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Editors

Advances in Digital Health and Medical Bioengineering II

**Volume 3 - Telemedicine, Biomaterials,
Environmental Protection, Medical
Imaging, and Biomechanics**

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ISSN 1680-0737
ISBN 978-3-032-23951-8
Number of Pages
V, 595

E-ISSN 1433-9277 (electronic)
ISBN 978-3-032-23952-5 (eBook)

Part of the book series: IFMBE Proceedings (IFMBE, volume 144)
<https://link.springer.com/book/9783032239518>

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This Springer imprint is published by the registered company Springer
Nature Switzerland AG The registered company address is: Gewerbestrasse
11, 6330 Cham, Switzerland.

PREFACE

The three volumes of *Advances in Digital Health and Medical Bioengineering*, part II, gathers all accepted and presented papers at the 13th International Conference on E-Health and Bioengineering, EHB-2025, November 13–14, 2025, Iași, Romania (www.ehbconference.ro).

This hybrid conference was organized by the Grigore T. Popa University of Medicine and Pharmacy of Iași / Faculty of Medical Bioengineering, International Society for Digital Health and Education, and co-organized by the Institute of Computer Science of Romanian Academy - Iasi Branch. The conference was mainly dedicated to the e-health systems, medical bioengineering and biomedical engineering, but also addresses related fields. Its specific aim and objectives are to promote concepts and advanced hardware and software technologies in the emerging domains of e-health, medical devices and instrumentation, biosignal and image processing, medical informatics, artificial intelligence in healthcare, biomechatronics, biomaterials, biotechnologies, medical physics, healthcare management, teaching and (e)learning, rehabilitative and assistive technologies, environmental protection, food technologies, as well as in some younger disciplines such as bioinformatics, and systems biology. Thus, EHB 2025 was an international forum for fundamental and applied research and applications in bioengineering and biomedical engineering. EHB 2025 brought together researchers from academic and research institutions, leading industrial companies, and government laboratories worldwide to promote and popularize the scientific fundamentals and applications of digital health and bioengineering.

The conference motto was *Innovation for a better healthcare*, and we have to stress that the ultimate goal of medical systems, we mean a better quality of life, from medical and social points of view, cannot be achieved without an efficient use of information and management systems and of biomedical technology.

The EHB Conference is the largest medical bioengineering conference in Romania and Eastern Europe. This year it received 478 submissions from 51 countries across six continents. Following a rigorous double-blind, two-round peer-review process, authors revised their papers based on reviewers' feedback, resulting in an acceptance rate of about 61%. We sincerely thank the authors, conference committee members, session chairs, and especially the reviewers—without their dedication, this conference and book would not be possible. Extended versions of selected best papers will be published in *Advances in Electrical and Computer Engineering*, *Revue Roumaine des Sciences Techniques, Série Électrotechnique et Énergétique*, and special issues of *Sensors and Applied Sciences (MDPI)*. Special thanks are also due to our honorary chair, Prof. Constantinos Pattichis (University of Cyprus), and to all committee members and external reviewers for their expertise and support.

Also, thank you very much to the plenary speakers: Prof. Radu-Emil Precup (Politehnica University of Timișoara, Romania), Omneya Attallah (Arab Academy for Science, Technology, and Maritime Transport, Alexandria, Egypt), Martin Rožánek (Czech Technical University in Prague, Czech Republic), and Carlo Ricciardi (University of Naples Federico II, Italy) for sharing their knowledge, expertise and experience. We appreciate very much the implication of the young researchers as authors, and the partnership with IFMBE, Springer Nature, EasyChair, iThenticate plagiarism verification, and with our sponsor (Applied Sciences journal, MDPI) for their essential support during the preparation of EHB 2025 and this book.

BOOK OVERVIEW

The book **Advances in Digital Health and Medical Bioengineering II**, published by Springer Nature, is structured in three volumes that cover the major scientific disciplines in digital health and medical bioengineering.

- **Volume 1: Medical Devices, Measurements, and Artificial Intelligence Applications** presents state-of-the-art research on medical devices and measurement technologies, together with advanced artificial intelligence methods for healthcare research and practice.
- **Volume 2: Health Technology Assessment, Biomedical Signal Processing, Medicine and Informatics** brings together contributions focused on the evaluation and optimization of health technologies, advanced biomedical signal processing methods, and modern medical informatics solutions.
- **Volume 3: Telemedicine, Biomaterials, Environmental Protection, Medical Imaging, and Biomechanics** presents interdisciplinary research spanning remote and technology-assisted healthcare, biomaterials and biotechnologies for medical applications.

This volume, *Telemedicine, Biomaterials, Environmental Protection, Medical Imaging, and Biomechanics*, presents interdisciplinary research in remote and technology-assisted healthcare, biomaterials and biotechnologies. It also covers medical imaging methods and analysis, biomechanics modeling and assessment, and health–environment applications related to monitoring, prevention, and protection. The third volume of this book contains 48 chapters and consists of 6 sections. The first section focuses on *Telemedicine* and includes six chapters addressing approaches to remote and technology-assisted healthcare. The contributions cover a broad spectrum of e-, m-, and p-health solutions, highlighting digital strategies for improving access and continuity of care. Remote monitoring for individuals with chronic diseases is also represented, illustrating practical frameworks for follow-up and long-term management outside traditional clinical settings. Beyond standard telehealth scenarios, the section expands toward predictive modeling for human health in extreme environments, including space-related contexts, and emphasizes wider societal applications such as disaster management, security, and ecosystem monitoring supported by telemedicine-related technologies.

The second section is dedicated to Biomaterials and includes six chapters covering material characterization, sensing applications, and modeling-based investigations. Several contributions address advanced biomaterials relevant to medical implants, including bioabsorbable vascular stents. A group of studies presents detectors for volatile organic compounds, highlighting the expanding role of sensing in biomedical and environmental contexts. The section is complemented by modeling and simulation approaches and interdisciplinary applications, linking fundamental material properties to applied biomedical solutions.

The third section addresses *Environmental Protection and Health* through four chapters that connect sustainable technologies with health-related outcomes and policy considerations. Topics include functionalization strategies for polymer-based materials such as PET fibers, and investigations into the beneficial properties of functionalized marine algae biomass. Another contribution presents an efficient

approach for removing mercury ions from aqueous solutions using low-cost adsorbents, emphasizing practical environmental remediation. The section also includes a broader systems-level perspective through an analysis of Romania's nuclear diplomacy, exploring the balance between technology and security in the context of green transition efforts and regional resilience.

The fourth section, the largest in this volume, focuses on *Medical Imaging and Image Processing* and includes nineteen chapters emphasizing clinically relevant applications supported by modern computational methods. A substantial set of contributions demonstrates how artificial intelligence can guide image analysis and medical decision support across multiple imaging modalities and diagnostic targets, including MRI-based evaluation of lumbar vertebrae, detection of endometrial abnormalities, retinal vessel extraction, skin lesion classification, thermal imaging approaches for breast cancer classification, automated cervical cell classification, and lung lesion segmentation in CT. Advanced methodologies are also presented for three-dimensional tumor segmentation, reflecting the increasing maturity of 3D learning and regularization strategies in medical imaging. The section further extends to diverse applications such as image-based animal behavior analysis for biomedical experiments, human-in-the-loop frameworks for improving 3D vascular segmentation completeness, multimodal video analytics for early autism detection, and AI-based food image recognition. Educational and translational directions are represented through the design and use of 3D-printed physical phantoms, while additional chapters address automated parasite detection in malaria screening, texture-based classification of colorectal tissue types, and structured approaches for calculating clinical indices such as the cardiothoracic index.

The 5th section of this volume is dedicated to *Biomechanics*, a salient domain of biomedical engineering and bioengineering, illustrated by six chapters. It includes an automated platform for kinematic assessment of hand motor deficits in neurological diseases, and a study showing how gait analysis can help identify digital biomarkers in functional motor disorders. Another chapter reports neurofunctional and biomechanical adaptations to robotic-assisted gait therapy in cerebral palsy. The section also presents position identification for vision-based robot control, an analysis of how contact point errors affect the apparent mechanical properties of giant unilamellar vesicles, and an investigation of how additive manufacturing and CT scanning parameters influence anthropomorphic phantom fidelity.

The sixth section explores *Food Technologies for Health* through four chapters, presenting an emerging interdisciplinary direction at the intersection of nutrition, bioengineering, and digital technologies. Topics include oxidative stress and its implications for digestion in farmed fish species, as well as the transformation of sea algae via fermentation for animal and human health applications. The section also incorporates a data-driven informatics perspective through work on IoT integration and smart contract security in Dairy 4.0, highlighting the role of digitalization in food systems. A further contribution examines coriander as a natural antioxidant approach to reducing oxidative stress in fish, complementing the section's broader emphasis on functional strategies to support health through food-related innovation.

January 2026

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