# Lecture Notes of the Institute for Computer Sciences, Social Informatics and Telecommunications Engineering

407

#### **Editorial Board Members**

Ozgur Akan

Middle East Technical University, Ankara, Turkey

Paolo Bellavista

University of Bologna, Bologna, Italy

Jiannong Cao

Hong Kong Polytechnic University, Hong Kong, China

Geoffrey Coulson

Lancaster University, Lancaster, UK

Falko Dressler

University of Erlangen, Erlangen, Germany

Domenico Ferrari

Università Cattolica Piacenza, Piacenza, Italy

Mario Gerla

UCLA, Los Angeles, USA

Hisashi Kobayashi

Princeton University, Princeton, USA

Sergio Palazzo

University of Catania, Catania, Italy

Sartaj Sahni

University of Florida, Gainesville, USA

Xuemin (Sherman) Shen

University of Waterloo, Waterloo, Canada

Mircea Stan

University of Virginia, Charlottesville, USA

Xiaohua Jia

City University of Hong Kong, Kowloon, Hong Kong

Albert Y. Zomava

University of Sydney, Sydney, Australia

More information about this series at https://link.springer.com/bookseries/8197

# Collaborative Computing: Networking, Applications and Worksharing

17th EAI International Conference, CollaborateCom 2021 Virtual Event, October 16–18, 2021 Proceedings, Part II



Editors Honghao Gao Shanghai University Shanghai, China

Xinheng Wang Xi'an Jiaotong-Liverpool University Suzhou, China

ISSN 1867-8211 ISSN 1867-822X (electronic) Lecture Notes of the Institute for Computer Sciences, Social Informatics and Telecommunications Engineering ISBN 978-3-030-92637-3 ISBN 978-3-030-92638-0 (eBook) https://doi.org/10.1007/978-3-030-92638-0

© ICST Institute for Computer Sciences, Social Informatics and Telecommunications Engineering 2021 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**

We are delighted to introduce the proceedings of the 17th European Alliance for Innovation (EAI) International Conference on Collaborative Computing: Networking, Applications and Worksharing (CollaborateCom 2021). This conference has brought together researchers, developers, and practitioners around the world who are interested in fully realizing the promises of electronic collaboration from the aspects of networking, technology and systems, user interfaces and interaction paradigms, and interoperation with application-specific components and tools.

This year's conference attracted 206 submissions. Each submission was reviewed by an average of three reviewers. After a rigorous review process, 69 papers were accepted, including 62 full papers and seven short papers in oral presentation sessions at the main conference tracks. The conference sessions covered optimization, UAV and traffic systems, recommendation systems, network and security, IOT and social networks, image handling and human recognition, edge computing, collaborative working, and deep learning and its applications. Apart from the high-quality technical paper presentations, the technical program also featured two keynote speeches and two technical workshops. The two keynote speeches were delivered by Jie Wu from Temple University and Dan Feng from Huazhong University of Science and Technology. The two workshops organized were Securing IoT Networks (SITN) and Data-driven Fault Diagnosis with Collaborative Computing. The SITN workshop aims to bring together expertise from academia and industry to build secure IoT infrastructures for smart society. The workshop on Data-driven Fault Diagnosis with Collaborative Computing aims to provide a forum for researchers and industrial practitioners to exchange their latest results on data-driven fault diagnosis techniques with collaborative computing.

Coordination with the steering chair, Imrich Chlamtac, and the steering committee members was essential for the success of the conference. We sincerely appreciate their constant support and guidance. It was also a great pleasure to work with such an excellent organizing committee team for their hard work in organizing and supporting the conference. In particular, we are grateful to the Technical Program Committee who completed the peer-review process for technical papers and helped to put together a high-quality technical program. We are also grateful to the conference manager, Karolina Marcinova, for her support and all the authors who submitted their papers to the CollaborateCom 2021 conference and workshops.

We strongly believe that the CollaborateCom conference provides a good forum for all researchers, developers, and practitioners to discuss all science and technology aspects that are relevant to collaborative computing. We also expect that the future

#### vi Preface

CollaborateCom conferences will be as successful and stimulating as this year's, as indicated by the contributions presented in this volume.

October 2021

Honghao Gao Xinheng Wang Yuanyuan Yang Kaizhu Huang Tun Lu

## **Organization**

## **Steering Committee**

Chair

Imrich Chlamtac University of Trento, Italy

**Members** 

Song Guo University of Aizu, Japan

Bo Li Hong Kong University of Science and

Technology, China

Xiaofei Liao Huazhong University of Science and Technology,

China

Xinheng Wang Xi'an Jiaotong-Liverpool University, China

Honghao Gao Shanghai University, China

## **Organizing Committee**

#### **General Chairs**

Eng Gee Lim Xi'an Jiaotong-Liverpool University, China

Yuanyuan Yang State University of New York, USA

Honghao Gao Shanghai University, China

Xinheng Wang Xi'an Jiaotong-Liverpool University, China

#### **Technical Program Committee Co-chairs**

Kaizhu Huang Xi'an Jiaotong-Liverpool University, China

Tun Lu Fudan University, China

Web Chair

Fei Cheng Xi'an Jiaotong-Liverpool University, China

#### **Publicity and Social Media Chairs**

Li Kuang Central South University, China
Andrei Tchernykh CICESE Research Center, Mexico

#### **Workshops Chairs**

Yusheng Xu Xidian University, China

Shahid Mumtaz Instituto de Telecomunicações, Portugal

#### **Publications Chairs**

Youhuizi Li Hangzhou Dianzi University, China

Azah Kamilah Binti Draman University Teknikal Malaysia Melaka, Malaysia

Xiaoxian Yang Shanghai Polytechnic University, China

**Panels Chair** 

Kyeongsoo (Joseph) Kim Xi'an Jiaotong-Liverpool University, China

**Tutorials Chair** 

Yuyu Yin Hangzhou Dianzi University, China

**Local Chairs** 

Junyao Duan Xi'an Jiaotong-Liverpool University, China Xiaoyi Wu Xi'an Jiaotong-Liverpool University, China

## **Technical Program Committee**

Anwer Al-Dulaimi University of Toronto, Canada Amjad Ali Korea University, South Korea Junaid Arshad University of West London, UK

Zhongqin Bi Shanghai University of Electric Power, China Bin Cao Zhejiang University of Technology, China Buqing Cao Hunan University of Science and Technology,

China

Liang Chen University of West London, UK Shizhan Chen Tianjing University, China Yihai Chen Shanghai University, China

Ying Chen Beijing University of Information Technology,

China

Fei Dai Yunnan University, China Yucong Duan Hainan University, China Xiaoliang Fan Fuzhou University, China

Shucun Fu Nanjing University of Information Science and

Technology, China

Fekade Getahun Addis Ababa University, Ethiopia

Jiwei Huang China University of Petroleum, Beijing, China

Tao Huang Silicon Lake University, China Congfeng Jiang Hangzhou Dianzi University, China

Malik Ahmad Kamran COMSATS University Islamabad, Pakistan

Li Kuang Central South University, China Rui Li Xidian University, China

Youhuizi Li Hangzhou Dianzi University, China Wenmin Lin Hangzhou Dianzi University, China

Jianxun Liu Hunan University of Science and Technology,

China

Shijun Liu Shandong University, China

Xihua Liu Nanjing University of Information Science and

Technology, China

Xuan LiuSoutheast University, ChinaYutao MaWuhan University, ChinaLin MengRitsumeikan University, Japan

Shunmei Meng Nanjing University of Science and Technology,

China

Elahe Naserianhanzaei University of Exeter, UK

Yu-Chun Pan University of West London, UK
Shanchen Pang China University of Petroleum, China
Lianyong Qi Qufu Normal University, China

Kuangyu Qin Wuhan University, China
Stephan Reiff-Marganiec University of Leicester, UK
Imed Romdhani Edinburgh Napier University, UK

Changai Sun University of Science and Technology, China

Xiaobing Sun Yangzhou University, China Wenda Tang Lancaster University, UK

George Ubakanma London South Bank University, UK

Shaohua Wan Zhongnan University of Economics and Law,

China

Dongjing Wang Hangzhou Dianzi University, China

Jian Wang Wuhan University, China Junhao Wen Chongqing University, China

Yiping Wen Hunan University of Science and Technology,

China

Yu Weng Minzu University of China, China

Yirui Wu Hohai University, China Yunni Xia Chongqing University, China

Haolong Xiang University of Auckland, New Zealand Jiuyun Xu China University of Petroleum, China

Xiaolong Xu Nanjing University of Information Science and

Technology, China

#### Organization

х

Yueshen Xu Xidian University, China

Xiaoxian Yang Shanghai Polytechnic University, China Yuyu Yin Hangzhou Dianzi University, China Li Yu Hangzhou Dianzi University, China Yuan Yuan Michigan State University, USA Chongqing University, China

Gaowei Zhang Nanyang Technology University, China

Jie Zhang Nanjing University, China

Yanmei Zhang Central University of Finance and Economics,

China

Yiwen Zhang Anhui University, China

Zijian Zhang Beijing Institute of Technology, China

Xuan Zhao Nanjing University, China

Zhuofeng Zhao North China University of Technology, China Yu Zheng Nanjing University of Information Science and

Technology, China

Ao Zhou Beijing University of Posts and

Telecommunications, China

Guobing Zou Shanghai University, China

## **Contents - Part II**

Edge Computing	
Energy-Efficient Cooperative Offloading for Multi-AP MEC in IoT Networks	3
Zhihui Cao, Haifeng Sun, Ning Zhang, and Xiang Lv	
Multi-truth Discovery with Correlations of Candidates in Crowdsourcing Systems  Hongyu Huang, Guijun Fan, Yantao Li, and Nankun Mu	18
D2D-Based Multi-relay-Assisted Computation Offloading in Edge Computing Network  Xuan Zhao, Song Zhang, Bowen Liu, Xutong Jiang, and Wanchun Dou	33
Delay-Sensitive Slicing Resources Scheduling Based on Multi-MEC Collaboration in IoV  Yan Liang, Xin Chen, Shengcheng Ma, and Libo Jiao	50
An OO-Based Approach of Computing Offloading and Resource Allocation for Large-Scale Mobile Edge Computing Systems  Yufu Tan, Sikandar Ali, Haotian Wang, and Jiwei Huang	65
<b>Edge Computing and Collaborative Working</b>	
Joint Location-Value Privacy Protection for Spatiotemporal Data Collection via Mobile Crowdsensing	87
Hybrid Semantic Conflict Prevention in Real-Time Collaborative Programming Wenhua Xu, Yiteng Zhang, Brian Chiu, Dong Chen, Jinfeng Jiang, Bowen Du, and Hongfei Fan	104
Supporting Cross-Platform Real-Time Collaborative Programming: Architecture, Techniques, and Prototype System	124

Yifan Ma, Zichao Yang, Brian Chiu, Yiteng Zhang, Jinfeng Jiang,

Bowen Du, and Hongfei Fan

Collaborative Computing Based on Truthful Online Auction Mechanism	
in Internet of Things Bilian Wu, Xin Chen, and Libo Jiao	144
A Hashgraph-Based Knowledge Sharing Approach for Mobile Robot Swarm	158
Xiao Shu, Bo Ding, Jie Luo, Xiang Fu, Min Xie, and Zhen Li	
Collaborative Working and Deep Learning and Application	
CASE: Predict User Behaviors via Collaborative Assistant Sequence Embedding Model	175
A Collaborative Optimization-Guided Entity Extraction Scheme  Qiaojuan Peng, Xiong Luo, Hailun Shen, Ziyang Huang, and Maojian Chen	190
A Safe Topological Waypoints Searching-Based Conservative Adaptive Motion Planner in Unknown Cluttered Environment  Jiachi Xu, Jiefu Tan, Chao Xue, Yaqianwen Su, Xionghui He, and Yongjun Zhang	206
Multi-D3QN: A Multi-strategy Deep Reinforcement Learning for Service Composition in Cloud Manufacturing  Jun Zeng, Juan Yao, Yang Yu, and Yingbo Wu	225
Transfer Knowledge Between Cities by Incremental Few-Shot Learning Jiahao Wang, Wenxiong Li, Xiuxiu Qi, and Yuheng Ren	241
Deep Learning and Application	
Multi-view Representation Learning with Deep Features for Offline Signature Verification Xingbiao Zhao, Changzheng Liu, Benzhuang Zhang, Limengzi Yuan, and Yuchen Zheng	261
Backdoor Attack of Graph Neural Networks Based on Subgraph Trigger  Yu Sheng, Rong Chen, Guanyu Cai, and Li Kuang	276
A UniverApproCNN with Universal Approximation and Explicit Training Strategy Yin Yang, Yifeng Wang, and Sengiao Yang	297

## **Contents – Part I**

Optimization for Collaborate System (Workshop Papers)	
Chinese Named Entity Recognition Based on Dynamically Adjusting Feature Weights	3
Qing Lv, Limin Zheng, and Miao Wang	
Location Differential Privacy Protection in Task Allocation for Mobile Crowdsensing Over Road Networks	20
Mohan Fang, Juan Yu, Jianmin Han, Xin Yao, Hao Peng, Jianfeng Lu, and Ngounou Bernard	
"Failure" Service Pattern Mining for Exploratory Service Composition	38
Optimal Control and Reinforcement Learning for Robot: A Survey	54
KTOBS: An Approach of Bayesian Network Learning Based on K-tree	
Optimizing Ordering-Based Search  Qingwang Zhang, Sihang Liu, Ruihong Xu, Zemeng Yang, and Jianxiao Liu	67
Recommendation Model Based on Social Homogeneity Factor and Social	
Influence Factor Weizhi Ying, Qing Yu, and Zuohua Wang	83
Attention Based Spatial-Temporal Graph Convolutional Networks	
for RSU Communication Load Forecasting	99
UVA and Traffic System	
Mobile Encrypted Traffic Classification Based on Message Type Inference Yige Chen, Tianning Zang, Yongzheng Zhang, Yuan Zhou, and Peng Yang	117
Fine-Grained Spatial-Temporal Representation Learning with Missing	<u>.</u>
Data Completion for Traffic Flow Prediction  Shiai Wang, Min Gao, Zongwei Wang, Jia Wang, Fan Wu, and Junhao Wen	138

Underwater Information Sensing Method Based on Improved Dual-Coupled Duffing Oscillator Under Lévy Noise Description Hanwen Zhang, Zhen Qin, and Dajiang Chen	156
Unpaired Learning of Roadway-Level Traffic Paths from Trajectories  Weixing Jia, Guiling Wang, Xuankai Yang, and Fengquan Zhang	171
Multi-UAV Cooperative Exploring for the Unknown Indoor Environment Based on Dynamic Target Tracking	191
Recommendation System	
MR-FI: Mobile Application Recommendation Based on Feature Importance and Bilinear Feature Interaction Mi Peng, Buqing Cao, Junjie Chen, Jianxun Liu, and Rong Hu	213
The Missing POI Completion Based on Bidirectional Masked Trajectory  Model	229
Dual-Channel Graph Contextual Self-Attention Network for Session-Based	
Recommendation	244
Context-aware Graph Collaborative Recommendation Without Feature Entanglement Tianyi Gu, Ping Li, and Kaiwen Huang	259
Improving Recommender System via Personalized Reconstruction of Reviews  Zunfu Huang, Bo Wang, Hongtao Liu, Qinxue Jiang, Naixue Xiong, and Yuexian Hou	277
Recommendation System and Network and Security	
Dynamic Traffic Network Based Multi-Modal Travel Mode Fusion Recommendation  Nannan Jia, Mengmeng Chang, Zhiming Ding, Zunhao Liu, Bowen Yang, Lei Yuan, and Lutong Li	299
Improving Personalized Project Recommendation on GitHub Based on Deep Matrix Factorization	318
Huan Yang, Song Sun, Junhao Wen, Haini Cai, and Muhammad Mateen	

Contents – Part I	xvii
An Intelligent SDN DDoS Detection Framework	333
Inspector: A Semantics-Driven Approach to Automatic Protocol Reverse Engineering	348
Yige Chen, Tianning Zang, Yongzheng Zhang, Yuan Zhou, Peng Yang, and Yipeng Wang	
MFF-AMD: Multivariate Feature Fusion for Android Malware Detection	368
Network and Security	
PSG: Local Privacy Preserving Synthetic Social Graph Generation	389
Topology Self-optimization for Anti-tracking Network via Nodes  Distributed Computing	405
An Empirical Study of Model-Agnostic Interpretation Technique for Just-in-Time Software Defect Prediction	420
Yet Another Traffic Black Hole: Amplifying CDN Fetching Traffic with RangeFragAmp Attacks	439
DCNMF: Dynamic Community Discovery with Improved Convex-NMF in Temporal Networks	460
Network and Security and IoT and Social Networks	
Loopster++: Termination Analysis for Multi-path Linear Loop	479
A Stepwise Path Selection Scheme Based on Multiple QoS Parameters Evaluation in SDN	498
Lin Liu, Jian-Tao Zhou, Hai-Feng Xing, and Xiao-Yong Guo	470

A Novel Approach to Taxi-GPS-Trace-Aware Bus Network Planning	520
Community Influence Maximization Based on Flexible Budget in Social Networks	534
Mengdi Xiao, Peng Li, Weiyi Huang, Junlei Xiao, and Lei Nie	334
An Online Truthful Auction for IoT Data Trading with Dynamic Data	
Owners Zhenni Feng, Junchang Chen, and Tong Liu	554
IoT and Social Networks and Images Handling and Human Recognition	
Exploiting Heterogeneous Information for IoT Device Identification Using Graph Convolutional Network  Jisong Yang, Yafei Sang, Yongzheng Zhang, Peng Chang, and Chengwei Peng	575
Data-Driven Influential Nodes Identification in Dynamic Social Networks Ye Qian and Li Pan	592
Human Motion Recognition Based on Wi-Fi Imaging	608
A Pervasive Multi-physiological Signal-Based Emotion Classification with Shapelet Transformation and Decision Fusion	628
A Novel and Efficient Distance Detection Based on Monocular Images for Grasp and Handover  Dianwen Liu, Pengfei Yi, Dongsheng Zhou, Qiang Zhang, Xiaopeng Wei, Rui Liu, and Jing Dong	642
Images Handling and Human Recognition and Edge Computing	
A Novel Gaze-Point-Driven HRI Framework for Single-Person	661

Semi-automatic Segmentation of Tissue Regions in Digital Histopathological Image	678
Xin He, Kairun Chen, and Mengning Yang	
T-UNet: A Novel TC-Based Point Cloud Super-Resolution Model	607
for Mechanical LiDAR	69/
Lu Ken, Deyi Li, Zhenchao Ouyang, Jianwei Mu, ana wen He	
Computation Offloading for Multi-user Sequential Tasks in Heterogeneous	
Mobile Edge Computing	713
Huanhuan Xu, Jingya Zhou, and Fei Gu	
Model-Based Evaluation and Optimization of Dependability for Edge	
Computing Systems	728
Jingyu Liang, Bowen Ma, Sikandar Ali, and Jiwei Huang	, 20
Author Index	749

Contents - Part I

xix