

Ka-Chun Wong
University of Toronto, Canada

Yongwei Wu
Tsinghua University, China

Zhenyu Wu
NEC Laboratories America Inc., USA

Yong Xiao
University of Houston, USA

Hui Xiong
Rutgers University, USA

Chenren Xu
Peking University, USA

Xiaochun Yang
Northeastern University, China

Jie Yang
Florida State University, USA

Panlong Yang
University of Science and Technology of China, China

Zheng Yang
Tsinghua University, China

Lan Yao
Northeastern University, China

Seongwook Youn
Korea National University of Transportation, South Korea

Ge Yu
Northeastern University, China

Xu Yu
Chinese University of Hong Kong, SAR China

Zhiwen Yu
Northwestern Polytechnical University, China

Chunhong Zhang
Beijing University of Posts and Telecommunications, China

Lan Zhang
Tsinghua University, China

Xu Zhang
Beijing University of Posts and Telecommunications, China

Yanyong Zhang
Rutgers University, USA

Huiqun Zhao
Northern Technology University, China

Jumin Zhao
Taiyuan University of Technology, China

Zenghua Zhao
Tianjin University, China

Zhbin Zhao
Northeastern University, China

Weiguo Zheng
The Chinese University of Hong Kong, SAR China

Aoying Zhou
East China Normal University, China

Xiangmin Zhou
RMIT University, Australia

Shiai Zhu
MCRLab, University of Ottawa, Canada

Lei Zou
Peking University, China
## Additional Reviewers

<table>
<thead>
<tr>
<th>Chen, Linlin</th>
<th>Li, Kai</th>
<th>Sagari, Shweta</th>
</tr>
</thead>
<tbody>
<tr>
<td>Choi, Yun-Sik</td>
<td>Li, Sugang</td>
<td>Sai, Mounika</td>
</tr>
<tr>
<td>Du, Haohua</td>
<td>Li, Ting</td>
<td>Su, Kai</td>
</tr>
<tr>
<td>Ertė, Pan</td>
<td>Li, Yingyu</td>
<td>Tan, Hailun</td>
</tr>
<tr>
<td>Fan, Zhang</td>
<td>Lin, Changfu</td>
<td>Velasco, Yesenia</td>
</tr>
<tr>
<td>Gao, Jun</td>
<td>Liu, Xin</td>
<td>Wang, Wenbo</td>
</tr>
<tr>
<td>Georgiou, Theodore</td>
<td>Liu, Xiruo</td>
<td>Wang, Zhitao</td>
</tr>
<tr>
<td>Hou, Jiahui</td>
<td>Lu, Xinjiang</td>
<td>Xie, Jin</td>
</tr>
<tr>
<td>Hu, Yiqing</td>
<td>Men, Hao</td>
<td>Yan, Shankai</td>
</tr>
<tr>
<td>Hussain, Rasheed</td>
<td>Mi, Xianghang</td>
<td>Zhang, Jiao</td>
</tr>
<tr>
<td>Jia, Zhenhua</td>
<td>Mukherjee, Shreyasee</td>
<td>Zhang, Jin</td>
</tr>
<tr>
<td>Jian, Xuési</td>
<td>Niu, Xing</td>
<td>Zhang, Yanru</td>
</tr>
<tr>
<td>Kumbhkar, Ratnesh</td>
<td>Nguyen, Hung</td>
<td>Zhao, Yi</td>
</tr>
<tr>
<td>Li, Feng</td>
<td>Qian, Jianwei</td>
<td>Zou, Rui</td>
</tr>
</tbody>
</table>
## Contents

**Best Paper Candidate**

- Similarity Search Algorithm over Data Supply Chain Based on Key Points... 3  
  *Peng Li, Hong Luo, Yan Sun, and Xin-Ming Li*

- Privacy-Preserving Strategyproof Auction Mechanisms for Resource Allocation in Wireless Communications.......................... 13  
  *Yu-E Sun, He Huang, Xiang-Yang Li, Yang Du, Miaomiao Tian, Hongli Xu, and Mingjun Xiao*

- Cost Optimal Resource Provisioning for Live Video Forwarding Across Video Data Centers............................................. 27  
  *Yihong Gao, Huadong Ma, Wu Liu, and Shui Yu*

- Research and Application of Fast Multi-label SVM Classification Algorithm Using Approximate Extreme Points ............... 39  
  *Zhongwei Sun, Zhongwen Guo, Mingxing Jiang, Xi Wang, and Chao Liu*

**Database and Big Data**

- Determining the Topic Hashtags for Chinese Microblogs Based on 5W Model............................................................. 55  
  *Zhibin Zhao, Jiahong Sun, Zhenyu Mao, Shi Feng, and Yubin Bao*

- HMVR-tree: A Multi-version R-tree Based on HBase for Concurrent Access......................................................... 68  
  *Shan Huang, Botao Wang, Shizhuo Deng, Kaili Zhao, Guoren Wang, and Ge Yu*

- Short- and Long-Distance Big Data Transmission: Tendency, Challenge Issues and Enabling Technologies....................... 78  
  *Weigang Hou, Xu Zhang, Lei Guo, Yuyang Sun, Siqi Wang, and Ye Zhang*

- A Compact In-memory Index for Managing Set Membership Queries on Streaming Data.................................................. 88  
  *Yong Wang, Xiaochun Yun, Shupeng Wang, and Xi Wang*
Smart Phone and Sensing Application

Accurate Identification of Low-Level Radiation Sources with Crowd-Sensing Networks ........................................... 101
  Chaocan Xiang, Panlong Yang, Wanru Xu, Zhendong Yang, and Xin Shen

Rotate and Guide: Accurate and Lightweight Indoor Direction Finding Using Smartphones ........................................... 111
  Xiaopu Wang, Yan Xiong, and Wenchao Huang

LaP: Landmark-Aided PDR on Smartphones for Indoor Mobile Positioning .............................................................. 123
  Xi Wang, Mingxing Jiang, Zhongwen Guo, Naijun Hu, Zhongwei Sun, and Jing Liu

WhozDriving: Abnormal Driving Trajectory Detection by Studying Multi-faceted Driving Behavior Features ........................................... 135
  Meng He, Bin Guo, Huihui Chen, Alvin Chin, Jilei Tian, and Zhiwen Yu

Trajectory Prediction in Campus Based on Markov Chains ........................................... 145
  Bonan Wang, Yihong Hu, Guochu Shou, and Zhigang Guo

Sensor Networks and RFID

Soil Moisture Content Detection Based on Sensor Networks ........................................... 157
  Zhan Huan, Li Chen, Liantao Wang, and Caiyan Wan

Missing Value Imputation for Wireless Sensory Soil Data: A Comparative Study ........................................... 172
  Guodong Sun, Jia Shao, Hui Han, and Xingjian Ding

Redundancy Elimination of Big Sensor Data Using Bayesian Networks ........................................... 185
  Sai Xie, Zhe Chen, Chong Fu, and Fangfang Li

IoT Sensing Parameters Adaptive Matching Algorithm ........................................... 198
  Zhijin Qiu, Naijun Hu, Zhongwen Guo, Like Qiu, Shuai Guo, and Xi Wang

Big Data in Ocean Observation: Opportunities and Challenges ........................................... 212
  Yingjian Liu, Meng Qiu, Chao Liu, and Zhongwen Guo

Machine Learning and Algorithm

MR-Similarity: Parallel Algorithm of Vessel Mobility Pattern Detection ........................................... 225
  Chao Liu, Yingjian Liu, Zhongwen Guo, Xi Wang, and Shuai Guo
Knowledge Graph Completion for Hyper-relational Data .......................... 236
  Miao Zhou, Chunhong Zhang, Xiao Han, Yang Ji, Zheng Hu, and Xiaofeng Qiu

Approximate Subgraph Matching Query over Large Graph ...................... 247
  Yu Zhao, Chunhong Zhang, Tingting Sun, Yang Ji, Zheng Hu, and Xiaofeng Qiu

A Novel High-Dimensional Index Method Based on the Mathematical Features ........................................... 257
  Yu Zhang, Jiayu Li, and Ye Yuan

Architecture and Applications

Target Detection and Tracking in Big Surveillance Video Data .................... 275
  Aiyun Yan, Jingjiao Li, Zhenni Li, and Lan Yao

SGraph: A Distributed Streaming System for Processing Big Graphs ............... 285
  Cheng Chen, Hejun Wu, Dyce Jing Zhao, Da Yan, and James Cheng

Towards Semantic Web of Things: From Manual to Semi-automatic Semantic Annotation on Web of Things .................................................. 295
  Zhenyu Wu, Yuan Xu, Chunhong Zhang, Yunong Yang, and Yang Ji

Efficient Online Surveillance Video Processing Based on Spark Framework ... 309
  Haitao Zhang, Jin Yan, and Yue Kou

Routing and Resource Management

Improved PC Based Resource Scheduling Algorithm for Virtual Machines in Cloud Computing ......................................................... 321
  Baiyou Qiao, Muchuan Shen, Junhai Zhu, Yujie Zheng, Xiaolong Li,
  Bin Tong, Donghai Chen, and Guoren Wang

Resource Scheduling and Data Locality for Virtualized Hadoop on IaaS Cloud Platform ..................................................... 332
  Dan Tao, Bingxu Wang, Zhaowen Lin, and Tin-Yu Wu

An Asynchronous 2D-Torus Network-on-Chip Using Adaptive Routing Algorithm .................................................. 342
  Zhenni Li, Jingjiao Li, Aiyun Yan, and Lan Yao

Security and Privacy

Infringement of Individual Privacy via Mining Differentially Private GWAS Statistics ......................................................... 355
  Yue Wang, Jia Wen, Xintao Wu, and Xinghua Shi
<table>
<thead>
<tr>
<th>Title</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Privacy Preserving in the Publication of Large-Scale Trajectory Databases</td>
<td>367</td>
</tr>
<tr>
<td>Fengyun Li, Fuxiang Gao, Lan Yao, and Yu Pan</td>
<td></td>
</tr>
<tr>
<td>A Trust System for Detecting Selective Forwarding Attacks in VANETs</td>
<td>377</td>
</tr>
<tr>
<td>Suwan Wang and Yuan He</td>
<td></td>
</tr>
<tr>
<td>Certificateless Key-Insulated Encryption: Cryptographic Primitive</td>
<td>387</td>
</tr>
<tr>
<td>for Achieving Key-Escrow Free and Key-Exposure Resilience</td>
<td></td>
</tr>
<tr>
<td>Libo He, Chen Yuan, Hu Xiong, and Zhiguang Qin</td>
<td></td>
</tr>
<tr>
<td><strong>Signal Processing and Pattern Recognition</strong></td>
<td></td>
</tr>
<tr>
<td>A Novel J wave Detection Method Based on Massive ECG Data and MapReduce</td>
<td>399</td>
</tr>
<tr>
<td>Dengao Li, Wei Ma, and Jumin Zhao</td>
<td></td>
</tr>
<tr>
<td>A Decision Level Fusion Algorithm for Time Series in Cyber Physical System</td>
<td>409</td>
</tr>
<tr>
<td>Jinshun Yang, Xu Zhang, and Dongbin Wang</td>
<td></td>
</tr>
<tr>
<td>An Improved Image Classification Method Considering Rotation Based on Convolutional Neural Network</td>
<td>421</td>
</tr>
<tr>
<td>Jingyi Qu</td>
<td></td>
</tr>
<tr>
<td><strong>Social Networks and Recommendation</strong></td>
<td></td>
</tr>
<tr>
<td>Semantic Trajectories Based Social Relationships Discovery Using WiFi Monitors</td>
<td>433</td>
</tr>
<tr>
<td>Fengzi Wang, Xinning Zhu, and Jiansong Miao</td>
<td></td>
</tr>
<tr>
<td>Improving Location Prediction Based on the Spatial-Temporal Trajectory</td>
<td>443</td>
</tr>
<tr>
<td>Ping Li, Xinning Zhu, and Jiansong Miao</td>
<td></td>
</tr>
<tr>
<td>Path Sampling Based Relevance Search in Heterogeneous Networks</td>
<td>453</td>
</tr>
<tr>
<td>Qiang Gu, Chunhong Zhang, Tingting Sun, Yang Ji, Zheng Hu, and Xiaofeng Qiu</td>
<td></td>
</tr>
<tr>
<td><strong>Author Index</strong></td>
<td>465</td>
</tr>
</tbody>
</table>