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Smart Applications of Artificial Intelligence and Big Data

EDITED BY

**SALWA BELAQZIZ, SALMA EL HAJJAMI,
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Smart Applications of Artificial Intelligence and Big Data

Smart Applications of Artificial Intelligence and Big Data covers a wide range of topics related to AI and big data, including machine learning, deep learning, natural language processing, computer vision, data analytics, and data mining. It focuses on the integration of these technologies to create smart applications, such as intelligent transportation systems, smart healthcare, smart cities, and smart grids.

This book comprises 21 chapters, each providing technical details pertaining to research, practical examples, and case studies to help readers understand the real-world applications of AI and big data technologies. The book also highlights cutting-edge research on AI and big data, including novel algorithms, tools, and techniques. It discusses the challenges and opportunities of using AI and big data to develop smart applications and provides recommendations for the development of responsible and transparent AI-based systems. This book is a valuable resource for researchers and professionals looking to stay up-to-date with the latest advancements in AI and big data and how they can be applied to solve real-world challenges.



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Preface

In the ever-evolving landscape of technology, the emergence of advanced computing systems and smart applications marks a transformative era in our understanding of artificial intelligence (AI) and machine learning. This edited volume unfolds a tapestry of cutting-edge research and profound insights across diverse domains within the boundless realm of AI and smart applications. As we stand at the crossroads of technological evolution, the chapters compiled herein traverse the trajectory of AI trends and challenges, showcasing the profound impact on communication, healthcare, security, and more.

This edited book, titled *Smart Applications of Artificial Intelligence and Big Data*, presents machine learning-based technologies divided into three parts: Artificial Intelligence, Smart Applications, and Internet of Things (IoT) and Big Data. The first part introduces the vast potential of AI in various fields, setting the stage for innovative applications and breakthroughs. The second part shifts the focus to practical implementations of smart applications. The third part delves into the integration of AI with IoT, creating intelligent solutions for smart cities. It also addresses the transformative potential of AI in managing and interpreting big data.

This edited compilation endeavors to provide a comprehensive exploration of the intricate interplay between AI and the multifaceted domains it influences. The contributors to this volume offer insights, analyses, and solutions that contribute to the ongoing narrative of this transformative era. Each chapter represents a unique contribution, a stepping stone in the collective journey toward a future where intelligent systems enhance our lives and redefine the boundaries of what is possible. The chapters herein provide not only knowledge but also a compass for navigating the vast and dynamic landscape of AI and machine intelligence.

This book is divided into three parts. The first part introduces AI and its applications, addressing the challenges and trends of future developments. The second part spotlights smart applications of AI in various fields. The third part explores the integration of AI with IoT and also examines the transformative impact of AI on big data. Together, these parts present a holistic view of the current state and future potential of AI.

PART I: ARTIFICIAL INTELLIGENCE (AI)

- **Chapter 1** explores the efficiency and cost-effectiveness of container live migration within cloud environments, specifically focusing on implementation within AWS.
- **Chapter 2** introduces a deep learning framework designed for the classification and localization of gastrointestinal abnormalities in wireless capsule endoscopy (WCE) images.
- **Chapter 3** details the application of U-Net architecture and transfer learning techniques for the segmentation of breast cancer in medical imaging.
- **Chapter 4** discusses the transformation of GPU-accelerated machine learning environments through the use of Docker cloud containers for improved efficiency and scalability.
- **Chapter 5** reviews various image-based deep learning methodologies applied to estimate atmospheric visibility, highlighting the latest advancements and applications.
- **Chapter 6** evaluates the effectiveness of interpretable machine learning algorithms in detecting distributed denial of service (DDoS) attacks to enhance cloud security.
- **Chapter 7** explores a novel method for classifying gastrointestinal bleeding in WCE images by integrating a stabilizing block with the Xception model.
- **Chapter 8** presents an advanced approach combining convolutional neural networks (CNNs), transfer learning, and ensemble learning for the recognition and classification of lung tumors in CT scan images.
- **Chapter 9** introduces a new method for pedestrian detection in intelligent surveillance systems using motion information and GLBP-Color features with SVM classification, tested on the INO Video Analytics dataset.

PART II: SMART APPLICATIONS

- **Chapter 10** investigates the use of ADALINE neural networks to compensate for harmonic currents in shunt active power filters, enhancing power quality.
- **Chapter 11** discusses the implementation of maximum power point tracking (MPPT) and vector control techniques in grid-connected photovoltaic systems.
- **Chapter 12** introduces GeoArgania, a comprehensive geolocation mapping dataset of Argania trees, aimed at supporting ecological and agricultural studies in the Souss region.
- **Chapter 13** proposes a PSM (platform-specific model) for NoSQL key-value databases to improve data handling and efficiency through model programming.

- **Chapter 14** examines the implementation and effectiveness of body temperature screening systems used during the COVID-19 pandemic for public health safety.
- **Chapter 15** details a signal processing system designed for heart rate extraction using plethysmography analysis, developed on the LabVIEW platform.
- **Chapter 16** investigates the temporal impacts of the COVID-19 pandemic through sentiment analysis and topic modeling of public opinion and discourse.

PART III: INTERNET OF THINGS (IoT) AND BIG DATA

- **Chapter 17** explores smart electric vehicle (EV) routing to charging stations aimed at optimizing traffic flow in smart cities, with a case study in Agadir.
- **Chapter 18** presents innovative techniques for dimensionality reduction and spectral unmixing tailored for hyperspectral data analysis to improve data interpretability and accuracy.
- **Chapter 19** introduces a detection system designed to identify counterfeit medicines, leveraging advanced data analysis and machine learning techniques.
- **Chapter 20** discusses an intrusion detection system enabled by software-defined networking (SDN) that utilizes machine learning and neural network schemes for enhanced security.
- **Chapter 21** highlights the importance of customized information security awareness programs in higher education, advocating for tailored approaches to enhance security education and practices.



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About the Editors

Dr. Salwa Belaqqiz is a Full Professor in Computer Science at the Faculty of Sciences, Ibn Zohr University in Agadir, and an affiliate professor at the Center for Remote Sensing Applications of the Mohammed VI Polytechnic University. She received her Ph.D. degree in Computer Science from Cadi Ayyad University of Marrakech in 2014, which focused on the development of a decision support approach for gravity irrigation systems management, based on the combination of multi-agent modeling, remote sensing, and optimization by evolutionary algorithms. Salwa Belaqqiz has worked at the National Institute of Agricultural Research in Toulouse as a postdoctoral researcher, where she participated in the development of an agent-based modeling and simulation platform to assess the environmental, economic, and social impacts of various management strategies and policies regarding the management and uses of water resources. Her main research interests include irrigation scheduling, smart farming, and decision support systems development, based on approaches combining artificial intelligence, big data, data science, agent-based modeling, physics-based modeling, remote sensing, IoT, and optimization algorithms for integrated water resources management. Salwa Belaqqiz co-supervises four Ph.D. students and participates in national and international research projects (ASSIWAT, MorSnow, GeanTech, PRIMA, ...). She has published papers in international peer-reviewed journals and participated in several international conferences.

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