

Lecture Notes in Electrical Engineering

Volume 1056

Series Editors

Leopoldo Angrisani, Department of Electrical and Information Technologies Engineering, University of Napoli Federico II, Napoli, Italy

Marco Arteaga, Departament de Control y Robótica, Universidad Nacional Autónoma de México, Coyoacán, Mexico
Samarjit Chakraborty, Fakultät für Elektrotechnik und Informationstechnik, TU München, München, Germany

Jiming Chen, Zhejiang University, Hangzhou, Zhejiang, China

Shanben Chen, School of Materials Science and Engineering, Shanghai Jiao Tong University, Shanghai, China

Tan Kay Chen, Department of Electrical and Computer Engineering, National University of Singapore, Singapore, Singapore

Rüdiger Dillmann, University of Karlsruhe (TH) IAIM, Karlsruhe, Baden-Württemberg, Germany

Haibin Duan, Beijing University of Aeronautics and Astronautics, Beijing, China

Gianluigi Ferrari, Dipartimento di Ingegneria dell'Informazione, Sede Scientifica Università degli Studi di Parma, Parma, Italy

Manuel Ferre, Centre for Automation and Robotics CAR (UPM-CSIC), Universidad Politécnica de Madrid, Madrid, Spain

Faryar Jabbari, Department of Mechanical and Aerospace Engineering, University of California, Irvine, CA, USA

Limin Jia, State Key Laboratory of Rail Traffic Control and Safety, Beijing Jiaotong University, Beijing, China

Janusz Kacprzyk, Intelligent Systems Laboratory, Systems Research Institute, Polish Academy of Sciences, Warsaw, Poland

Alaa Khamis, Department of Mechatronics Engineering, German University in Egypt El Tagamoa El Khames, New Cairo City, Egypt

Torsten Kroeger, Intrinsic Innovation, Mountain View, CA, USA

Yong Li, College of Electrical and Information Engineering, Hunan University, Changsha, Hunan, China

Qilian Liang, Department of Electrical Engineering, University of Texas at Arlington, Arlington, TX, USA

Ferran Martín, Departament d'Enginyeria Electrònica, Universitat Autònoma de Barcelona, Bellaterra, Barcelona, Spain

Tan Cher Ming, College of Engineering, Nanyang Technological University, Singapore, Singapore

Wolfgang Minker, Institute of Information Technology, University of Ulm, Ulm, Germany

Pradeep Misra, Department of Electrical Engineering, Wright State University, Dayton, OH, USA

Subhas Mukhopadhyay, School of Engineering, Macquarie University, NSW, Australia

Cun-Zheng Ning, Department of Electrical Engineering, Arizona State University, Tempe, AZ, USA

Toyoaki Nishida, Department of Intelligence Science and Technology, Kyoto University, Kyoto, Japan

Luca Oneto, Department of Informatics, Bioengineering, Robotics and Systems Engineering, University of Genova, Genova, Genova, Italy

Bijaya Ketan Panigrahi, Department of Electrical Engineering, Indian Institute of Technology Delhi, New Delhi, Delhi, India

Federica Pascucci, Dipartimento di Ingegneria, Università degli Studi Roma Tre, Roma, Italy

Yong Qin, State Key Laboratory of Rail Traffic Control and Safety, Beijing Jiaotong University, Beijing, China

Kan Woon Seng, School of Electrical and Electronic Engineering, Nanyang Technological University, Singapore, Singapore

Joachim Speidel, Institute of Telecommunications, University of Stuttgart, Stuttgart, Germany

Germano Veiga, FEUP Campus, INESC Porto, Porto, Portugal

Haitao Wu, Academy of Opto-electronics, Chinese Academy of Sciences, Haidian District Beijing, China

Walter Zamboni, Department of Computer Engineering, Electrical Engineering and Applied Mathematics, DIEM—Università degli studi di Salerno, Fisciano, Salerno, Italy

Junjie James Zhang, Charlotte, NC, USA

Kay Chen Tan, Department of Computing, Hong Kong Polytechnic University, Kowloon Tong, Hong Kong

The book series *Lecture Notes in Electrical Engineering* (LNEE) publishes the latest developments in Electrical Engineering—quickly, informally and in high quality. While original research reported in proceedings and monographs has traditionally formed the core of LNEE, we also encourage authors to submit books devoted to supporting student education and professional training in the various fields and applications areas of electrical engineering. The series cover classical and emerging topics concerning:

- Communication Engineering, Information Theory and Networks
- Electronics Engineering and Microelectronics
- Signal, Image and Speech Processing
- Wireless and Mobile Communication
- Circuits and Systems
- Energy Systems, Power Electronics and Electrical Machines
- Electro-optical Engineering
- Instrumentation Engineering
- Avionics Engineering
- Control Systems
- Internet-of-Things and Cybersecurity
- Biomedical Devices, MEMS and NEMS

For general information about this book series, comments or suggestions, please contact leontina.dicecco@springer.com.

To submit a proposal or request further information, please contact the Publishing Editor in your country:

China

Jasmine Dou, Editor (jasmine.dou@springer.com)

India, Japan, Rest of Asia

Swati Meherishi, Editorial Director (Swati.Meherishi@springer.com)

Southeast Asia, Australia, New Zealand

Ramesh Nath Premnath, Editor (ramesh.premnath@springernature.com)

USA, Canada

Michael Luby, Senior Editor (michael.luby@springer.com)

All other Countries

Leontina Di Cecco, Senior Editor (leontina.dicecco@springer.com)

**** This series is indexed by EI Compendex and Scopus databases. ****

Basabi Chakraborty · Arindam Biswas ·
Amlan Chakrabarti
Editors

Advances in Data Science and Computing Technologies

Select Proceedings of ADSC 2022

Editors

Basabi Chakraborty
School of Computing
Madanapalle Institute of Technology
and Science
Angallu, Andhra Pradesh, India

Iwate Prefectural University
Iwate, Japan

Amlan Chakrabarti
A.K. Choudhury School of Information
Technology
University of Calcutta
Kolkata, West Bengal, India

Arindam Biswas
Kazi Nazrul University
Asansol, West Bengal, India

ISSN 1876-1100 ISSN 1876-1119 (electronic)
Lecture Notes in Electrical Engineering
ISBN 978-981-99-3655-7 ISBN 978-981-99-3656-4 (eBook)
<https://doi.org/10.1007/978-981-99-3656-4>

© The Editor(s) (if applicable) and The Author(s), under exclusive license to Springer Nature Singapore Pte Ltd. 2023

This work is subject to copyright. All rights are solely and exclusively licensed 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

Contents

Fertilizer Recommendation System for High Crop Yield based on Prediction Model: A Comparative Analysis	1
Bhuvaneswari Swaminathan, P. Saravanan, and V. Subramaniyaswamy	
Prediction of Future Career Course of Students Through RF Algorithm	9
Sukarna Dey Mondal, Dipendra Nath Ghosh, and Pabitra Kumar Dey	
Survey of Various Machine Learning Techniques for Analyzing IoMT-Based Remote Patient Monitoring System	27
Sayyed Johar and G. R. Manjula	
A Novel Approach to Predicting the Cardiovascular Sickness	33
Debabrata Swain, Meet Kava, Ranjana Jadhav, and Santosh Satapathy	
Intelligent System for Detecting Spam Emails Using Machine Learning Classifiers	43
Debabrata Swain, Naresh Chillur, Meet Kava, and Amol Bhilare	
Optical Flow-Based Movement Alert System for Assisting Visually Impaired People	51
Jyoti Madake, Rohan Aparajit, Pranjali Balikai, Akhil Bhalgat, Shripad Bhatlawande, and Swati Shilaskar	
Detection of Fallen Trees and Vehicles Plying on the Road for Safety of Visually Impaired People	63
Swati Shilaskar, Ruturaj Desai, Shripad Bhatlawande, Nishit Chaudhari, Soham Bugad, and Jyoti Madake	
Electronic Travel Aid for Bus Detection and Bus-Route Number Recognition for Blind People	71
Shripad Bhatlawande, Harshita Agrawal, Adhiraj Jagdale, Anusha Agrawal, and Swati Shilaskar	

LSTM-Based Encoder–Decoder Model for Transliteration of English, Marathi, and Hindi Query	79
Ranjana Jadhav, Adwait Bhosale, Tejas Gadi, Sanskruti Bahure, Akshay Bargaje, and Amey Chopde	
A Study on Hiding Internet of Things (IoT) Communication	89
Ujjal Dey Sarkar, Namrata Samanta, and Pabak Indu	
Automatic Speech Recognition Using Acoustic Modeling	109
Deepali Joshi, Pratik Waso, Rushikesh Shelke, Swapnil Jadhav, Kaustubh Bhale, and Akshada Padalkar	
Effect of Dropout on Convolutional Neural Network for Hyperspectral Image Classification	121
Somenath Bera and Vimal K. Shrivastava	
State Derivative Optimal Control Law for Submersible Autonomous Robotic Vehicle in Steering Plane	133
Siddhartha Vadapalli and Subhasish Mahapatra	
ASR for Indian Regional Languages Using Fine-Tuned Wav2Vec2 Model	141
Premanand Ghadekar, Khushi Jhanwar, Ameya Karpe, Akash Sivanandan, Tanishka Shetty, and Prannay Khushalani	
Intelligent Online Voting System for Twenty-First Century and Smart Cities 5.0: An Empirical Approach through Blockchain with ML Techniques	151
Rohit Rastogi, Priyanshu Arora, Luv Dhamija, and Rajat Shrivastava	
An Empirical Study on Credit Risk Assessment Using Ensemble Classifiers	157
Arijit Bhattacharya, Souvik Kumar Parui, Saroj Kr. Biswas, and Ardhendu Mandal	
Audio Based Text Summarization Using Natural Language Processing	171
Premanand Ghadekar, Divsehaj Singh Anand, Aryan Kumar Gupta, Preeti Oswal, Dheeraj Sharma, and Shreyas Khare	
Blockchain-Enabled Security in Vehicular Ad Hoc Network	181
Sharad Pratap Singh and G. Hanumat Sastry	
Stock Selection Using Ontological Financial Analysis	191
Bikram Pratim Bhuyan and Hanumat Sastry	
Components of Information Diffusion and Its Models in Online Social Networks; a Comparative Study	199
Aaquib Hussain Ganai, Rana Hashmy, and Hilal Ahmad Khanday	

Development of a Residual Neural Network Architecture for the Detection of Diabetic Retinopathy in Retinal Fundus Images	207
Sachin S. Bhat	
Prediction Markets Using Machine Learning	219
Tarun Kharkwal and Shweta Meena	
Evaluation of Optimum Batting Order Based on Partnership Analysis Using Ant Colony Optimization Technique	227
Mousumi Tarafder, Soumen Santra, Sweta Sharma, and Arpan Deyasi	
Identification of Rock Images in Mining Industry: An Application of Deep Learning Technique	235
Soumyadeep Paty and Supreeti Kamilya	
Evaluation of Teachers' Performance Using Fuzzy Inferences System	243
Ashadul Haque and Md Firoj Ali	
A Detailed Analysis on Intrusion Detection Systems, Datasets, and Challenges	259
Chetan Gupta, Amit Kumar, and Neelesh Kumar Jain	
Object Detection Under Low-Lighting Conditions Using Deep Learning Architectures: A Comparative Study	269
Arrun Sivasubramanian, J. Arun Prakash, K. S. Dharshan Kumar, V. R. Prashanth, V. Sowmya, and V. V. Sajith Variyar	
Terahertz Image Processing: A Boon to the Imaging Technology	277
Jayashree Karmakar, Debabrata Samanta, Amit Banerjee, and M. P. Karthikeyan	
Developing a Talent Identification Model for Predicting Player Position in Football Using Machine Learning Algorithms	285
R. Sujatha, B. Uma Maheswari, D. Kavitha, and Kiran Kandaswamy	
Implementation of Anticipated Technique in Digital Mammography for Piloting Classification of Breast Cancer Using CNN	295
Sarbjit Kaur Dhillon and Jasmeen Gill	
Three-Layered Hybrid Analysis Technique for Android Malware Detection	303
Tejpal Sharma and Dhavleesh Rattan	
A Survey on LSB Replacement-Based Statistical Image Steganalysis Techniques	313
Bibek Ranjan Ghosh, Siddhartha Banerjee, and Joytsna Kumar Mandal	

Emotion Recognition Using Text and Speech Through Machine Learning	321
Chaitanya Singla and Sukhdev Singh	
Condition-Based Monitoring of Power Transformer with Graphical Analysis of Incipient Faults Using Fuzzy Inference Expert System	331
Rahul Soni and Bhinal Mehta	
Disease Classification in the Cotton Using Convolution Neural Networks	341
Aviral Sharma and Gunjan Chhabra	
A Short Review on XAI Techniques in Text Data	353
Mahuya Ghosh, Amit Kumar Das, and Amlan Chakrabarti	
Performance of Multi Hop, Multi Link CRN with Energy Harvesting in Presence of CCI	365
Souvik Manna, Chanchal Kumar De, and Debasis De	
Performance Evaluation of Path Restoration Techniques in a Network	375
Vidhu Baggan, Jyoti Snehi, Manish Snehi, and Varinder Kaur Attri	
An Insight to Bitcoin Price Using Weber's Law	385
Manan Roy Choudhury, Anurag Dutta, and Arnab Kumar De	
Named Entity Recognition Using Deep Learning and BERT for Tamil and Hindi Languages	395
Sreelekshmi Menon, J. P. Sanjanasri, B. Premjith, and K. P. Soman	
Brain Signal Classification Using Decomposition Techniques and Deep Learning	405
T. R. Karthik, Rohith Ramakrishnan, Anirudh Vadakedath, V. Sowmya, E. A. Gopalakrishnan, and G. Jyothish Lal	
PSO-Based Traffic Signals in a Real-World City	411
Vandana Singh, Sudip Kumar Sahana, and Vandana Bhattacharjee	
BERT-Based Dependency Parser for Hindi	421
Aparna Nambiar, B. Premjith, J. P. Sanjanasri, and K. P. Soman	
Game Theory Strategies in Cloud Security with Implementation	429
Saurjyadeep Das, Sugandha Sharma, Sudhanshu Srivastava, Shelly Garg, and Ratna Rajpal	
Detection of Phishing Attack Using Machine Learning	441
Uttkarsh Rastogi, Tanu, Vinayak Singhal, Ankush Gupta, and Vimal Kumar	
An Efficient Framework to Maximize Street Lighting Coverage	451
Tanmoy Dey and Parag Kumar Guha Thakurta	

Traveling Tournament Problem and the Different Methods of Solutions: A Brief Review	461
Rajarshi Basu, Pratik Chowdhury, Baisakhi Das, Shyama Mondal, Kingshuk Chatterjee, and Alok Mukherjee	
Application of Binary Flower Pollination Optimization in Radial Distribution System	469
Nasim Ali Khan, Sanjib Deb, Mir Abubakkar Siddik, Prabir Mondal, Swarnali Bhar, Sourav Majumdar, and Soumya Basu	
Development of a Natural Calamity Alert System for Tourists: An Application of PEAS Technology	481
Goldina Ghosh, Anwesa Das, Anasuya Dev, Abhinandan Das, Birol Roy, Debapriya Bhowmick, and Prasenjit Saha	
Resource Allocation and Optimization Scheduling Scheme of Edge Resources in Fog Computing Access Network	491
Balajee Maram, T. Daniya, and Veeraj Gampala	
On Multi-objective Fuzzy Shortest Path Problem	499
Swapna Halder, Saibal Majumder, Arindam Biswas, Bijoy Kumar Mandal, and Sheng-Lung Peng	
Design and Simulation of Microstrip Patch Antennas with Textile Dielectrics for Body Sensor Networks (BSNs) and Wearable IoT Applications	511
Chaitanya Vijaykumar Mahamuni	
An Investigation into the Efficacy of Interactive Tools in the Online Teaching-Learning Process	523
Subhechha Majumdar, Tanmay Bhowmik, Amitava Choudhury, and Rajesh Srivastava	
Steganography Tools and Their Analysis Concerning Distortion in Stego Image	531
Urmila Pilania, Rohit Tanwar, and Keshav Kaushik	
Density-Based Spatio-Temporal Clustering Model for Earthquake Analysis and Seismo-Tectonic Zoning	539
Ashish Sharma, Sandeep Vyas, and Anand Nayyar	
Reconfigurable Intelligent Surface-Based Cooperative Spectrum Sensing Over Noisy Reporting Channel	547
Girraj Sharma, Sandeep Vyas, Anand Nayyar, and Ritu Sharma	
Optimization of Crystalline Silicon Solar Cell Parameters Using PC1D	557
Md. Irfan, Sudipta Banerjee, Hasnain Rza, and Abhigyan Maji	

Machine Learning-Based Approach for Prediction of Forest Fire Using Ensemble Learning	567
Tanuj Bhatt and Arun Malik	
Artificial Intelligence in Military Applications of 21st Century	575
Sugandha Sharma, Kaushik Ghosh, Ratna Rajpal, Ishan Bhalla, Parul Gupta, Digambar Ranakit Dutta, and Saya Garg	
Quality of Service of the Internet of Things—A Survey of Current Research Trends for Evolving 5G-IoT Scenario	585
Dipankar Chatterjee and A. C. Mondal	
Optimization of Classification Algorithm for Improving Semantic-Based Text Classification	593
Rahul Bhandari, Anuj Kumar Jain, Mukund Pratap Singh, and Kamal Deep Garg	
Meme-Text Analysis: Identifying Sentiment of Memes	605
P. Aditya Krishna Rohit, S. Sachin Kumar, and K. P. Soman	
Augmented Reality in Chemistry Education: An Exploratory Analysis	613
Priyanka Datta, Amanpreet Kaur, and Archana Mantri	
Survey of Pedestrian Trajectory Prediction Techniques Using Surveillance Videos	623
Adya Bansal, Aroma Agarwal, Muskan Lalit, and K. R. Seeja	
Oil Spill Detection from Images Using Deep Learning	631
Vignesh Gopinath, S. Sachin Kumar, Neethu Mohan, and K. P. Soman	
An Efficient 8T GDI Enable Full Adder Design for Data Path Subsystem	641
Dolly Thakur, Hemant Patidar, Vikas Maheshwari, Rajib Kar, and Prashant Upadhyay	
A Transfer-Learning-Based Deep Network for Detecting Violence in Real-Time Videos	659
Soma Hazra, Sounak Saha, Sunirmal Khatua, and Banani Saha	
Detection of Chaotic Cellular Automata Using Convolutional Neural Networks: A Comparative Study	667
Supreeti Kamilya and Soumyadeep Paty	
Bird Species Identification and Classification Based on Feature Analysis Using VGG19 Framework	677
Nilanjana Adhikari, Bikramjit Das, Biplab Roy, Suman Bhattacharya, and Mahamuda Sultana	

Exploring the Human USP Gene Family and Its Association with Cancer: An In Silico Study	685
Sujay Ray and Arundhati Banerjee	
AI in Pervasive Healthcare: A Survey	695
Kaushik Ghosh, Sugandha Sharma, Sulagna Sarkar, and Alka Kaushik	
Analysis and Detection of Alzheimer's Disease Using Machine Learning Approach	703
Raghubir Singh Salaria and Neeraj Mohan	
Design of Cost-Effective WSN by Minimizing Energy Consumption Using Hybrid Algorithm	711
Avishek Banerjee, Nitin Arvind Shelke, Navneet Pratap Singh, Tanmay Bhowmik, Bishwajit Roy, and Arindam Biswas	
Isolating Brain Tissue from Abnormal Tissue Using MRI-Based U-Net Convolutional Neural Network	721
Brijit Bhattacharjee, Bikash Debnath, Jadav Chandra Das, and Debashish De	
Plant Disease Identification Through Study of Leaf Images	729
Aniket Das, Piyasi Das, Amlan Chakrabarti, Rik Das, and Chira Dutta	
An Analysis of Random Non-deterministic Signals Using Recursive Methods and Stochastic Control System	737
Tanmoy Singha, Lisha Misra, Joydeep Dutta, Rudra Sankar Dhar, and Arindam Biswas	
A Machine Learning-Based Approach to Identify Hand Gestures	749
Kunal Bhardwaj, Sakshi Bansal, and Kaushik Ghosh	

About the Editors

Basabi Chakraborty received B.Tech., M.Tech., and Ph.D. degrees in Radio Physics and Electronics from Calcutta University, India, and worked at Indian Statistical Institute, Calcutta, India until 1990. From 1991 to 1993 she worked as a part-time researcher in Advanced Intelligent Communication Systems Laboratory in Sendai, Japan. She received another Ph.D. in Information Science from Tohoku University, Sendai in 1996. From 1996 to 1998, she worked as a postdoctoral research fellow at the Research Institute of Electrical Communication, Tohoku University, Japan. In 1998 she joined as a faculty in the Software and Information Science department of Iwate Prefectural University, Iwate, Japan. Her research areas are pattern recognition, image processing, soft computing techniques, biometrics, data mining, and online social media mining.

Arindam Biswas received M.Tech. in Radio Physics and Electronics from the University of Calcutta, India, in 2010 and a Ph.D. from NIT Durgapur in 2013. He was a postdoctoral researcher at Pusan National University, South Korea with the prestigious BK21PLUS Fellowship, Republic of Korea. He was a visiting Professor at the Research Institute of Electronics, Shizuoka University, Japan. Dr. Biswas has 12 years of teaching, research, and administrative experience. Presently, Dr. Biswas is working as an Associate Professor in the School of Mines and Metallurgy at Kazi Nazrul University, Asansol, West Bengal, India. He has 54 papers in journals, 36 conference papers, 8 books, 06 Edited Volumes, and 01 book chapter to his credit. His research interest is in carrier transport in the low dimensional system and electronic device, non-linear optical communication, and THz semiconductor source.

Amlan Chakrabarti is a Full Professor in the A. K. Choudhury School of Information Technology at the University of Calcutta. He is an M.Tech. from the University of Calcutta and did his Doctoral research at Indian Statistical Institute, Kolkata. He was a Post-Doctoral fellow at the School of Engineering, Princeton University, the USA during 2011–2012. He is the recipient of the prestigious DST BOYSCAST fellowship award in Engineering Science (2011), Indian National Science Academy (INSA) Visiting Faculty Fellowship (2014), JSPS Invitation Research Award (2016),

Erasmus Mundus Leaders Award from EU (2017), and Hamied Visiting Professorship from University of Cambridge (2018) and Siksha Ratna Award by Department of Higher Education Government of West Bengal (2018). He has also served in various capacities in various higher education organizations both at national and international levels. He has received multiple project grants in the areas of Security in Cyberphysical Systems, Embedded System Design, VLSI Design, Quantum Computing, Computer Vision, and Data Science from various national and international agencies (DST, DRDO, MietY, UGC, DAE, Ministry of Social Empowerment, WB-DST, Tata Consultancy Services, Intel India, etc.). He has published around 150 research papers in referred journals and conferences. His areas of research interest are quantum computing, reconfigurable computing, embedded systems design, VLSI design, computer vision, and machine learning.

[Home](#) > [Advances in Data Science and Computing Technologies](#) > Conference paper

On Multi-objective Fuzzy Shortest Path Problem

| Conference paper | First Online: 30 September 2023

| pp 499–509 | [Cite this conference paper](#)



[Advances in Data Science and
Computing Technologies](#)
(ADSC 2022)

[Swapna Halder](#) , [Saibal Majumder](#), [Arindam Biswas](#), [Bijoy Kumar Mandal](#) & [Sheng-Lung Peng](#)

 Part of the book series: [Lecture Notes in Electrical Engineering](#) ((LNEE, volume 1056))



 Included in the following conference series:
[International Conference on Advances in Data Science and Computing Technologies](#)

 262 Accesses

Abstract

Being a network optimization problem, the shortest path problem (SPP) is considered as one of the popular and frequently encountered optimization problems to address real-world

problems. In this paper, we investigate a multi-objective SPP under the paradigm of fuzzy set theory. The proposed problem minimizes both cost and time of a given network, where every edges are associated with cost and time parameters represented as fuzzy triangular numbers to incorporate uncertainty involved with real-world phenomenon. Here, we have modeled a fuzzy chance-constrained model of multi-objective SPP and eventually solved the deterministic transformation of the model using weighted sum method.

 This is a preview of subscription content, [log in via an institution](#)  to check access.

Access this chapter

Log in via an institution

Chapter

EUR 29.95

Price includes VAT (India)

Available as PDF

Read on any device

Instant download

Own it forever

Buy Chapter

▼ eBook

EUR 160.49

▼ Softcover Book

EUR 199.99

▼ Hardcover Book

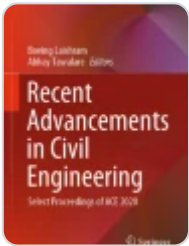
EUR 199.99

Tax calculation will be finalised at checkout

Purchases are for personal use only

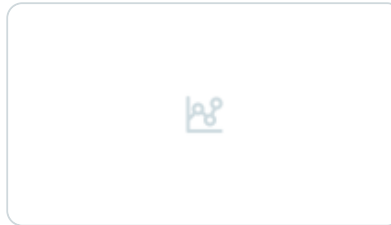
[Institutional subscriptions](#) →

Similar content being viewed by others



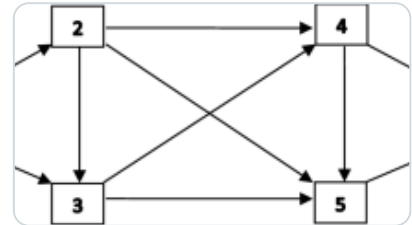
Solving Fuzzy Shortest Path Problem with Decision Maker's Perspective

Chapter | © 2022



Shortest path problem in fuzzy, intuitionistic fuzzy and neutrosophic environment: an...

Article | Open access
30 March 2019



Dijkstra algorithm for shortest path problem under interval-valued Pythagorean fuzzy...

Article | Open access
25 October 2018

References

1. Ahuja RK, Magnanti TL, Orlin JB (1993) Network flows: theory, algorithms, and applications. Prentice Hall, New Jersey

[Google Scholar](#)

2. Dijkstra EW (1959) A note on two problems in connexion with graphs. Numer Math 1:269–271

[Article](#) [MathSciNet](#) [MATH](#) [Google Scholar](#)

3. Floyd RW (1962) Algorithm 97: shortest path. Commun Assoc Comput Mach 5(6):345

[Google Scholar](#)

4. Sedeño-Noda A, Raith A (2015) A Dijkstra-like method computing all extreme supported non-dominated solutions of the biobjective shortest path problem. Comput Oper Res 57:83–94

[Article](#) [MathSciNet](#) [MATH](#) [Google Scholar](#)

5. Shi N, Zhou S, Wang F, Tao Y, Liu L (2017) The multi-criteria constrained shortest path problem. Transp Res Part E Logistics Transp Rev 101:13–29

[Article](#) [Google Scholar](#)

6. Majumder S, Saha B, Anand P, Kar S, Pal T (2018) Uncertainty based genetic algorithm with varying population for random fuzzy maximum flow problem. Expert Syst 35(4):e12264

[Article](#) [Google Scholar](#)

7. Frank H, Hakimi SL (1965) Probabilistic flows through a communication network. IEEE Trans Circuit Theory 12(3):413–414

[Article](#) [Google Scholar](#)

8. Chen BY, Lam WHK, Sumalee A, Li Z-l (2012) Reliable shortest path finding in stochastic networks with spatial correlated link travel times. Int J Geogr Inf Sci 26(2):365–386

[Article](#) [Google Scholar](#)

9. Nie Y, Wu X (2009) Shortest path problem considering on-time arrival probability. Transp Res Part B Methodological 43(6):597–613

[Article](#) [Google Scholar](#)

10. Zockaie A, Nie YM, Mahmassani HS (2014) Simulation-based method for finding minimum travel time budget paths in stochastic networks with correlated link times. Transp Res Rec 2457(1):140–148

[Google Scholar](#)

11. Huang X (2007) Chance-constrained programming models for capital budgeting with NPV as fuzzy parameters. J Comput Appl Math 198(1):149–159

[Article](#) [MathSciNet](#) [MATH](#) [Google Scholar](#)

12. Liu B (2007) Uncertainty theory, 2nd edn. Springer-Verlag, Berlin, Heidelberg

[MATH](#) [Google Scholar](#)

13. Dubois D, Prade H (1980) Fuzzy sets and systems: theory and applications. Academic Press, New York

[MATH](#) [Google Scholar](#)

14. Klein CM (1991) Fuzzy shortest paths. Fuzzy Sets Syst 39(1):27–41

[Google Scholar](#)

15. Okada S, Gen M (1994) Fuzzy shortest path problem. Comput Ind Eng 27(1–4):465–468

16. Okada S (2004) Fuzzy shortest path problems incorporating interactivity among paths. Fuzzy Sets Syst 142(3):335–357

[Article](#) [MathSciNet](#) [MATH](#) [Google Scholar](#)

17. Ji X, Iwamura K, Shao Z (2007) New models for shortest path problem with fuzzy arc lengths. Appl Math Model 31(2):259–269

[Article](#) [MATH](#) [Google Scholar](#)

18. Hernandez F, Lamata MT, Verdegay JL, Yamakami A (2007) The shortest path problem on networks with fuzzy parameters. Fuzzy Sets Syst 158(14):1561–1570

[Article](#) [MathSciNet](#) [MATH](#) [Google Scholar](#)

19. Mahdavi I, Nourifar R, Heidarzade A, Amiri NM (2009) A dynamic programming approach for finding shortest chains in a fuzzy network. Appl Soft Comput 9(2):503–511

[Article](#) [Google Scholar](#)

20. Tajdin A, Mahdavi I, Mahdavi-Amiri N, Sadeghpour-Gildeh B (2010) Computing a fuzzy shortest path in a network with mixed fuzzy arc lengths using α -cuts. Comput Math Appl 60(4):989–1002

[MathSciNet](#) [MATH](#) [Google Scholar](#)

21. Dou Y, Zhu L, Wang HS (2012) Solving the fuzzy shortest path problem using multi-criteria decision method based on vague similarity measure. Appl Soft Comput 12(6):1621–1631

22. Deng Y, Chen Y, Zhang Y, Mahadevan S (2012) Fuzzy Dijkstra algorithm for shortest path problem under uncertain environment. Appl Soft Comput 12(3):1231–1237

23. Hassanzadeh R, Mahdavi I, Mahdavi-Amiri N, Tajdin A (2013) A genetic algorithm for solving fuzzy shortest path problems with mixed fuzzy arc lengths. Math Comput Model 57(1–2):84–99

24. Ebrahimnejad A, Karimnejad Z, Alrezaamiri H (2015) Particle swarm optimization algorithm for solving shortest path problems with mixed fuzzy arc weights. Int J Appl Decis Sci 8(2):203–222

25. Anusuya V, Sathya R (2014) A new approach for solving type-2 fuzzy shortest path problem. Ann Pure Appl Math 8(1):83–92

26. Kumar R, Jha S, Singh S (2017) Shortest path problem in network with type-2 triangular fuzzy arc length. J Appl Res Ind Eng 4(1):1–7

27. Mahdavi I, Mahdavi-Amiri N, Nejati S (2011) Algorithms for biobjective shortest path problems in fuzzy networks. Iran J Fuzzy Syst 8(4):9–37

28. Kumar MK, Sastry VN (2013) A new algorithm to compute Pareto-optimal paths in a multi objective fuzzy weighted network. *Opsearch* 50(3):297–318

[Article](#) [MathSciNet](#) [MATH](#) [Google Scholar](#)

29. Zadeh LA (1965) Fuzzy sets. *Inf Control* 8(3):338–353

[Article](#) [MATH](#) [Google Scholar](#)

30. Nahmias S (1978) Fuzzy variable. *Fuzzy Sets Syst* 1(2):97–110

[Article](#) [MathSciNet](#) [MATH](#) [Google Scholar](#)

31. Liu B, Liu Y-K (2002) Expected value of fuzzy variable and fuzzy expected value models. *IEEE Trans Fuzzy Syst* 10(4):445–450

[Article](#) [Google Scholar](#)

32. Gao J, Lu M (2005) Fuzzy quadratic minimum spanning tree problem. *Appl Math Comput* 164(3):773–788

[MathSciNet](#) [MATH](#) [Google Scholar](#)

Acknowledgements

We are indebted to the technical program committee and the anonymous reviewers for accepting our manuscript in the International Conference on Advances in Data Science and Computing Technologies (ADSC-2022) held at Kazi Nazrul University (Public University), Asansol, West Bengal, India 713340, during 23rd–24th June 2022.

Author information

Authors and Affiliations

Centre for IOT and AI Integration with Education–Industry–Agriculture, Kazi Nazrul University, Asansol, West Bengal, India

Swapna Halder & Arindam Biswas

Department of Computer Science and Engineering, St. Thomas' College of Engineering and Technology, West Bengal, Kolkata, India

Swapna Halder

Department of Computer Science and Engineering (Data Science), Dr. B.C. Roy Engineering College, Durgapur, West Bengal, India

Saibal Majumder

School of Mines and Metallurgy, Kazi Nazrul University, Asansol, West Bengal, India

Arindam Biswas

Department of Computer Science and Engineering, NSHM Knowledge Campus, Durgapur, West Bengal, India

Bijoy Kumar Mandal

Department of Creative Technologies and Product Design, National Taipei University of Business, Taoyuan, 32462, Taiwan

Sheng-Lung Peng

Corresponding author

Correspondence to [Swapna Halder](#).

Editor information

Editors and Affiliations

School of Computing, Madanapalle Institute of Technology and Science, Angallu, Andhra Pradesh, India

Basabi Chakraborty

Kazi Nazrul University, Asansol, West Bengal, India

Arindam Biswas

A.K. Choudhury School of Information Technology, University of Calcutta, Kolkata, West Bengal, India

Amlan Chakrabarti

Rights and permissions

[Reprints and permissions](#)

Copyright information

© 2023 The Author(s), under exclusive license to Springer Nature Singapore Pte Ltd.

About this paper

Cite this paper

Halder, S., Majumder, S., Biswas, A., Mandal, B.K., Peng, S.L. (2023). On Multi-objective Fuzzy Shortest Path Problem. In: Chakraborty, B., Biswas, A., Chakrabarti, A. (eds) Advances in Data Science and Computing Technologies. ADSC 2022. Lecture Notes in Electrical Engineering, vol 1056. Springer, Singapore. https://doi.org/10.1007/978-981-99-3656-4_51

[.RIS](#) [.ENW](#) [.BIB](#)

DOI

https://doi.org/10.1007/978-981-99-3656-4_51

Published

30 September 2023

Publisher Name

Springer, Singapore

Print ISBN

978-981-99-3655-7

Online ISBN

978-981-99-3656-4

eBook Packages

Publish with us

Policies and ethics [↗](#)