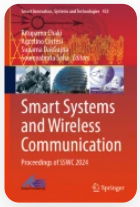
Breast Cancer Classification Using Machine Learning: A Comprehensive Review and Analysis

| Conference paper | First Online: 18 April 2025

| pp 397–411 | Cite this conference paper



Smart Systems and Wireless Communication

(SSWC 2024)

Priyanka Roy, Joyjit Patra, Srijita Bhattacharyya, Soumi Badyakar & Prasenjit Maji

Part of the book series: Smart Innovation, Systems and Technologies ((SIST,volume 433))

Included in the following conference series:
International Conference on Smart Systems and Wireless Communication

Abstract

Breast cancer is one of the most prevalent and potentially life-threatening diseases affecting women worldwide. Early and accurate diagnosis is crucial for improving patient outcomes and survival rates. In recent years, machine learning techniques have shown promising results in aiding medical professionals in the classification and diagnosis of breast cancer. This paper presents a comprehensive review and analysis of various machine learning approaches employed for breast cancer classification. The study covers data preprocessing, feature extraction, model selection, performance evaluation, and emerging trends in the field. Through an extensive survey

of existing literature, this paper aims to provide a holistic understanding of the advancements, challenges, and future directions in utilizing machine learning for breast cancer classification.

References

1. Schneble, E.J., Graham, L.J., Shupe, M.P., Flynt, F.L., Banks, K.P., Kirkpatrick, A.D., Nissan, A., Henry, L., Stojadinovic, A., Shumway, N.M., Avital, I., Peoples, G.E., Setlik, R.F.: Current approaches and challenges in early detection of breast cancer recurrence. J Cancer **5**(4), 281–90 (2014). https://doi.org/10.7150/jca.8016

Article Google Scholar

2. Ren, W., Chen, M., Qiao, Y., Zhao, F.: Global guidelines for breast cancer screening: a systematic review. Breast **64**, 85-99 (2022). https://doi.org/10.1016/j.breast.2022.04.003

3. Dias, J.: Breast cancer diagnostic typologies by grade-of-membership fuzzy modeling. 129–133 (2009)

Google Scholar

4. Saraswat, S., Keswani, B., Saraswat, V.: Classification of breast cancer using machine learning: an in-depth analysis. In: Tripathi, A.K., Anand, D., Nagar, A.K. (eds) Proceedings of World Conference on Artificial Intelligence: Advances and Applications. WWCA 1997. Algorithms for Intelligent Systems. Springer, Singapore (2023). https://doi.org/10.1007/978-981-99-5881-8_16

5. Ankit., Bansal, H., Arora, D., Soni, K., Chugh, R., Vardhan, S.: Breast cancer classification using machine learning. Int. J. Sci. Res. Comput. Sci., Eng. Inf. Technol. **10**, 575–588 (2024). https://doi.org/10.32628/CSEIT2410274

6. Thakur, N., Kumar, P., Kumar, A.: A systematic review of machine and deep learning techniques for the identification and classification of breast cancer through medical image modalities. Multimed Tools Appl **83**, 35849–35942 (2024). https://doi.org/10.1007/s11042-023-16634-w

Article Google Scholar

7. Zwitter, M., Soklic, M.: Breast cancer. UCI machine learning repository (1988). https://doi.org/10.24432/C51P4M

8. Houssein, E.H., Emam, M.M., Ali, A.A., Suganthan, P.S.: Deep and machine learning techniques for medical imaging-based breast cancer: a comprehensive review. Expert Syst. Appl. **167**, 114161 (2021). https://doi.org/10.1016/j.eswa.2020.114161

9. Bharati, S., Podder, P., Mondal, M.R.H.: Artificial neural network based breast cancer screening: a comprehensive review. arXiv preprint arXiv:2006.01767 [eess.IV] (2020). https://doi.org/10.48550/arXiv.2006.01767.

10. Radak, M., Lafta, H.Y., Fallahi, H.: Machine learning and deep learning techniques for breast cancer diagnosis and classification: a comprehensive review of medical imaging studies. J Cancer Res Clin Oncol. **149**(12), 10473–10491 (2023). https://doi.org/10.1007/s00432-023-04956-z

Article Google Scholar

11. Painuli, D., Bhardwaj, S., Köse, U.: Recent advancement in cancer diagnosis using machine learning and deep learning techniques: a comprehensive review. Comput Biol Med. **146**, 105580 (2022). https://doi.org/10.1016/j.compbiomed.2022.

Article Google Scholar

12. Sun, M.-L., et al.: Application of machine learning to stomatology: a comprehensive review. IEEE Access **8**, 184360–184374 (2020). https://doi.org/10.1109/ACCESS.2020.3028600

Article Google Scholar

13. Obare, M.: Survey and comparative analysis of machine learning algorithms for breast cancer diagnosis: a comprehensive review **19**, 1136–1149 (2023). https://doi.org/10.30574/wjarr.2023.19.1.1464

14. Huerfano Maldonado, Y.M., Mora, M., Vilches, K., Hernández García, R., Gutiérrez Aguilar, R., Vera, M.: A comprehensive review of extreme learning machine on medical imaging. Neurocomputing **556**, 126618 (2023). https://doi.org/10.1016/j.neucom.2023.126618

15. Mohammed, A., Kora, R.: A comprehensive review on ensemble deep learning: opportunities and challenges. J. King Saud Univ. Comput. Inf. Sci. **35** (2023). https://doi.org/10.1016/j.jksuci.2023.01.014

16. Reddy, A., Soni, B., Sudheer. K.Z.: Breast cancer detection by leveraging machine learning. ICT Express **6** (2020). https://doi.org/10.1016/j.icte.2020.04.009

17. Moingeon, P., Kuenemann, M., Guedj, M.: Artificial Intelligence-enhanced drug design and development: toward a computational precision medicine. Drug Discov. Today **27** (2021). https://doi.org/10.1016/j.drudis.2021.09.006

18. Gonçalves, C., Souza, J., Fernandes, H.: CNN architecture optimization using bio-inspired algorithms for breast cancer detection in infrared images. Comput. Biol. Med. **142**, 105205 (2022). https://doi.org/10.1016/j.compbiomed.2021.105205.

Author information

Authors and Affiliations

Department of Information Technology, Dr. B.C. Roy Engineering College Durgapur, Durgapur, India
Priyanka Roy, Srijita Bhattacharyya & Soumi Badyakar

Department of Computer Science and Engineering, Dr. B.C. Roy Engineering College Durgapur, Durgapur, India
Joyjit Patra

Department of Computer Science and Design, Dr. B.C. Roy Engineering College Durgapur, Durgapur, India

Prasenjit Maji

Corresponding author

Correspondence to Priyanka Roy .

Editor information

Editors and Affiliations

School of Information Technology, University of Calcutta, Kolkata, West Bengal, India
Rituparna Chaki

DAIS, Ca' Foscari University, Venezia, Italy
Agostino Cortesi

Department of Information Technology, JIS College of Engineering, West Bengal, West Bengal, India
Suparna DasGupta

Department of Information Technology, JIS College of Engineering, Kalyani, West Bengal, India
Soumyabrata Saha

Rights and permissions

Copyright information

About this paper

Cite this paper

Roy, P., Patra, J., Bhattacharyya, S., Badyakar, S., Maji, P. (2025). Breast Cancer Classification Using Machine Learning: A Comprehensive Review and Analysis. In: Chaki, R., Cortesi, A., DasGupta, S., Saha, S. (eds) Smart Systems and Wireless Communication. SSWC 2024. Smart Innovation, Systems and Technologies, vol 433. Springer, Singapore. https://doi.org/10.1007/978-981-96-1348-9_30

DOI
https://doi.org/10.1007/978-981-96-1348-9_30

Published
18 April 2025

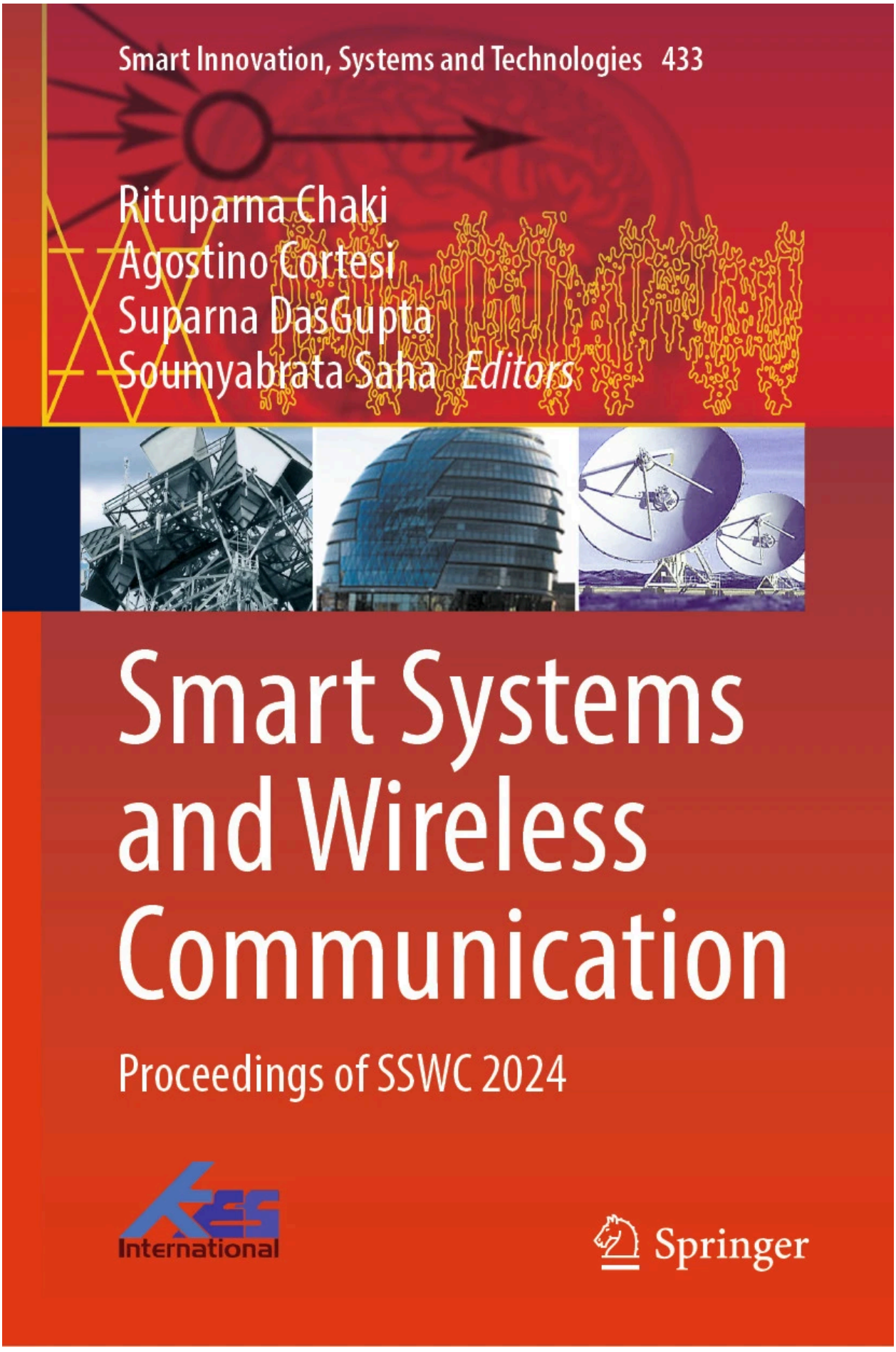
Publisher Name
Springer, Singapore

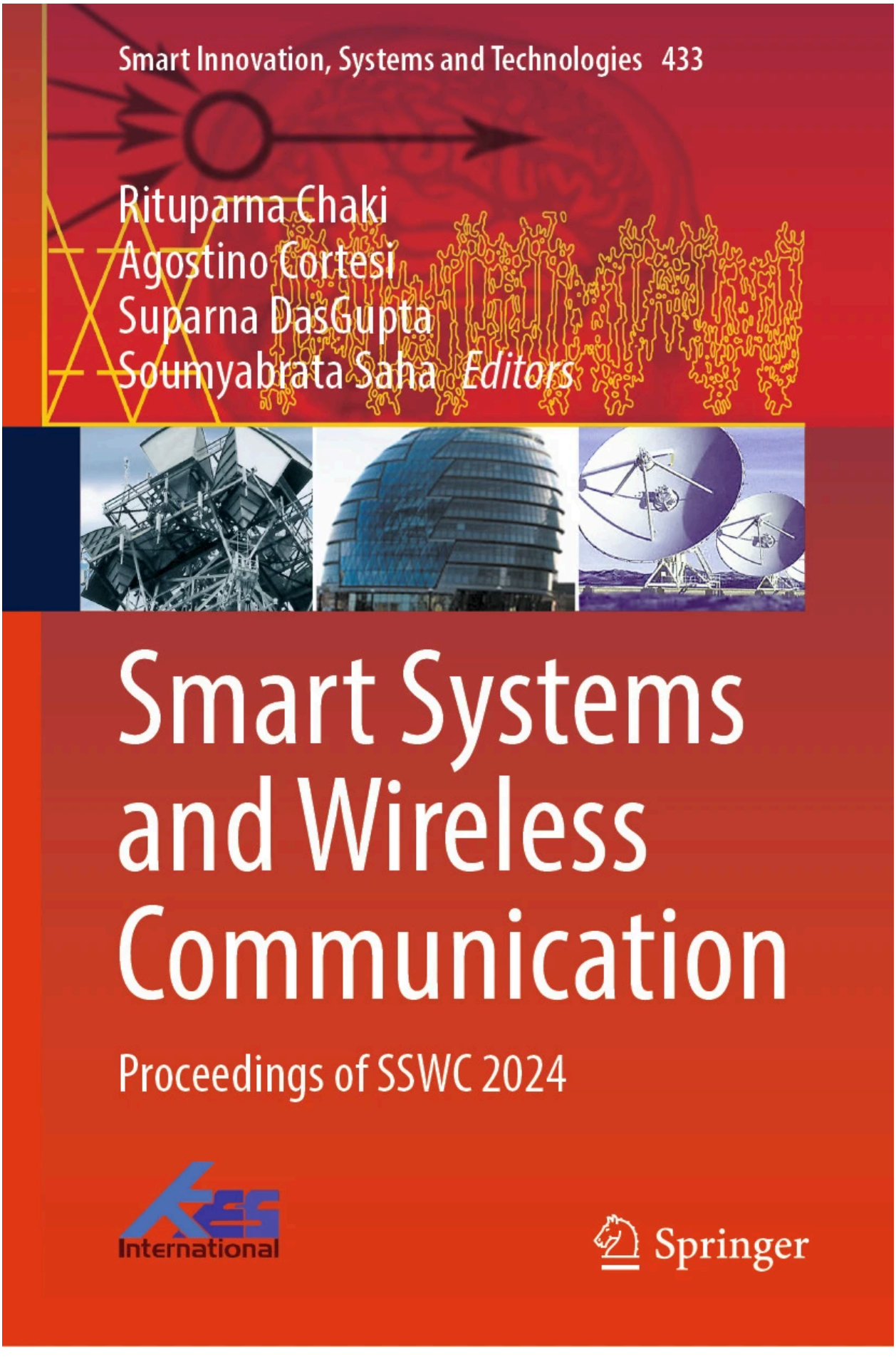
Print ISBN
978-981-96-1347-2

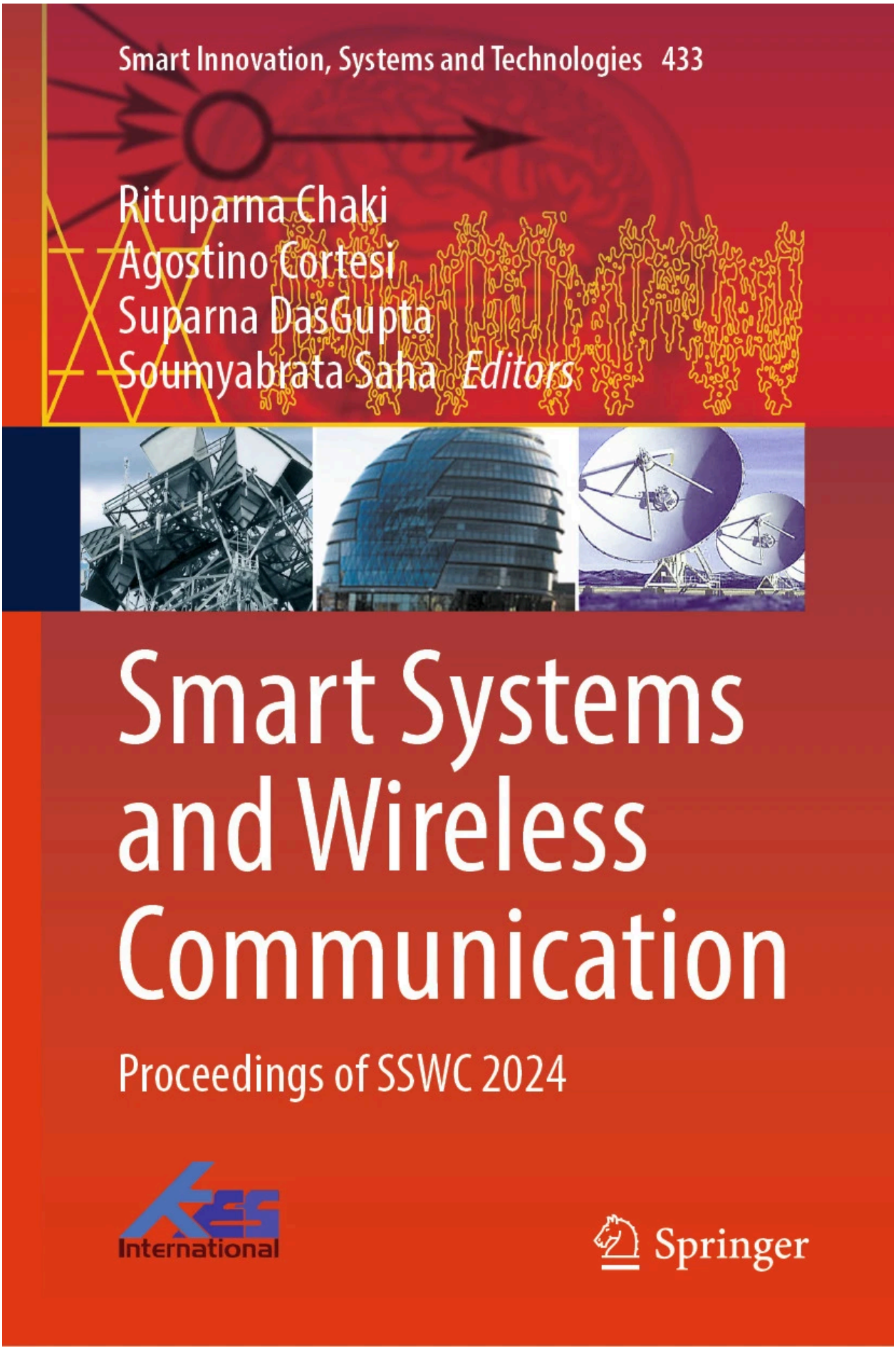
Online ISBN
978-981-96-1348-9

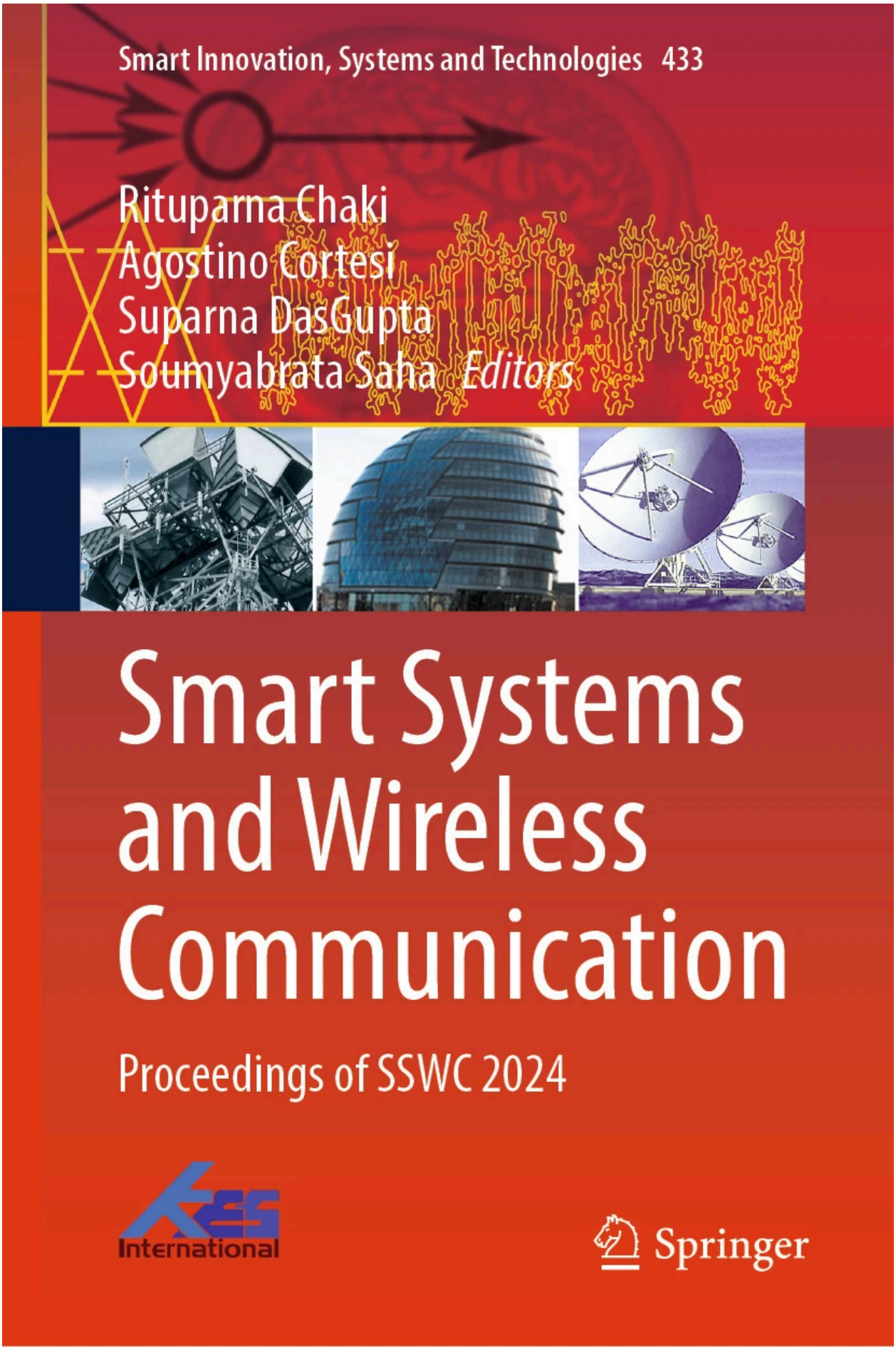
eBook Packages
Engineering
Engineering (R0)

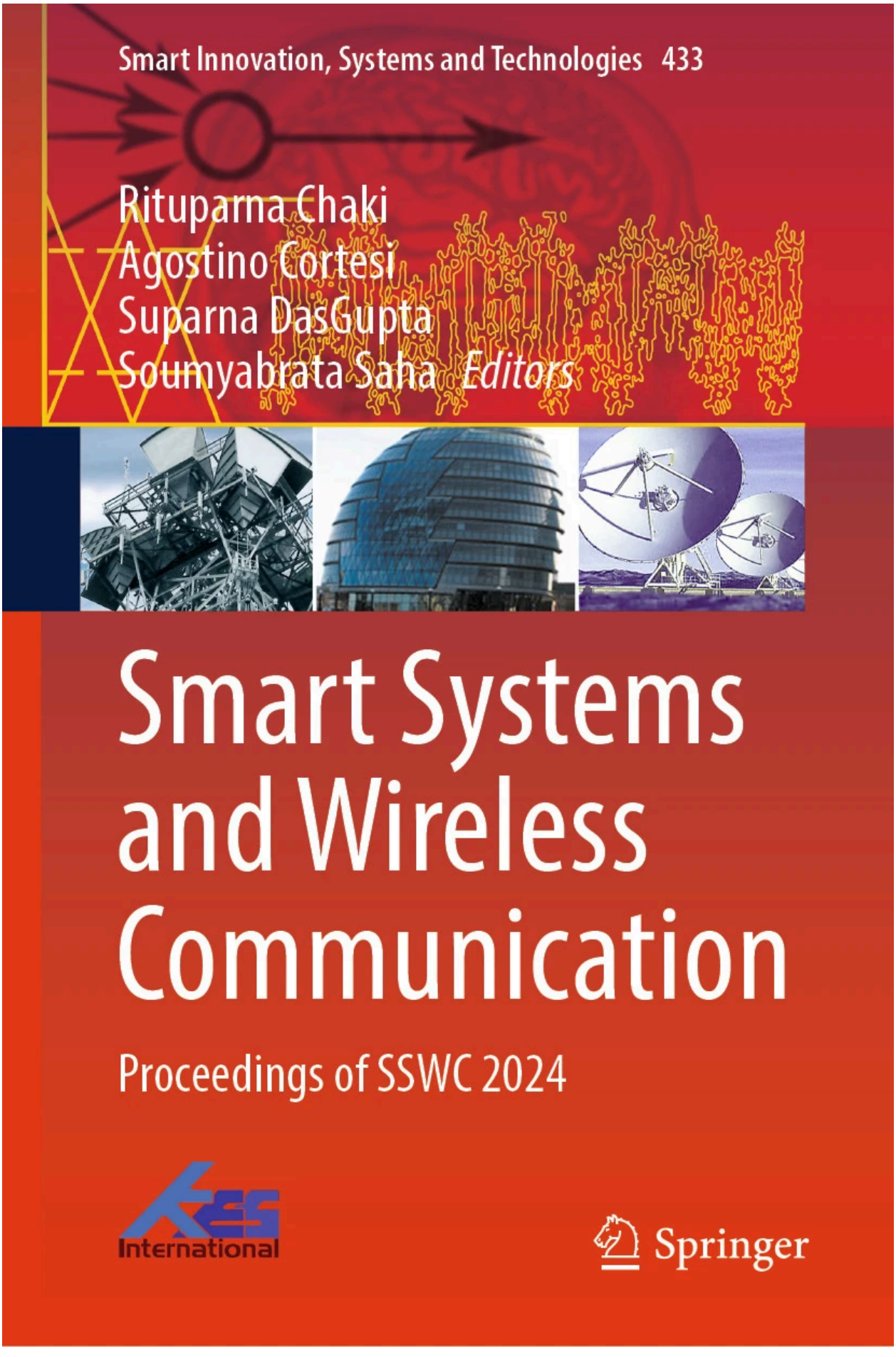
Publish with us

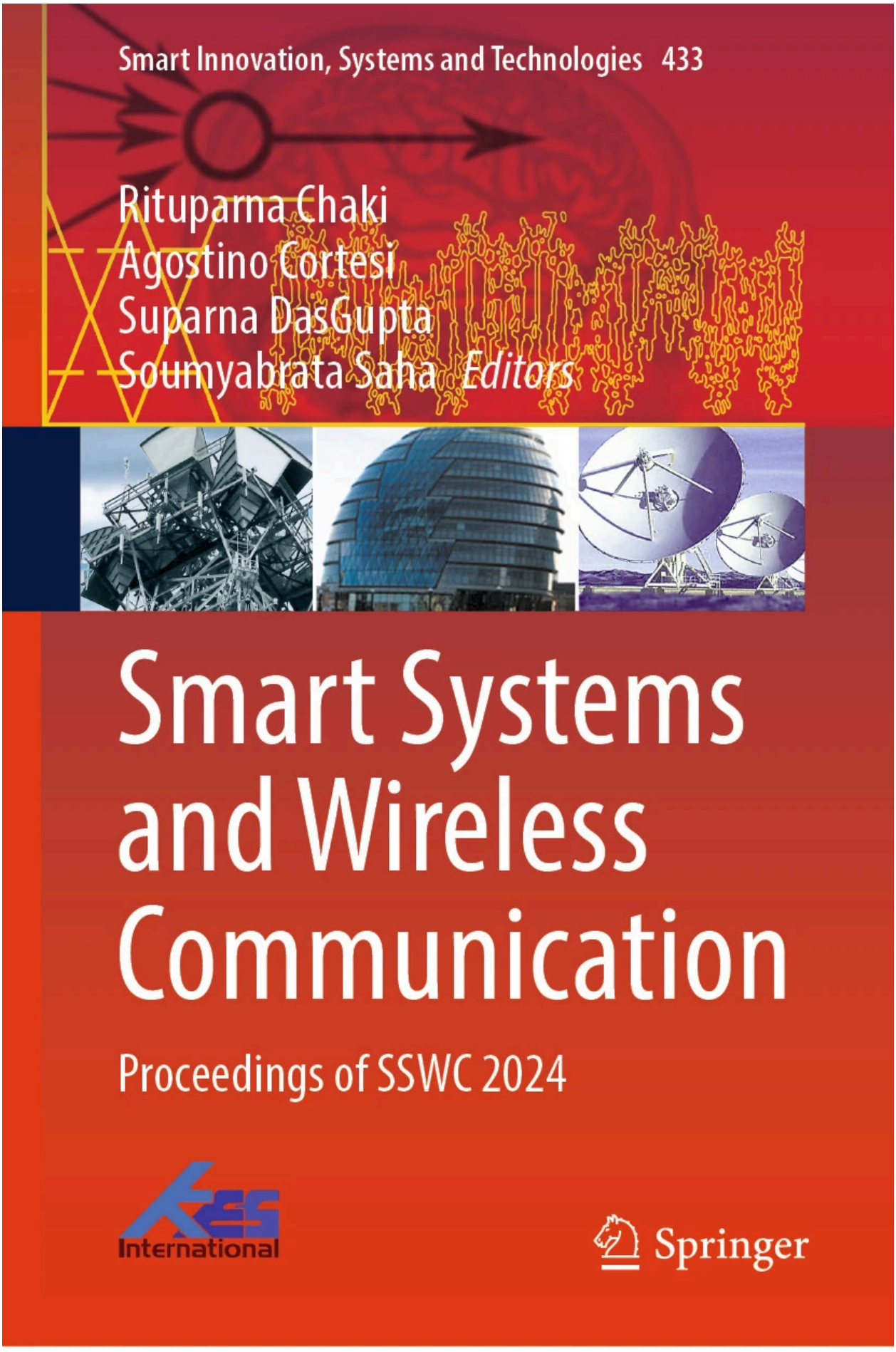

Smart Innovation, Systems and Technologies 433
Rituparna Chaki
Agostino Cortesi
Suparna DasGupta
Soumyabrata Saha Editors
Smart Systems and Wireless Communication
Proceedings of SSWC 2024
International
Springer

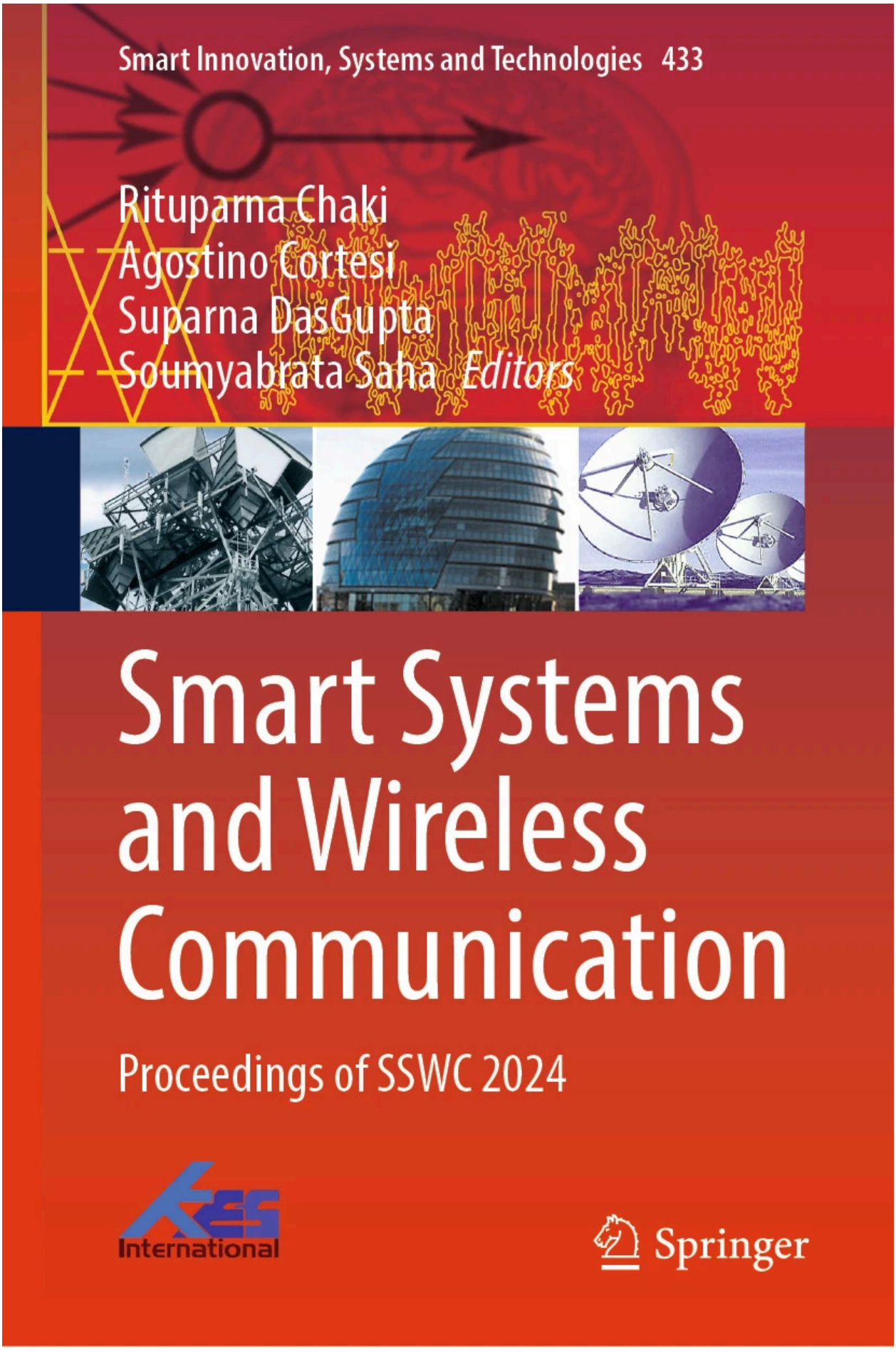

Smart Innovation, Systems and Technologies 433
Rituparna Chaki
Agostino Cortesi
Suparna DasGupta
Soumyabrata Saha Editors
Smart Systems and Wireless Communication
Proceedings of SSWC 2024
International
Springer

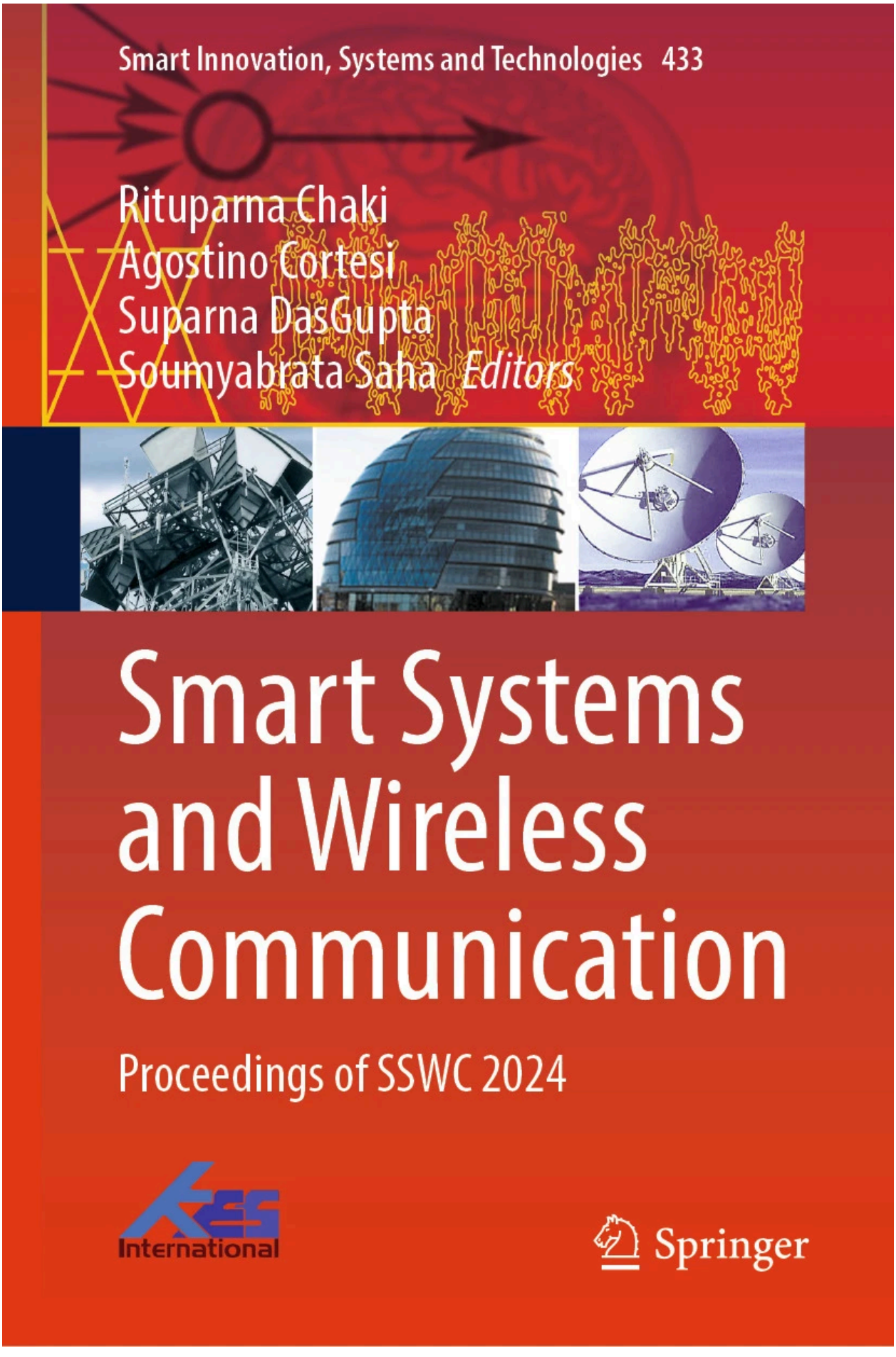

Smart Innovation, Systems and Technologies 433
Rituparna Chaki
Agostino Cortesi
Suparna DasGupta
Soumyabrata Saha Editors
Smart Systems and Wireless Communication
Proceedings of SSWC 2024
International
Springer

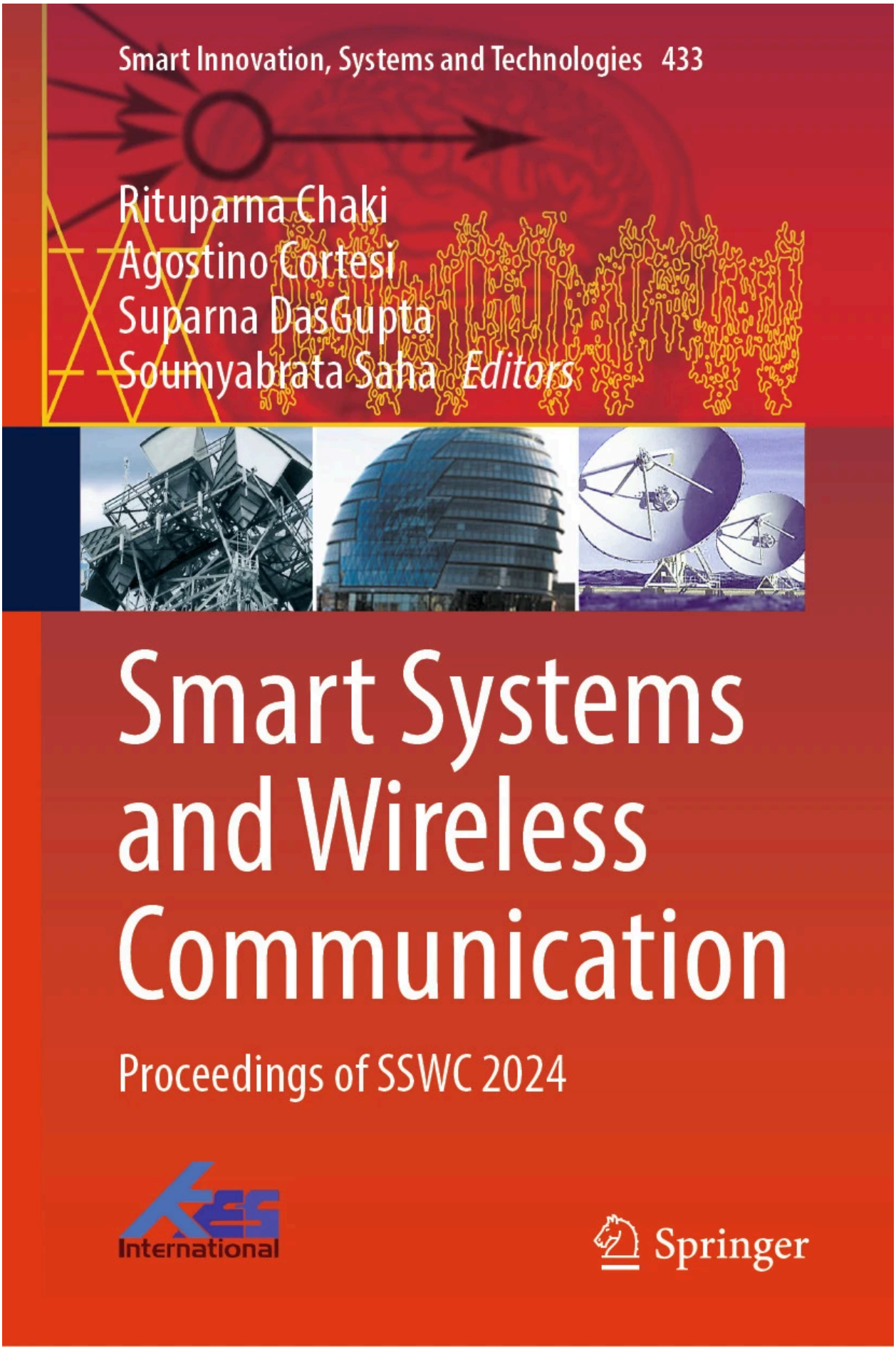

Smart Innovation, Systems and Technologies 433
Rituparna Chaki
Agostino Cortesi
Suparna DasGupta
Soumyabrata Saha Editors
Smart Systems and Wireless Communication
Proceedings of SSWC 2024
International
Springer

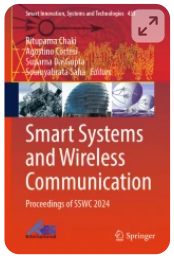

Smart Innovation, Systems and Technologies 433
Rituparna Chaki
Agostino Cortesi
Suparna DasGupta
Soumyabrata Saha Editors
Smart Systems and Wireless Communication
Proceedings of SSWC 2024
International
Springer


Smart Innovation, Systems and Technologies 433
Rituparna Chaki
Agostino Cortesi
Suparna DasGupta
Soumyabrata Saha Editors
Smart Systems and Wireless Communication
Proceedings of SSWC 2024
International
Springer


Smart Innovation, Systems and Technologies 433
Rituparna Chaki
Agostino Cortesi
Suparna DasGupta
Soumyabrata Saha Editors
Smart Systems and Wireless Communication
Proceedings of SSWC 2024
International
Springer


Smart Innovation, Systems and Technologies 433
Rituparna Chaki
Agostino Cortesi
Suparna DasGupta
Soumyabrata Saha Editors
Smart Systems and Wireless Communication
Proceedings of SSWC 2024
International
Springer


Smart Innovation, Systems and Technologies 433
Rituparna Chaki
Agostino Cortesi
Suparna DasGupta
Soumyabrata Saha Editors
Smart Systems and Wireless Communication
Proceedings of SSWC 2024
International
Springer



Smart Systems and Wireless Communication

Proceedings of SSWC 2024

| Conference proceedings | © 2025

Overview

Editors: Rituparna Chaki, Agostino Cortesi, Suparna DasGupta, Soumyabrata Saha

Presents research works on smart systems and wireless communication

Provides results of SSWC 2024 held in Kalyani, India

Serves as a reference for researchers and practitioners in academia and industry

Part of the book series: Smart Innovation, Systems and Technologies (SIST, volume 433)

Included in the following conference series:

SSWC: International Conference on Smart Systems and Wireless Communication

Conference proceedings info: SSWC 2024.

About this book

The volume is a collection of high-quality research papers presented at International Conference on Smart Systems and Wireless Communication, SSWC 2024, organized Department of Information Technology, JIS College of Engineering, Kalyani, West Bengal, India, during 29-30 November 2024. This book focuses smart cities, smart farming, smart healthcare, wireless networks communication, internet of things, cyber physical systems, human computer interaction, big data and data analytics, high performance computing, requirements engineering, analysis and verification

techniques, security systems, distributed systems, biometrics, bioinformatics, robotic process automation, and machine learning.

Keywords

Communication Networks Smart Systems Internet of Things

Machine Learning High Performance Computing Social Dynamics and Networks

Green Computing Proceedings of SSWC 2024

Search within this book

Search

Table of contents (49 papers)

Deep Learning and NLP

Machine Learning and Applications

Download chapter PDF

Security Solutions

Previous 1 2 3 Next

Back to top

Other volumes

1. **Smart Systems and Wireless Communication**

Editors and Affiliations

School of Information Technology, University of Calcutta, Kolkata, India

Rituparna Chaki

DAIS, Ca' Foscari University, Venezia, Italy

Agostino Cortesi

Department of Information Technology, JIS College of Engineering, West Bengal, India

Suparna DasGupta

Department of Information Technology, JIS College of Engineering, Kalyani, India

Soumyabrata Saha

About the editors

Rituparna Chaki is a full professor in the A K Choudhury School of Information Technology, University of Calcutta, India, since June 2015. She joined academia as a faculty member in the West Bengal University of Technology in 2005. Before that, she has served under Government of India in maintaining industrial production database. Besides, she has served as a visiting professor in the AGH University of Science & Technology, Cracow, Poland, since 2013 for consecutive years. Rituparna did her Ph.D. from Jadavpur University in 2002. She has been associated in organizing many conferences in India and abroad as a program chair, OC chair or as member of Technical Program Committee. She has published more than 60 research papers in reputed journals and peer-reviewed conference proceedings. Her research interest is primarily in ad hoc networking and its security. She is a professional member of IEEE and ACM.

Agostino Cortesi, Ph.D., is a full Professor of Computer Science at Ca' Foscari University, Venice, Italy. He has extensive experience in the area of static analysis and software verification techniques. His main research interests concern programming languages theory, software engineering, and static analysis techniques, with particular emphasis on security applications. He serves as co-editor in chief of the book series "Services and Business Process Reengineering" published by Springer Nature. He has been the adviser of several doctoral and postdoctoral students from Italy and abroad (e.g., India, Cuba, USA) and has published more than 200 papers in high-level international journals and proceedings of international conferences. According to Scopus, his h-index is 23, with more than 2.000 citations. Currently, he holds the chairs of “Software Engineering,” “Program Analysis and Verification,” “Computer Networks and Information Systems” and “Data Programming.”

Suparna Dasgupta is Associate Professor in the Department of Information Technology, JIS College of Engineering, India, since August 2005. She did her Ph.D. from University of Calcutta in 2022. Suparna has recognized as REDHAT Certified System Administrator and AWS Academy Educator. She has been associated in organizing many conferences in India as member of Technical Program Committee. She has published more than 35 research papers in Journals, Book Chapters, and peer-reviewed Conference Proceedings. She has published more than 20 number of patents. Her research interest is primarily in vehicular ad hoc networking and its security. She is a professional member of ACM, CSI, ISTE.

Soumyabrata Saha works as Associate Professor in the Department of Information Technology, JIS College of Engineering, India, since August 2005. He completed his Ph.D. from University of Calcutta in 2023. He has been associated in organizing many conferences in India as member of Program Committee and Technical Program Committee. He has published more than 30 research papers in Journals, Book Chapters, and peer-reviewed Conference Proceedings. He has published more than 25 number of patents. His research interest is primarily in Wireless Sensor Networks, Internet of Things. He is a Life member of CSI, ISTE.

Bibliographic Information

Book Title
Smart Systems and Wireless Communication

Book Subtitle
Proceedings of SSWC 2024

Editors
Rituparna Chaki, Agostino Cortesi, Suparna DasGupta, Soumyabrata Saha

Series Title
Smart Innovation, Systems and Technologies

DOI
https://doi.org/10.1007/978-981-96-1348-9

Publisher
Springer Singapore

eBook Packages
Engineering, Engineering (R0)

Hardcover ISBN
978-981-96-1347-2
Published: 18 April 2025

Softcover ISBN
978-981-96-1350-2
Due: 02 May 2026

eBook ISBN
978-981-96-1348-9
Published: 17 April 2025

Series ISSN
2190-3018

Series E-ISSN
2190-3026

Edition Number
1

Number of Pages
XXVIII, 689

Number of Illustrations
72 b/w illustrations, 225 illustrations in colour

Topics
Communications Engineering, Networks,

Wireless and Mobile Communication, Artificial Intelligence, Cyber-physical systems, IoT, Professional Computing

Publish with us

Policies and ethics

Back to top