### Yang Wang · Guobin Zhu · Qilong Han · Liehui Zhang · Xianhua Song · Zeguang Lu (Eds.)

Communications in Computer and Information Science

1629

# Data Science

8th International Conference of Pioneering Computer Scientists, Engineers and Educators, ICPCSEE 2022 Chengdu, China, August 19–22, 2022, Proceedings, Part II







#### Communications in Computer and Information Science 1629

Editorial Board Members

Joaquim Filipe D Polytechnic Institute of Setúbal, Setúbal, Portugal

Ashish Ghosh Indian Statistical Institute, Kolkata, India

Raquel Oliveira Prates *Federal University of Minas Gerais (UFMG), Belo Horizonte, Brazil* 

Lizhu Zhou

Tsinghua University, Beijing, China

More information about this series at https://link.springer.com/bookseries/7899

Yang Wang · Guobin Zhu · Qilong Han · Liehui Zhang · Xianhua Song · Zeguang Lu (Eds.)

## Data Science

8th International Conference of Pioneering Computer Scientists, Engineers and Educators, ICPCSEE 2022 Chengdu, China, August 19–22, 2022 Proceedings, Part II



*Editors* Yang Wang Southwest Petroleum University Chengdu, China

Qilong Han Harbin Engineering University Harbin, China

Xianhua Song Harbin University of Science and Technology Harbin, China Guobin Zhu University of Electronic Science and Technology of China Chengdu, China

Liehui Zhang Southwest Petroleum University Chengdu, China

Zeguang Lu National Academy of Guo Ding Institute of Data Sciences Beijing, China

 ISSN 1865-0929
 ISSN 1865-0937 (electronic)

 Communications in Computer and Information Science
 ISBN 978-981-19-5208-1

 ISBN 978-981-19-5208-1
 ISBN 978-981-19-5209-8 (eBook)

 https://doi.org/10.1007/978-981-19-5209-8
 ISBN 978-981-19-5209-8

© The Editor(s) (if applicable) and The Author(s), under exclusive license

to Springer Nature Singapore Pte Ltd. 2022

This work is subject to copyright. All rights are reserved by the Publisher, whether the whole or part of the material is concerned, specifically the rights of translation, reprinting, reuse of illustrations, recitation, broadcasting, reproduction on microfilms or in any other physical way, and transmission or information storage and retrieval, electronic adaptation, computer software, or by similar or dissimilar methodology now known or hereafter developed.

The use of general descriptive names, registered names, trademarks, service marks, etc. in this publication does not imply, even in the absence of a specific statement, that such names are exempt from the relevant protective laws and regulations and therefore free for general use.

The publisher, the authors, and the editors are safe to assume that the advice and information in this book are believed to be true and accurate at the date of publication. Neither the publisher nor the authors or the editors give a warranty, expressed or implied, with respect to the material contained herein or for any errors or omissions that may have been made. The publisher remains neutral with regard to jurisdictional claims in published maps and institutional affiliations.

This Springer imprint is published by the registered company Springer Nature Singapore Pte Ltd. The registered company address is: 152 Beach Road, #21-01/04 Gateway East, Singapore 189721, Singapore

#### Preface

As the chairs of the 8th International Conference of Pioneer Computer Scientists, Engineers and Educators 2022 (ICPCSEE 2022, originally ICYCSEE), it is our great pleasure to welcome you to the conference proceedings. ICPCSEE 2022 was held in Chengdu, China, during August 19–22, 2022, and hosted by the Southwest Petroleum University, the University of Electronic Science and Technology of China, and the National Academy of Guo Ding Institute of Data Sciences, China. The goal of this conference series is to provide a forum for computer scientists, engineers, and educators.

This year's conference attracted 263 paper submissions. After the hard work of the Program Committee, 63 papers were accepted to appear in the conference proceedings, with an acceptance rate of 24.7%. The major topic of this conference is data science. The accepted papers cover a wide range of areas related to basic theory and techniques for data science including mathematical issues in data science, computational theory for data science, big data management and applications, data quality and data preparation, evaluation and measurement in data science, data visualization, big data mining and knowledge management, infrastructure for data science, machine learning for data science, data security and privacy, applications of data science, case studies of data science, multimedia data management and analysis, data-driven scientific research, data-driven bioinformatics, data-driven healthcare, data-driven management, data-driven e-government, data-driven smart city/planet, data marketing and economics, social media and recommendation systems, data-driven security, data-driven business model innovation, and social and/or organizational impacts of data science.

We would like to thank all the Program Committee members, a total of 261 people from 142 different institutes or companies, for their hard work in completing the review tasks. Their collective efforts made it possible to attain quality reviews for all the submissions within a few weeks. Their diverse expertise in each research area helped us to create an exciting program for the conference. Their comments and advice helped the authors to improve the quality of their papers and gain deeper insights.

We thank the team at Springer, whose professional assistance was invaluable in the production of the proceedings. A big thanks also to the authors and participants for their tremendous support in making the conference a success.

Besides the technical program, this year ICPCSEE offered different experiences to the participants. We hope you enjoyed the conference.

June 2022

Liehui Zhang Hongzhi Wang Yang Wang Guobin Zhu Qilong Han

#### Organization

The 8th International Conference of Pioneering Computer Scientists, Engineers and Educators (http://2022.icpcsee.org) was held in Chengdu, China, during August 19–22, 2022, and hosted by the Southwest Petroleum University, the University of Electronic Science and Technology of China and the National Academy of Guo Ding Institute of Data Sciences, China.

#### **General Chairs**

Liehui Zhang Hongzhi Wang	Southwest Petroleum University, China Harbin Institute of Technology, China
Program Chairs	
Yang Wang	Southwest Petroleum University, China
Guobin Zhu	University of Electronic Science and Technology of China, China
Qilong Han	Harbin Engineering University, China
Program Co-chairs	
Xiaohua Xu	University of Science and Technology of China, China
Zhao Kang	University of Electronic Science and Technology of China, China
Yingjie Zhou	Sichuan University, China
Jinshan Tang	George Mason University, USA
Jingfeng Jiang	Michigan Technological University, USA
Xiaohu Yang	Hebei University, China
Organization Chairs	
L'a Cana	Quality of Datas I and I and China

Jie Gong	Southwest Petroleum University, China
Yishu Zhang	Southwest Petroleum University, China
Jiong Mu	Sichuan Agricultural University, China
Xianhua Niu	Xihua University, China
Wei Pan	China West Normal University, China

#### **Organization Co-chairs**

Bo Peng	Southwest Petroleum University, China
Jian Zhang	Southwest Petroleum University, China
Fei Teng	Southwest Jiaotong University, China
Xin Yang	Southwestern University of Finance and Economics, China
Yongqing Zhang	Chengdu University of Information Technology, China
Hongyu Han	Sichuan Normal University, China
Chuanlin Liu	Southwest Petroleum University, China
Publication Chairs	
Xianhua Song	Harbin University of Science and Technology, China
Zeguang Lu	National Academy of Guo Ding Institute of Data Sciences, China
Publication Co-chairs	
r ublication Co-chairs	
V' D'	

Xiaoou Ding	Harbin Institute of Technology, China
Dan Lu	Harbin Engineering University, China

#### **Forum Chairs**

Lei Chen	Chengdu Supercomputing Center, China
Xiaoliang Chen	Xihua University, China
Hai Li	iQIYI Inc., China
Pinle Qin	North University of China, China

#### **Oral Session Chairs**

Fan Min	Southwest Petroleum University, China
Ping Li	Southwest Petroleum University, China
Xin Wang	Southwest Petroleum University, China

#### **Registration and Financial Chair**

Zhongchan Sun	National Academy of Guo Ding Institute of Data
	Sciences, China

#### **Academic Committee Chair**

Hongzhi Wang	Harbin Institute of Technology, China	
Academic Committee Vice President		
Qilong Han	Harbin Engineering University, China	
Academic Committee Secretary General		
Zeguang Lu	National Academy of Guo Ding Institute of Data Sciences, China	
Academic Committee Under Secretary General		
Xiaoou Ding	Harbin Institute of Technology, China	
Academic Committee Secretaries		
Dan Lu Zhongchan Sun	Harbin Engineering University, China National Academy of Guo Ding Institute of Data Sciences, China	
Academic Committee Exec	utive Members	
Cham Tat Huei	UCSI University, Malaysia	
Xiaoju Dong	Shanghai Jiao Tong University, China	

	UCSI University, Malaysia
Xiaoju Dong	Shanghai Jiao Tong University, China
Lan Huang	Jilin University, China
Ying Jiang	Kunming University of Science and Technology, China
Weipeng Jiang	Northeast Forestry University, China
Min Li	Central South University, China
Junyu Lin	Institute of Information Engineering, CAS, China
Xia Liu	Hainan Province Computer Federation, China
Rui Mao	Shenzhen University, China
Qiguang Miao	Xidian University, China
Haiwei Pan	Harbin Engineering University, China
Pinle Qin	North University of China, China
Xianhua Song	Harbin University of Science and Technology, China
Guanglu Sun	Harbin University of Science and Technology, China
Jin Tang	Anhui University, China
Ning Wang	Xiamen Huaxia University, China

Xin Wang Yan Wang Yang Wang Shengke Wang Yun Wu Liang Xiao

Junchang Xin Zichen Xu Xiaohui Yang Chen Ye Canlong Zhang Zhichang Zhang Yuanyuan Zhu

#### **Steering Committee**

Jiajun Bu Wanxiang Che Jian Chen Wenguang Chen Xuebin Chen Xiaoju Dong Qilong Han Yiliang Han Yinhe Han Hai Jin Weipeng Jing Wei Li Min Li Junyu Lin Yunhao Liu Zeguang Lu Rui Mao

Qiguang Miao Haiwei Pan Pinle Qin Tianjin University, China Zhengzhou University of Technology, China Southwest Petroleum University, China Ocean University of China, China Guizhou University, China Nanjing University of Science and Technology, China Northeastern University, China Hangzhou Dianzi University, China Guangxi Normal University, China Northwest Normal University, China Wuhan University, China

Zhejiang University, China Harbin Institute of Technology, China ParaTera, China Tsinghua University, China North China University of Science and Technology, China Shanghai Jiao Tong University, China Harbin Engineering University, China Engineering University of CAPF, China Institute of Computing Technology, Chinese Academy of Sciences, China Huazhong University of Science and Technology, China Northeast Forestry University, China Central Queensland University, Australia Central South University, China Institute of Information Engineering, Chinese Academy of Sciences, China Michigan State University, USA National Academy of Guo Ding Institute of Data Sciences, China Shenzhen University, China Xidian University, China Harbin Engineering University, China North University of China, China

The PLA Information Engineering University, China Harbin University of Science and Technology, China Tsinghua University, China Institute of Software, Chinese Academy of Sciences. China Peking University, China Hongzhi Wang Harbin Institute of Technology, China Jilin University, China Beijing Huazhang Graphics & Information Co., Ltd, China Nanjing University of Science and Technology, China Northeastern University, China Peking University, China Yingtao Zhang Harbin Institute of Technology, China Institute of Computing Technology, Chinese Yunquan Zhang Academy of Sciences, China National University of Defense Technology, **Baokang** Zhao China Sichuan University, China Liehuang Zhu Beijing Institute of Technology, China

#### **Program Committee**

Zheng Shan

Guanglu Sun

Jie Tang Feng Tian

Tao Wang

Xiaohui Wei

Lifang Wen

Liang Xiao

Xiaoru Yuan

Yu Yao

Min Zhu

Witold Abramowicz	Poznan University of Economics, Poland
Chunyu Ai	University of South Carolina Upstate, USA
Jiyao An	Hunan University, China
Ran Bi	Dalian University of Technology, China
Zhipeng Cai	Georgia State University, USA
Yi Cai	South China University of Technology, China
Zhao Cao	Beijing Institute of Technology, China
Wanxiang Che	Harbin Institute of Technology, China
Wei Chen	Beijing Jiaotong University, China
Hao Chen	Hunan University, China
Xuebin Chen	North China University of Science and
	Technology, China
Chunyi Chen	Changchun University of Science and
	Technology, China
Yueguo Chen	Renmin University, China
Siyao Cheng	Harbin Institute of Technology, China
Byron Choi	Hong Kong Baptist University, China

Vincenzo Deufemia Gong Dianxuan Xiaofeng Ding Jianrui Ding Hongbin Dong Lei Duan Xiping Duan Xiaolin Fang Ming Fang Jianlin Feng Jing Gao Yu Gu Oi Han Meng Han Qinglai He Wei Hu Lan Huang Hao Huang Feng Jiang Bin Jiang Cheqing Jin Hanjiang Lai Shiyong Lan Hui Li Zhixu Li Mingzhao Li Peng Li Jianjun Li Xiaofeng Li Zheng Li Min Li Zhixun Li Hua Li Rong-Hua Li Cuiping Li Qiong Li

University of Salerno, Italy North China University of Science and Technology, China Huazhong University of Science and Technology, China Harbin Institute of Technology, China Harbin Engineering University, China Sichuan University, China Harbin Normal University, China Southeast University, China Changchun University of Science and Technology, China Sun Yat-sen University, China Dalian University of Technology, China Northeastern University, China Harbin Institute of Technology, China Georgia State University, USA Arizona State University, USA Nanjing University, China Jilin University, China Wuhan University, China Harbin Institute of Technology, China Hunan University, China East China Normal University, China Sun Yat-sen University, China Sichuan University, China Xidian University, China Soochow University, China Royal Melbourne Institute of Technology, Australia Shaanxi Normal University, China Huazhong University of Science and Technology, China Sichuan University, China Sichuan University, China Central South University, China Nanchang University, China Changchun University of Science and Technology, China Shenzhen University, China Renmin University of China, China Harbin Institute of Technology, China

Yanli Liu Hailong Liu Guanfeng Liu Yan Liu Zeguang Lu Binbin Lu Junling Lu Jizhou Luo Li Mohan Tiezheng Nie Haiwei Pan Jialiang Peng Fei Peng Yuwei Peng Shaojie Qiao Li Qingliang Zhe Ouan Yingxia Shao Wei Song Yanan Sun Minghui Sun Guanghua Tan Yongxin Tong Xifeng Tong Vicenc Torra Leong Hou Hongzhi Wang Yingjie Wang Dong Wang Yongheng Wang Chunnan Wang Jinbao Wang Xin Wang Peng Wang Chaokun Wang Xiaoling Wang Jiapeng Wang Huayu Wu

Sichuan University, China Northwestern Polytechnical University, China Macquarie University, Australia Harbin Institute of Technology, China National Academy of Guo Ding Institute of Data Sciences, China Sichuan University, China Shaanxi Normal University, China Harbin Institute of Technology, China Jinan University, China Northeastern University, China Harbin Engineering University, China Norwegian University of Science and Technology, Norway Hunan University, China Wuhan University, China Southwest Jiaotong University, China Changchun University of Science and Technology, China Hunan University, China Peking University, China North China University of Technology, China Oklahoma State University, USA Jilin University, China Hunan University, China Beihang University, China Northeast Petroleum University, China University of Skövde, Sweden University of Macau, China Harbin Institute of Technology, China Yantai University, China Hunan University, China Hunan University, China Harbin Institute of Technology, China Harbin Institute of Technology, China Tianjin University, China Fudan University, China Tsinghua University, China East China Normal University, China Harbin Huade University, China Institute for Infocomm Research, Singapore

Yan Wu Changchun University of Science and Technology, China Sheng Xiao Hunan University, China Ying Xu Hunan University, China Jing Xu Changchun University of Science and Technology, China Nanjing University of Aeronautics and Jianqiu Xu Astronautics, China Yaohong Xue Changchun University of Science and Technology, China Li Xuwei Sichuan University, China Mingyuan Yan University of North Georgia, USA Yajun Yang Tianjin University, China Gaobo Yang Hunan University, China Heilongjiang University, China Lei Yang Ning Yang Sichuan University, China Xiaochun Yang Northeastern University, China Bin Yao Shanghai Jiao Tong University, China Jilin University, China Yuxin Ye Xiufen Ye Harbin Engineering University, China Northeast Normal University, China Minghao Yin Harbin Engineering University, China Dan Yin China University of Mining and Technology, Zhou Yong China Lei Yu Georgia Institute of Technology, USA Ye Yuan Northeastern University, China Yunnan University, China Kun Yue Xiaowang Zhang Tianjin University, China Lichen Zhang Shaanxi Normal University, China Yingtao Zhang Harbin Institute of Technology, China Harbin Institute of Technology, China Yu Zhang Wenjie Zhang University of New South Wales, Australia **Dongxiang Zhang** University of Electronic Science and Technology of China, China Renmin University of China, China Xiao Zhang Kejia Zhang Harbin Engineering University, China Yonggang Zhang Jilin University, China Huijie Zhang Northeast Normal University, China Boyu Zhang Utah State University, USA Jian Zhao Changchun University, China Sichuan University, China Oijun Zhao Bihai Zhao Changsha University, China

Xiaohui Zhao Jiancheng Zhong Fucai Zhou Changjian Zhou Min Zhu Yuanyuan Zhu Wangmeng Zuo University of Canberra, Australia Hunan Normal University, China Northeastern University, China Northeast Agricultural University, China Sichuan University, China Wuhan University, China Harbin Institute of Technology, China

#### **Contents – Part II**

#### **Big Data Management and Applications**

Research on the Realization Path and Application of a Data Governance	
System Based on Data Architecture Fang Miao, Wenhui Yang, Yan Xie, and Wenjie Fan	3
rang muao, wennut tang, tan xie, ana wenjie ran	
Data Quality Identification Model for Power Big Data	20
Haijie Zheng, Bing Tian, Xiaobao Liu, Wenbin Zhang, Shenqi Liu, and Cong Wang	
Data Security and Privacy	
Effective and Lightweight Defenses Against Website Fingerprinting	
on Encrypted Traffic	33
Data Hiding in the Division Domain: Simultaneously Achieving Robustness to Scaling and Additive Attacks	47
Shu Yu, Junren Qin, Jiarui Deng, Shanxiang Lyu, and Fagang Li	47
BMSC: A Novel Anonymous Trading Scheme Based on Zero-Knowledge	
Proof in Ethereum	59
Yang Li, Yinyun Zhang, Mengmeng Wang, Jianming Zhu, and Xiuli Wang	
Research on the Design and Education of Serious Network Security Games	78
Keyong Wang, Pei Wang, Yuanheng Zhang, and Dequan Yang	
KPH: A Novel Blockchain Privacy Preserving Scheme Based on Paillier	
and FO Commitment	92
Yang Li, Mengmeng Wang, Jianming Zhu, and Xiuli Wang	
Blockchain Access Control Scheme Based on Multi-authority	105
Attribute-Based Encryption         Yang Li, Baoyue Qi, Mengmeng Wang, Jianming Zhu, and Xiuli Wang	105
Applications of Data Science	
Study on the Intelligent Control Model of a Greenhouse Flower Growing	
Environment	127

Jinyang Zhen, Rui Xu, Jian Li, Shiming Shen, and Jianhui Wen

A Multi-event Extraction Model for Nursing Records Ruoyu Song, Lan Wei, and Yuhang Guo	146
Cuffless Blood Pressure Estimation Based on Both Artificial and Data-Driven Features from Plethysmography	159
User Attribute Prediction Method Based on Stacking Multimodel Fusion Qiuhong Chen, Caimao Li, Hao Lin, Hao Li, and Yuquan Hou	172
How is the Power of the Baidu Index for Forecasting Hotel Guest Arrivals? –A Case Study of Guilin Haitao Yu, Le Liu, Zhongjun Wu, and Yajun Jiang	185
A Facial Size Automatic Measurement and Analysis Technology Dongliang Yang, Changjiang Song, Hantao Zhao, and Tongjun Liu	212
Intelligent Industrial Auxiliary System Based on AR Technology Tao Wang, Xinqi Shen, Junpei Ma, Zhuorui Chang, and Linyan Guo	221
Infrastructure for Data Science	
Industry-Oriented Cloud Edge Intelligent Assembly Guidance System Difei Liu, Zhuorui Chang, Junpei Ma, Tao Wang, and Mei Li	233
An Intelligent Data Routing Scheme for Multi-UAV Avionics System Based on Integrated Communication Effectiveness Yan Zou, Meng Wu, Shaoqing Zhang, Feiyan Li, Jiarun Chen, Yazhuo Wang, Chuan Lin, and Guangjie Han	243
Intelligent Scheduling Strategies for Computing Power Resources in Heterogeneous Edge Networks	253
A Survey of Detection Methods for Software Use-After-Free Vulnerability Faming Lu, Mengfan Tang, Yunxia Bao, and Xiaoyu Wang	272
Coverage Optimization of Field Observation Instrument Networking Based on an Improved ABC Algorithm Xingyue Deng, Jiuyuan Huo, and Ling Wu	298

#### **Education Track**

Predicting Student Rankings Based on the Dual-Student Performance Comparison Model	309
Yijie Chen and Zhengzhou Zhu	309
M-ISFCM: A Semisupervised Method for Anomaly Detection of MOOC Learning Behavior	323
Shichao Zhou, Liefeng Cao, Ruizhe Zhang, and Guozi Sun	
Classroom Teaching Effect Monitoring and Evaluation System with Deep Integration of Artificial Intelligence	337
Audit Scheme of University Scientific Research Funds Based       on Consortium Blockchain         Pengfan Yue and Heng Pan       Pan	351
Performance Evaluation for College Curriculum Teaching Reform Using Artificial Neural Network Jia Li and Siyang Zhi	376
Document-Level Sentiment Analysis of Course Review Based on BG-Caps Jing Wu, Tianyi Liu, and Wei Hu	394
Research on Effective Teaching Based on the BOPPPS Model Under the Background of Engineering Education Professional Certification <i>Fang Yin, Chengyan Li, Dongpu Sun, and Libo Zhou</i>	406
A Study of Vocational College Students' Anxiety in English Vocabulary Learning	412
Forecast and Analysis of Passenger Flow at Sanya Airport Based on Gray System Theory	427

#### **Regulatory Technology in Finance**

Decentralized Counterparty Matches and Automatic Settlement of Interest	
Rate Swap Through Blockchain's Smart Contracts	437
Jian Zhao, Jinjing Liu, Hua Wang, Lin Lin, and Shaohua Xiang	

Imbalanced Problem in Initial Coin Offering Fraud Detection           Yifan Zheng and Maoning Wang	448
The Impact of Policy on the Clustering of the Blockchain Industry: Evidence from GMM Estimates Xiaolei Xu, Zhen Wu, Xiaotuo Qiao, Yuxi Zhang, and Haifeng Guo	465
Credit Risk Analysis of Chinese Companies by Applying the CAFÉ Approach George X. Yuan, Chengxing Yan, Yunpeng Zhou, Haiyang Liu, Guoqi Qian, and Yukun Shi	475
Author Index	503