

Preface

From the book editors' sides, this compendium has been hoped to serve as a most helpful reference work in 2021 on the areas of contemporary clean cosmopolitan and urban, regional, and rural, spatial-temporal and environmental, agricultural and industrial operational research and artificial intelligence, arts and sciences. After diligent work from the authors', reviewers', editors' and all further sides, this book project has become a success in gathering, organizing and condensing emerging research material on state-of-the-art, discoveries and inventions related to electronic and electrical, informational and energetic, recoverable and renewable, creative and re-creative resources and their mobile, maneuverable and agile uses with care, a wide horizon and responsibility. Herewith the provided consistent monograph and compendium of scientific research on problems about renewable energy and power supply for urban and rural regions, about nature and culture, about mobility and hospitality, is a very considerate scholarly source which studies the efficient usage of those modern resources that have a fostering impact on sustainable development of our cities and rural surroundings, hence on immigration and emigration into and out of our megalopolises and, ultimately, on social peace inside and among our nations.

The perception of *smart cities* includes a strategy which uses different types of technologies, artificial intelligence (AI), deep learning (DL), machine learning (ML) and operational research (OR). Therein, through the internet of things (IoT) and sensor-based data collection, the chosen strategy extrapolates information by the use of insights gained from those data, in order to efficiently monitor, manage or track assets, resources, and services in an urban area. These models deeply affect the localities where they are being applied and can create together immense chances for an urban recovery, for better quality of life, for physical and mental health protection, and for economic and social development or re-development.

Because of this book's international directedness, it can become a valuable and unique reference work which outlines the advanced progress achieved worldwide in related areas of OR, AI, city-planning, land-use and -panning, renewable energy, electronical, information and mobility technologies, healthcare, sports, culture and

lifestyle. It is on the way of becoming recognized at a global stage for its comprehensive analytical and practically important content.

Smart Cities and Machine Learning in Urban Health is a selected selection of innovative investigation on the methodologies and applications of DL and ML strategies in the fields of mobility, mechanical and electrical engineering, robotics, sensorics, automation, safety, environmental protection, culture, medicine, space-time planning, economics, business, finance, science and further engineering, engineering. While highlighting topics including data hybridization, computational modeling, and artificial intelligence, this book is ideally designed for engineers, IT specialists, data analysts, data scientists, engineers, researchers, academicians, philanthropes and policy makers who are seeking for current research on DL or ML methods and their applications in emerging smart-city, smart-technology, and healthcare industries.

Smart Cities and Machine Learning in Urban Health strongly promotes an interdisciplinarity which develops and illustrates the concepts of reliability, resilience and security in relation to a smart city, and the modern chances given by AI, DM, ML and OR. This book examines the ability of an area and its communities to recover in ad decent time from diverse kinds of crisis or difficulties; the rigidity and resistance of an area and its communities to possible crisis; the ability of an area, its communities, infrastructure, and business to spring back into shape; and the responsiveness and mitigation towards the crisis with a special look at the impact of the contemporary and simultaneous COVID-19 pandemic. This was a great challenge of this book project. The investigations' theoretical foundation base on a wide range of non-architectural sources, primarily from AI towards, sociology, urban and rural studies, and technological development. However, it explores everything on cases taken from real cities, herewith transforming them into subjects of architectural interest. By its coverage of topics such as carbon emission reduction, digital healthcare systems and urban transformation, this work is an essential and unique resource for graduate and post-graduate students, researchers, university faculty, engineers, public management, hospital administration, scholars, academicians, decision makers, and policymakers.

AI, DL, ML and OR are disciplines and methodologies which employ but also transcend the worlds of data description and classical statistics. Optimization of this new approach is still not finalized, but there is a necessity for scientific research on the diverse applications and tools of AI, DL, ML and OR. Today contemporary algorithms, codes and techniques coming from neuro-imaging, brain imaging, etc., create high-quality neurophysiological data with a resolution quality never seen before. These growing momentums and fast dynamics generate promising avenues to enhance an understanding of our central nervous system and finally of a deeper learning. Complexity and further calculation-based problems occurred because of the high size, diversity and interactivity of neuronal systems and the

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large number of constituents with yet unidentified connections between them. Most innovative reflections, approaches and processes of computational and OR-supported neuroscience allow for more realistic biological-physical models which provide astonishing chances for conditional behaviour, connections and representations between brain areas in neural, cognitive and mental, economic, professional and daily life's cases of decision making.

In these times, readers from all over the globe are searching for helpful and novel material which supply researchers with an appropriate training in cutting-edge numerical mathematics and intelligent AI, DL, ML and OR techniques in order to overcome complicated real-world problems. It is here where modern Optimization comes into play and makes a great difference. Compared with other works, this book reveals a good balance between basic theory, advanced algorithms and hands-on AI, DL, ML and OR projects. The presented and discussed problems are "hot topics" in the areas of smart cities, industry 4.0, computer science and mathematics. Hence, this book is expected to become a useful reference book of our many young and upcoming scholars from across the world.

This offered book encompasses remarkable excerpts of the state-of-the-art while reflecting a number of tendencies, preferences and fashions, which, in its domains, have never been combined or composed, compiled and published so far. The offer, initialization and unfolding of a user-author and user-system interactions in relation to automation, robotics, sensorics, AI, DL, ML and OR from a human viewpoint, and the role of these methodologies and tools in the post-COVID-19 era, could become great chances for humankind.

Invited topics of this compendium include, but were not limited to, the following:

- *Carbon Emissions,*
- *COVID-19,*
- *Digital Healthcare Systems,*
- *Digitalization,*
- *Fire Safety,*
- *Fuzzy Random Matric Generators,*
- *Plastic Waste,*
- *Public Open Spaces,*
- *Smart Health,*
- *Urban Transformation,*
- *Vertical Gardening.*

This book comprises has welcomed and includes novel progress in theory, methodologies and practical implementations in city and country design and planning, ecology, mobility and transportation, tourism, energy resources and renewable

resources, electrical vehicles, communication and information transmission, education, skills and competences, AI, DL and ML, OR, optimization and soft computing. It has been addressing policy makers, chief executive officers, governmental staff, academicians, research officers, post-graduates, scientists, educators, industrialist, business leaders, entrepreneurs, engineers, decision-makers and city planners.

Subsequently, we present a short introduction of the ten chapters of this book.

In the first chapter called “Smart Health: From the Hospital to the City – Regulatory Challenges for Upcoming Digital HealthCare Systems,” the author Cristiana Lauri examines urban health innovations as they play a crucial role in addressing the most significant economic, social and environmental changes in the current urban contexts. This new approach results in two significant aspects for public health governance. The author understands the impacts and the challenges for the regulatory framework, with a special focus on the Italian experience. The pandemic has triggered a rethinking of the health-care system according to a new prevention principle-based-approach.

The second chapter named “City Vertical Gardening: An Ecological Approach to Urban Planning Linkages Between Machine Learning, Biometric Data, Climate Control, and Urban Health,” authored by Vasiliki Geropanta and Triantafyllos Ampatzoglou, states that City Health describes the health of the city’s population through health city profiles. These bring together key pieces of information on health and its determinants in the city, as well as all elements that can influence health and disease in the urban context. It gives a term that correlates mental and physical health with the urban environment, stressing some main causes of imbalance.

The third chapter called “A Methodological Approach for Creating Urban Commons of Wellness in Public Open Spaces in the City of Chania” by Sofia Mavroudi and Panagiotis Parthenios investigates the wellbeing factor within the urban context by a methodological process for understanding and recreating the term “wellness,” focusing on public open spaces. Using as case study from the city of Chania, this research firstly proposes the assessment of 4 well-being indicators in specific areas of the city linking their effect on people’s disposition and then uses the generated data for the redesign of public open spaces.

By intelligent reflections, the fourth chapter, “How Digitalization Is Affecting Urban Transformation,” authored by Cinzia Bellone, Fabio Andreassi, and Fabio Naselli, analyzes the role that digital innovation has whenever it is connected in shaping urban spatial and functional transformations. Smart city implementation is one of the results of the new relationship between technology and physical settlement, but it still does not find methodological completeness as it is still linked

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to connected sensors and numerical flows of data. The authors explore the critical issues and open up new research paths following this study.

In the fifth chapter called “Impact of Statistical Intelligent Analysis on Corona Virus Disease,” the authors Kanak Saxena and Umesh Banodha note that statistical intelligence not only formulates the analysis model robustly but also transparently so that the system that can be easily visible and understandable to mankind. They focus on statistical intelligence analysis that includes the properties of the error tolerance, forecasting and the high reliability. Statistics will assist in path selection to formulate the highly adaptive intelligent system with the above said functionalities with reduction in the overall cost factors.

In the sixth chapter, “Methodologies to Associate COVID-19 Spreading Data to Space and Scale: A Report on the First Outbreak,” the authors Lais-Ioanna Margiori and Stylianos Krommydakakis state that the global community is facing a fast spreading virus causing the COVID-19 disease pandemic. One of the most important actions to contain the spread of this disease is to know the factors that facilitate its transmission. For this goal, a number of factors has been studied in order to understand how this virus is spreading. The main area is the role of topographical and urban data and population densities in the spread of the disease.

In the seventh chapter named “Modeling Digital Healthcare Services Using NLP and IoT in Smart Cities,” Kalpana Verma says that smart cities shall have computerized health services to help the treatment of health issues based on a centralized framework. These computerized healthcare services involve the patient, medical support staff and doctors. The author describes the digital healthcare services in the context of NLP and IoT that would help in the improvement of quality of life for people living in smart cities, and discusses a possible case study on NLP and IoT in digital healthcare in smart cities.

In the eighth chapter called “Use of Plastic Waste in Bitumen,” Aditya Singh and Saumyadeep Bhowmik point out that when we mix plastic waste with bitumen, then we are able to enhance bitumen’s physical properties for a specific road mix. Then, bitumen’s stability and water resisting capacity is upgraded. It also acts as a superior binding material than without the addition of plastic waste. Through this work, they are able to find the optimum percentage of bitumen. This will also act as a part of smart waste disposal in smart cities and improve the air quality.

In the ninth chapter named “A Novel Approach for Fire Safety,” coauthored by Ebru Efeoglu and Gurkan Tuna, liquids and solvents in industrial products are identified as producing flammable vapor which, when mixed with air, can ignite or explode. The authors present a novel approach for the classification of liquids is proposed. The proposed approach relies on the use of a vector network analyzer, a patch antenna and a group of classifiers. As proven in the study, Random Forest algorithm can provide higher accuracy than REPTree algorithm in the classification

of hazardous liquids. A prototype system is currently under development in order to integrate the components.

Then in the tenth chapter, “Bilevel Optimization of Taxing Strategies for Carbon Emissions Using Fuzzy Random Matrix Generators,” the authors Timothy Ganesan and Irraiivan Elamvazuthi carry out a Bilevel (BL) optimization of taxing strategies in consideration of carbon emissions. The BL optimization problem was considered with two primary targets: 1. designing an optimal taxing strategy (imposed on power generation companies), and 2. developing an optimal economic dispatch (ED) scheme. The resulting interaction is represented using a Stackelberg game. Detailed performance and comparative analysis are given.

The editors wish that the selected fields and picked topics of this book will represent and highlight a paradigmatic core sample of worldwide studies on given and emerging complicated, sometimes longer lasting problems on *Smart Cities and Machine Learning in Urban Health* and their areas of City Planning and Land Use, of High Technology and the Arts, of Science and Development, of Healthcare and Medicine, of Economics and Finance, via approaches, results, programs, codes, arrangements and devices of *Operational Research* and *Artificial Intelligence*. We and all readers may be thankful to the publishing house of *IGI Global* for its approving, hosting and continuously supporting this compendium as a pioneering research project. We thank all the guest editors, Professor J. Joshua Thomas, Professor Vasiliki Geropanta, Professor Anna Karagianni, Professor Vladimir Panchenko, and Professor Pandian Vasant, for their foresight, hard work and dedication in sharing their visions with the worldwide community. Together with them know we wish that the authors’ premium and exciting studies will stimulate, motivate and initiate new cooperation and advancements on a global stage, of an exquisite level of quality, and as a service to humanity and the whole creation.

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