Lecture Notes in Electrical Engineering

Volume 1056

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

Springer

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

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

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.

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

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.

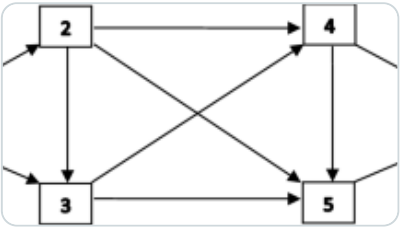
Similar content being viewed by others

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

Article Google Scholar

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. Hernandes 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

Article Google Scholar

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

Article Google Scholar

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

Article MathSciNet MATH Google Scholar

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

Google Scholar

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

Google Scholar

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

Google Scholar

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

MathSciNet MATH Google Scholar

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

Copyright information

About this paper

Cite this paper

Halder, S., Majumder, S., Biswas, A., Mandal, B.K., Peng, SL. (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

Intelligent Technologies and Robotics

Intelligent Technologies and Robotics (R0)

Publish with us

Policies and ethics