

## 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 subseries at <http://www.springer.com/series/7407>

David Mohaisen · Ruoming Jin (Eds.)

# Computational Data and Social Networks

10th International Conference, CSoNet 2021  
Virtual Event, November 15–17, 2021  
Proceedings

*Editors*

David Mohaisen   
University of Central Florida  
Orlando, FL, USA

Ruoming Jin  
Kent State University  
Kent, OH, USA

ISSN 0302-9743                      ISSN 1611-3349 (electronic)  
Lecture Notes in Computer Science  
ISBN 978-3-030-91433-2              ISBN 978-3-030-91434-9 (eBook)  
<https://doi.org/10.1007/978-3-030-91434-9>

LNCS Sublibrary: SL1 – Theoretical Computer Science and General Issues

© Springer Nature Switzerland AG 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

The 10th International Conference on Computational Data and Social Networks (CSoNet 2021), held online, is a premier interdisciplinary forum that brings together researchers and practitioners from all fields of big data and social networks, such as billion-scale network computing, social network/media analysis, mining, security and privacy, and deep learning. CSoNet 2021 aims to address emerging, yet important computational problems with a focus on the fundamental background, theoretical technology development, and real-world applications associated with big data network analysis, modelling, and deep learning. CSoNet 2021 welcomed both the presentation of original research results, the exchange and dissemination of truly innovative theoretical advancements, as well as outcomes of practical deployments and real-world applications in the broad area of information networks.

The core research topics include: theories of network organization; influence modeling, propagation, and maximization; adversarial attacks of network; NLP and affective computing; computational methods for social good; and security, trust, and privacy, among others. We have selected 18 regular full papers, 8 short papers, along with 4 two-page extended abstracts for presentation and publication. An additional 4 invited papers from active researchers in the related fields are also included. Similar to previous years, a few special tracks with specific themes were organized. A special track on Information Spread in Social, Data and Economic Networks accepted 2 papers and 2 abstracts, and the 2nd International Symposium on Fact-Checking, Fake News and Malware Detection in Online Social Networks (OSNs) accepted 3 papers along with 2 abstracts. A number of selected best papers were invited for publication in the Journal of Combinatorial Optimization, IEEE Transactions on Network Science and Engineering, and Computational Social Networks.

This conference would not have been possible without the support of a large number of individuals. First, we sincerely thank all authors for submitting their high quality work to the conference, especially as the Covid-19 pandemic continues to ravage communities and countries around the world. We fully understand the unique challenges facing authors during the pandemic. Our thanks also go to all Technical Program Committee members and sub-reviewers for their willingness to provide timely and detailed reviews of all submissions. Their hard work during the pandemic made the success of the conference possible. We also offer our special thanks to the Publicity and Publication Chairs for their dedication in disseminating the call and encouraging participation in such challenging times, in addition to the preparation of the proceedings. Special thanks are also due to the Special Tracks Chair, Finance Chair and the Web Chair. Lastly, we acknowledge the support and patience of Springer staff members throughout the process.

November 2021

Ruoming Jin  
David Mohaisen

# Organization

## General Chairs

Long Le	University of Quebec, Canada
Jun Pei	Hefei University of Technology, China

## Technical Program Committee Chairs

Ruoming Jin	Kent State University, USA
David Mohaisen	University of Central Florida, USA

## Publicity Chairs

Duy Nguyen	San Diego State University, USA
Khoa Phan	La Trobe University, Australia
Yang Zhou	Auburn University, USA
Alfred Zimmermann	Reutlingen University, Germany
Gwangil Jeon	Incheon National University, South Korea

## Web Chair

Abdellah Chehri	University of Quebec, Canada
-----------------	------------------------------

## Steering Committee

My T. Thai (Chair)	University of Florida, USA
Kim-Kwang Raymond Choo	University of Texas at San Antonio, USA
Zhi-Li Zhang	University of Minnesota, USA
Weili Wu	University of Texas, Dallas, USA

## Technical Program Committee Members

Thang Dinh	Virginia Commonwealth University, USA
Zhi Liu	University of North Texas, USA
Akrati Saxena	Eindhoven University of Technology, The Netherlands
Weizhi Meng	Technical University of Denmark, Denmark
Jinyoung Han	Sungkyunkwan University, South Korea
Zhenming Liu	College of William and Mary, USA
Ting Hua	Virginia Tech, USA
Tho Quan	Ho Chi Minh City University of Technology, Vietnam
Marwan Omar	Saint Leo University, USA

Rajdeep Bhowmik	Binghamton University, USA
Mohammed Abuhamad	Loyola University, USA
Donghyun Kim	Georgia State University, USA
Vamsi Paruchuri	University of Central Arkansas, USA
Ralucca Gera	Naval Postgraduate School, USA
Pavel Kromer	VSB – Technical University of Ostrava, Czech Republic
Yuan Yao	Nanjing University, China
Hien Nguyen	Banking University of Ho Chi Minh City, Vietnam
Rhongho Jang	Wayne State University, USA

## List of Subreviewers

Vitaly Belik  
Vladimir Boginski  
Ngoc-Tu Huynh  
Antonina Podusova  
Kirill Yanchuk  
Qipeng Zheng

# Contents

## Combinatorial Optimization and Learning

Streaming Algorithms for Maximizing Non-submodular Functions on the Integer Lattice. . . . .	3
<i>Bin Liu, Zihan Chen, Huijuan Wang, and Weili Wu</i>	
Causal Inference for Influence Propagation—Identifiability of the Independent Cascade Model . . . . .	15
<i>Shi Feng and Wei Chen</i>	
Streaming Algorithms for Budgeted $k$ -Submodular Maximization Problem . . .	27
<i>Canh V. Pham, Quang C. Vu, Dung K. T. Ha, and Tai T. Nguyen</i>	
Approximation Algorithms for the Lower Bounded Correlation Clustering Problem . . . . .	39
<i>Sai Ji, Yinhong Dong, Donglei Du, and Dachuan Xu</i>	
Approximation Algorithm for Maximizing Nonnegative Weakly Monotonic Set Functions . . . . .	50
<i>Min Cui, Donglei Du, Dachuan Xu, and Ruiqi Yang</i>	
Differentially Private Submodular Maximization over Integer Lattice. . . . .	59
<i>Jiaming Hu, Dachuan Xu, Donglei Du, and Cuixia Miao</i>	
Maximizing the Sum of a Supermodular Function and a Monotone DR-submodular Function Subject to a Knapsack Constraint on the Integer Lattice. . . . .	68
<i>Jingjing Tan, Yicheng Xu, Dongmei Zhang, and Xiaoqing Zhang</i>	

## Deep Learning and Applications to Complex and Social Systems

A Framework for Accelerating Graph Convolutional Networks on Massive Datasets . . . . .	79
<i>Xiang Li, Ruoming Jin, Rajiv Ramnath, and Gagan Agrawal</i>	
AdvEdge: Optimizing Adversarial Perturbations Against Interpretable Deep Learning . . . . .	93
<i>Eldor Abdukhmidov, Mohammed Abuhamad, Firuz Juraev, Eric Chan-Tin, and Tamer AbuHmed</i>	



<b>Incorporating Transformer Models for Sentiment Analysis and News Classification in Khmer . . . . .</b>	<b>106</b>
<i>Md Rifatul Islam Rifat and Abdullah Al Imran</i>	
<b>Deep Bangla Authorship Attribution Using Transformer Models . . . . .</b>	<b>118</b>
<i>Abdullah Al Imran and Md Nur Amin</i>	
<b>A Deep Learning Based Traffic Sign Detection for Intelligent Transportation Systems . . . . .</b>	<b>129</b>
<i>Bao-Long Le, Gia-Huy Lam, Xuan-Vinh Nguyen, The-Manh Nguyen, Quoc-Loc Duong, Quang Dieu Tran, Trong-Hop Do, and Nhu-Ngoc Dao</i>	
<b>Detecting Hate Speech Contents Using Embedding Models . . . . .</b>	<b>138</b>
<i>Phuc H. Duong, Cuong C. Chung, Loc T. Vo, Hien T. Nguyen, and Dat Ngo</i>	
<b>MIC Model for Cervical Cancer Risk Factors Deep Association Analysis . . .</b>	<b>147</b>
<i>Tiehua Zhou, Yingxuan Tang, Ling Gong, Hua Xie, Minglei Shan, and Ling Wang</i>	
<b>Power Grid Cascading Failure Prediction Based on Transformer . . . . .</b>	<b>156</b>
<i>Tianxin Zhou, Xiang Li, and Haibing Lu</i>	
<b>Measurements of Insight from Data</b>	
<b>Security Breaches in the Healthcare Domain: A Spatiotemporal Analysis . . .</b>	<b>171</b>
<i>Mohammed Al Kiono, Marwan Omar, Manar Mohaisen, and David Mohaisen</i>	
<b>Social and Motivational Factors for the Spread of Physical Activities in a Health Social Network . . . . .</b>	<b>184</b>
<i>NhatHai Phan, David Kil, Brigitte Piniewski, and Dejing Dou</i>	
<b>Understanding the Issues Surrounding COVID-19 Vaccine Roll Out via User Tweets . . . . .</b>	<b>197</b>
<i>Jose Esparza, Gissella Bejarano, Arti Ramesh, and Anand Seetharam</i>	
<b>Complex Networks Analytics</b>	
<b>Minimize Travel Time with Traffic Flow Density Equilibrium on Road Network . . . . .</b>	<b>209</b>
<i>Qinghua Tang, Demin Li, Shuang Zhou, and Yue Fu</i>	
<b>Network Based Framework to Compare Vaccination Strategies . . . . .</b>	<b>218</b>
<i>Rishi Ranjan Singh, Amit Kumar Dhar, Arzad Alam Kherani, Naveen Varghese Jacob, Ashitabh Misra, and Devansh Bajpai</i>	

<b>Groups Influence with Minimum Cost in Social Networks . . . . .</b>	<b>231</b>
<i>Phuong N. H. Pham, Canh V. Pham, Hieu V. Duong, Trung Thanh Nguyen, and My T. Thai</i>	
<b>Recovering Communities in Temporal Networks Using Persistent Edges . . . .</b>	<b>243</b>
<i>Konstantin Avrachenkov, Maximilien Drevet, and Lasse Leskelä</i>	
<b>Community Detection Using Semilocal Topological Features and Label Propagation Algorithm . . . . .</b>	<b>255</b>
<i>Deepanshu Malhotra, Raluca Gera, and Akshat Saxena</i>	
<b>Twitter Analysis of Covid-19 Misinformation in Spain . . . . .</b>	<b>267</b>
<i>Diego Saby, Olivier Philippe, Nataly Buslón, Javier del Valle, Oriol Puig, Ramón Salaverria, and Maria José Rementeria</i>	
<b>Comparing Community-Aware Centrality Measures in Online Social Networks . . . . .</b>	<b>279</b>
<i>Stephany Rajeh, Marinette Savonnet, Eric Leclercq, and Hocine Cherifi</i>	
<b>Two-Tier Cache-Aided Full-Duplex Content Delivery in Satellite–Terrestrial Networks . . . . .</b>	<b>291</b>
<i>Quynh T. Ngo, Khoa T. Phan, Wei Xiang, Abdun Mahmood, and Jill Slay</i>	
 <b>Special Track: Fact-Checking, Fake News and Malware Detection in Online Social Networks</b>	
<b>Mean User-Text Agglomeration (MUTA): Practical User Representation and Visualization for Detection of Online Influence Operations. . . . .</b>	<b>305</b>
<i>Evan Crothers, Herna Viktor, and Nathalie Japkowicz</i>	
<b>The Role of Information Organization and Knowledge Structuring in Combatting Misinformation: A Literary Analysis. . . . .</b>	<b>319</b>
<i>Kevin Matthe Caramancion</i>	
<b>Fake News Detection Using LDA Topic Modelling and K-Nearest Neighbor Classifier . . . . .</b>	<b>330</b>
<i>Mario Casillo, Francesco Colace, Brij B. Gupta, Domenico Santaniello, and Carmine Valentino</i>	
<b>Machine Learning Technique for Fake News Detection Using Text-Based Word Vector Representation. . . . .</b>	<b>340</b>
<i>Akshat Gaurav, B. B. Gupta, Ching-Hsien Hsu, Arcangelo Castiglione, and Kwok Tai Chui</i>	

# Special Track: Information Spread in Social and Data Networks

Summarization Algorithms for News: A Study of the Coronavirus Theme and Its Impact on the News Extracting Algorithm . . . . .	351
---	-----

*Lyudmila Gadasina, Vladislav Veklenko, and Pasi Luukka*

Social Cohesion During the Stay-at-Home Phase of the First Wave of the COVID-19 Pandemic on Polish-Speaking Twitter . . . . .	361
---	-----

*Andrzej Jarynowski, Alexander Semenov, Monika Wójta-Kempa, and Vitaly Belik*

Target Set Selection in Social Networks with Influence and Activation Thresholds . . . . .	371
--	-----

*Zhecheng Qiang, Eduardo L. Pasiliao, and Qipeng P. Zheng*

## Extended Abstracts

Social Activity and Decentralized Applications in Blockchain-Based Social Networks . . . . .	383
--	-----

*Cheick Tidiane Ba, Galdeman Alessia, Matteo Zignani, and Sabrina Gaito*

Vulnerabilities Assessment of Deep Learning-Based Fake News Checker under Poisoning Attacks . . . . .	385
---	-----

*Lelio Campanile, Pasquale Cantiello, Mauro Iacono, Fiammetta Marulli, and Michele Mastroianni*

Transfer Learning and Loan Default Prediction . . . . .	387
---	-----

*Tzvi Feinberg, Alexander Semenov, Yongpei Guan, Dmitry Grigoriev, and Artem Prokhorov*

Author Index . . . . .	389
------------------------	-----