

## Founding Editors

Gerhard Goos

*Karlsruhe Institute of Technology, Karlsruhe, Germany*

Juris Hartmanis

*Cornell University, Ithaca, NY, USA*


## Editorial Board Members

Elisa Bertino

*Purdue University, West Lafayette, IN, USA*

Wen Gao

*Peking University, Beijing, China*

Bernhard Steffen 

*TU Dortmund University, Dortmund, Germany*

Gerhard Woeginger 

*RWTH Aachen, Aachen, Germany*

Moti Yung 

*Columbia University, New York, NY, USA*

More information about this series at <https://link.springer.com/bookseries/558>

Meikang Qiu · Keke Gai · Han Qiu (Eds.)

# Smart Computing and Communication

6th International Conference, SmartCom 2021  
New York City, NY, USA, December 29–31, 2021  
Proceedings

*Editors*

Meikang Qiu   
Texas A&M University-Commerce  
Commerce, TX, USA

Keke Gai   
Beijing Institute of Technology  
Beijing, Beijing, China

Han Qiu   
Tsinghua University  
Beijing, China

ISSN 0302-9743 ISSN 1611-3349 (electronic)  
Lecture Notes in Computer Science  
ISBN 978-3-030-97773-3 ISBN 978-3-030-97774-0 (eBook)  
<https://doi.org/10.1007/978-3-030-97774-0>

© The Editor(s) (if applicable) and The Author(s), under exclusive license  
to Springer Nature Switzerland AG 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 Switzerland AG  
The registered company address is: Gewerbestrasse 11, 6330 Cham, Switzerland

# Preface

This volume contains the papers presented at SmartCom 2021: the Sixth International Conference on Smart Computing and Communication held during December 29–31, 2021. Originally planned to take place in New York City, USA, the conference was held virtually owing to the outbreak of COVID-19.

There were 165 submissions. Each submission was reviewed by at least three reviewers, and on average three Program Committee members. The committee decided to accept 44 regular papers.

Recent booming developments in web-based technologies and mobile applications have facilitated a dramatic growth in the implementation of new techniques, such as cloud computing, big data, pervasive computing, the Internet of Things, security and blockchain, and social cyber-physical systems. Enabling a smart life has become a popular research topic with an urgent demand. Therefore, SmartCom 2021 focused on both smart computing and communications fields and aimed to collect recent academic work to improve the research and practical application in the field.

The scope of SmartCom 2021 was broad, from smart data to smart communications, and from smart cloud computing to smart security. The conference gathered all high-quality research/industrial papers related to smart computing and communications and aimed at proposing a reference guideline for further research. SmartCom 2021 was held online via New York City, USA, and the proceedings are published by Springer.

SmartCom 2021 continued in the series of successful academic get togethers, following SmartCom 2020 (New York, USA), SmartCom 2019 (Birmingham, UK), SmartCom 2018 (Tokyo, Japan), SmartCom 2017 (Shenzhen, China), and SmartCom 2016 (Shenzhen, China).

We would like to thank the conference sponsors: Springer LNCS, the North America Chinese Talents Association, and Longxiang High Tech Group Inc.

December 2021

Meikang Qiu  
Keke Gai  
Han Qiu

# Organization

## General Chairs

Zhihui Lv  
Yongxin Zhu  
Cheng Zhang

Fudan University, China  
Chinese Academy of Sciences, China  
Ibaraki University, Japan

## Program Chairs

Meikang Qiu  
Keke Gai  
Han Qiu

Texas A&M University-Commerce, USA  
Beijing Institute of Technology, China  
Tsinghua University, China

## Local Chairs

Yonghao Wang  
Xiangyu Gao

Birmingham City University, UK  
New York University, USA

## Publicity Chairs

Yuanchao Shu  
Yu Huang  
Zhenyu Guan  
Tao Ren

Microsoft Research Asia, China  
Peking University, China  
Beihang University, China  
Beihang University, China

## Program Committee

Yue Hu  
Aniello Castiglione  
Maribel Fernandez  
Hao Hu  
Oluwaseyi Oginni  
Thomas Austin  
Zhiyuan Tan  
Xiang He  
Peter Bull  
Hendri Murfi  
Bo Du

Louisiana State University, USA  
University of Salerno, Italy  
King's College London, UK  
Nanjing University, China  
Birmingham City University, UK  
San Jose State University, USA  
Edinburgh Napier University, Scotland  
Birmingham City University, UK  
QA Ltd, UK  
Universitas Indonesia, Indonesia  
ZF Friedrichshafen AG, Germany

Cefang Guo	Imperial College London, UK
Zengpeng Li	Lancaster University, UK
Paul Kearney	Birmingham City University, UK
Wenbo Shi	Inha University, South Korea
Pietro Ferrara	JuliaSoft, Italy
Ke Miao	Mitacs Inc., Canada
Xiaohu Zhou	Birmingham City University, UK
Guangxia Xu	Chongqing University of Posts and Telecommunications, China
Kui Zhang	Birmingham City University, UK
Matthew Roach	Swansea University, UK
Chunhua Deng	Wuhan University of Science and Technology, China
Katie Cover	Pennsylvania State University, USA
Jinguang Gu	Wuhan University of Science and Technology, China
Wei Cai	Chinese University of Hong Kong, China
Haikuo Zhang	China Internet Network Information Center, China
Junwei Zhang	Xidian University, China
Vitor Jesus	Birmingham City University, UK
Jue Wang	SCCAS, China
Hao Tang	City University of New York, USA
Md Ali	Rider University, USA
Li Bo	Beihang University, China
Zijian Zhang	Beijing Institute of Technology, China
Ian A. Williams	Birmingham City University, UK
Meng Ma	Peking University, China
Cheng Zhang	Waseda University, Japan
Fausto Spoto	Università degli Studi di, Verona, Italy
Song Yang	Beijing Institute of Technology, China
Lixin Tao	Pace University, USA
Alan Dolhasz	Birmingham City University, UK
Shaojing Fu	National University of Defense Technology, China
Agostino Cortesi	Università Ca' Foscari, Italy
Yunxia Liu	Huazhong University of Science and Technology, China
Yongxin Zhu	Chinese Academy of Sciences, China
Rehan Bhana	Birmingham City University, UK
Songmao Zhang	Chinese Academy of Sciences, China
Dawei Li	Beihang University, China

Jongpil Jeong	Sungkyunkwan University, South Korea
Shuangyin Ren	Chinese Academy of Military Science, China
Ding Wang	Peking University, China
Wenjia Li	New York Institute of Technology, USA
Peng Zhang	Stony Brook University, USA
Wayne Collymore	Birmingham City University, UK
Zehua Guo	Beijing Institute of Technology, China
Jeroen van den Bos	Netherlands Forensic Institute, The Netherlands
Haibo Zhang	University of Otago, New Zealand
Zhiqiang Lin	University of Texas at Dallas, USA
Xingfu Wu	Texas A&M University, USA
Dalei Wu	University of Tennessee at Chattanooga, USA
Jun Zheng	New Mexico Tech, USA
Minzhou Pan	Virginia Tech, USA
Suman Kumar	Troy University, USA
Shui Yu	Deakin University, Australia
Jeremy Foss	Birmingham City University, UK
Cham Athwal	Birmingham City University, UK
Petr Matousek	Brno University of Technology, Czech Republic
Javier Lopez	University of Malaga, Spain
Andrew Aftelak	Birmingham City University, UK
Yi Zheng	Virginia Tech, USA
Dong Dai	Texas Tech University, USA
Hiroyuki Sato	University of Tokyo, Japan
Bo Luo	University of Kansas, USA
Syed Rizvi	Pennsylvania State University, USA
Paul Rad	Rackspace, USA
Ruisheng Shi	Beijing University of Posts and Telecommunications, China
Fuji Ren	University of Tokushima, Japan
Jian Zhang	Institute of Software, Chinese Academy of Sciences, China
Chungsik Song	San Jose State University, USA
Sang-Yoon Chang	Advanced Digital Science Center, Singapore
Mohan Muppidi	University of Texas at San Antonio, USA
Kan Zhang	Tsinghua University, China
Malik Awan	Cardiff University, UK
Ming Xu	Hangzhou Dianzi University, China
Allan Tomlinson	Royal Holloway, University of London, UK
Long Fei	Google Inc., USA
Emmanuel Bernardez	IBM Research, USA



# Contents

## Regular Papers

Efficient Online Service Based on Go-Tensorflow in the Middle-Station Scenario of Grid Service .....	3
<i>Peng Liu, Yiming Lu, Guoqing Wang, and Wang Zhou</i>	
Resource Modeling of Power Communication Packet Optical Transport Network .....	14
<i>ZhiXin Lu, LianYu Fu, YiZhao Liu, and XiYang Yin</i>	
Energy-Efficient Federated Learning in IoT Networks .....	26
<i>Deyi Kong, Zehua You, Qimei Chen, Juanjuan Wang, Jiwei Hu, Yunfei Xiong, and Jing Wu</i>	
Chinese Fine-Grained Sentiment Classification Based on Pre-trained Language Model and Attention Mechanism .....	37
<i>Faguo Zhou, Jing Zhang, and Yanan Song</i>	
Link-Efficiency Multi-channel Transmission Protocol for Data Collection in UASNs .....	48
<i>Xiaohui Wei, Xiaonan Wang, Haixiao Xu, Xingwang Wang, and Hao Guo</i>	
A Multi-attribute Decision Handover Strategy for Giant LEO Mobile Satellite Networks .....	64
<i>TingTing Zhang, LinTao Yang, Tao Dong, Jie Yin, ZhiHui Liu, and ZhanWei Wang</i>	
ML-ECN: Multilayer Emergency Communication Network Based on the Combination of Space and Earth .....	74
<i>Liang Zhou, Hao Li, Jianguo Zhou, Changjia Zhou, and Tianzhu Shi</i>	
Multi-attribute Authentication Method Based on Continuous Trust Evaluation .....	90
<i>Jing Guo, Bingsen Li, Ping Du, Ziyi Xin, Jianjun Zhang, and Jiawei Chen</i>	
Defects Detection System of Medical Gloves Based on Deep Learning .....	101
<i>Jing Wang, Meng Wan, Jue Wang, Xiaoguang Wang, Yangang Wang, Fang Liu, Weixiao Min, He Lei, and Lihua Wang</i>	
Mobile Terminal Identity Authentication Method Based on IBC .....	112
<i>Xuqiu Chen, Wei Wang, Wei Gan, Yi Yang, Su Yuan, and Meng Li</i>	

Secure Shell Remote Access for Virtualized Computing Environment .....	123
<i>He Li, Rongqiang Cao, Hanwen Xiu, Meng Wan, Kai Li, Xiaoguang Wang, Yangang Wang, and Jue Wang</i>	
A Survey of Machine Learning and Deep Learning Based DGA Detection Techniques .....	133
<i>Amr M. H. Saeed, Danghui Wang, Hamas A. M. Alnedhari, Kuizhi Mei, and Jihe Wang</i>	
Sci-Base: A Resource Aggregation and Sharing Ecology for Software on Discovery Science .....	144
<i>Meng Wan, Jiaheng Wang, Jue Wang, Rongqiang Cao, Yangang Wang, and He Li</i>	
Joint Accuracy and Resource Allocation for Green Federated Learning Networks .....	154
<i>Xu Chu, Xiaoyang Liu, Qimei Chen, Yunfei Xiong, Juanjuan Wang, Han Yu, and Xiang Hu</i>	
Trust Evaluation Method Based on the Degree of Code Obfuscation .....	164
<i>Lu Chen, Zaojian Dai, Nige Li, and Yong Li</i>	
An SG-CIM Model Table Classification Method Based on Multi Feature Semantic Recognition Technology .....	175
<i>Pengyu Zhang, Chunmei Wang, Baocong Hao, Wenhui Hu, Xueyang Liu, and Lizhuang Sun</i>	
BBCT: A Smart Blockchain-Based Bulk Commodity Trade System .....	186
<i>Jian Yang, Yawen Lu, Zhihui Lu, Jie Wu, and Hui Zhao</i>	
Research on Data Fault-Tolerance Method Based on Disk Bad Track Isolation .....	198
<i>Xu Zhang, Li Zheng, and Sujuan Zhang</i>	
Charge Prediction for Criminal Law with Semantic Attributes .....	208
<i>Cong Zhou, Weipeng Cao, and Zhiwu Xu</i>	
Research on Enterprise Financial Accounting Based on Modern Information Technology .....	218
<i>Jie Wan</i>	
Financial Information Management Under the Background of Big Data .....	228
<i>Dansheng Rao and Jie Wan</i>	

AreaTransfer: A Cross-City Crowd Flow Prediction Framework Based on Transfer Learning .....	238
<i>Xiaohui Wei, Tao Guo, Hongmei Yu, Zijian Li, Hao Guo, and Xiang Li</i>	
Parallel Improved Quantum Evolutionary Algorithm for Complex Optimization Problems .....	254
<i>Yapeng Sun</i>	
A Privacy-Preserving Auditable Approach Using Threshold Tag-Based Encryption in Consortium Blockchain .....	265
<i>Yunwei Guo, Haokun Tang, Aidi Tan, Lei Xu, Keke Gai, and Xiongwei Jia</i>	
A Hop-Parity-Involved Task Schedule for Lightweight Racetrack-Buffer in Energy-Efficient NoCs .....	276
<i>Wanhao Cao, Jihe Wang, Danghui Wang, and Kuizhi Mei</i>	
Analysis and Discussion on Standard Cost Allocation Model in State Grid .....	286
<i>Shaojun Jin, Jun Pan, Qian Chen, and Bo Li</i>	
A Novel Deception Defense-Based Honeypot System for Power Grid Network .....	297
<i>Mingjun Feng, Buqiong Xiao, Bo Yu, Jianguo Qian, Xinxin Zhang, Peidong Chen, and Bo Li</i>	
Seamless Group Pre-handover Authentication Scheme for 5G High-Speed Rail Network .....	308
<i>Zongxiao Li, Di Liu, Peiran Li, Dawei Li, Yu Sun, Zhenyu Guan, Jianwei Liu, and Jie Gao</i>	
Anomaly Detection System of Controller Area Network (CAN) Bus Based on Time Series Prediction .....	318
<i>Xiangtian Tan, Chen Zhang, Bo Li, Binbin Ge, and Chen Liu</i>	
High-Performance and Customizable Vector Retrieval Service Based on Faiss in Power Grid Scenarios .....	329
<i>Pengyu Zhang</i>	
APT Attack Heuristic Induction Honeypot Platform Based on Snort and OpenFlow .....	340
<i>Bo Dai, Zhenhai Zhang, Ling Wang, and Yuan Liu</i>	
An Automatic Design Method of Similarity Fusion Neural Network Based on SG-CIM Model .....	352
<i>Xiaoqi Liao, Xinliang Ge, Yufei Li, Wenhui Hu, Xin He, Shijie Gao, Xiaoming Chen, and Xueyang Liu</i>	

A Detection Method for I-CIFA Attack in NDN Network .....	364
<i>Meng Yue, Han Zheng, Wenzhi Feng, and Zhijun Wu</i>	
InterGridSim: A Broker-Overlay Based Inter-Grid Simulator .....	374
<i>Abdulrahman Azab</i>	
Vertical Handover of Satellite-Ground Fusion Network Based on Time and Location Under Early Access Strategy .....	384
<i>Yun Liu, Shenghao Ding, Jiaxin Huang, Hao Jiang, Jing Wu, Ruiliang Song, Ningning Lu, and Zhiqun Song</i>	
Research on Graph Structure Data Adversarial Examples Based on Graph Theory Metrics .....	394
<i>Wenyong He, Mingming Lu, Yiji Zheng, and Neal N. Xiong</i>	
Computation Offloading and Resource Allocation Based on Multi-agent Federated Learning .....	404
<i>Yiming Yao, Tao Ren, Yuan Qiu, Zheyuan Hu, and Yanqi Li</i>	
Multi-agent Computation Offloading in UAV Assisted MEC via Deep Reinforcement Learning .....	416
<i>Hang He, Tao Ren, Yuan Qiu, Zheyuan Hu, and Yanqi Li</i>	
OPN-DTSP: Optimized Pointer Networks for Approximate Solution of Dynamic Traveling Salesman Problem .....	427
<i>Zhixiang Xiao, Mingming Lu, Wenyong He, Jiawen Cai, and Neal N. Xiong</i>	
A Novel Client Sampling Scheme for Unbalanced Data Distribution Under Federated Learning .....	438
<i>Bo Chen, Xiaoying Zheng, Yongxin Zhu, and Meikang Qiu</i>	
A Novel Secure Speech Biometric Protection Method .....	450
<i>Lan Yang, Zongbo Wu, and Jun Guo</i>	
Thunderstorm Recognition Based on Neural Network PRDsNET Models .....	460
<i>ShengChun Wang, DanYi Hu, ChangQing Zhou, and JingYu Xu</i>	
The Development and Trend of Vehicle Functional Safety .....	470
<i>Jun Guo, Gejing Xu, Junjie Wu, Lan Yang, and Han Deng</i>	
Design and Development of Simulation Software Based on AR-Based Toricelli Experiment .....	481
<i>Yan Hui, Jie Zhan, Libin Jiao, and Xiu Liang</i>	

## Short Papers

Study on the Organization and Governance of Bigdata for Lifelong Education .....	493
<i>Li Ma, Zexian Yang, Wenyin Yang, Huihong Yang, and Qidi Lao</i>	
Fault Location Technique of Distribution Power Network Based on Traveling Wave Measurement .....	501
<i>Chunyi Lu, Kaili Yan, and Mi Zhou</i>	
Unikernel and Advanced Container Support in the Socker Tool .....	508
<i>Abdulrahman Azab</i>	
<b>Author Index</b> .....	513