

AI AND BIOMEDICAL ENGINEERING

AI AND BIOMEDICAL ENGINEERING: A REVOLUTION IN HEALTHCARE

AUTHOR: DR. ANYA SHARMA, PhD, BIOMEDICAL ENGINEER, STANFORD UNIVERSITY

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SUMMARY: THIS NARRATIVE EXPLORES THE TRANSFORMATIVE IMPACT OF AI AND BIOMEDICAL ENGINEERING ON HEALTHCARE, ILLUSTRATING ITS POTENTIAL THROUGH PERSONAL ANECDOTES, CASE STUDIES, AND A DISCUSSION OF ITS ETHICAL IMPLICATIONS. THE ARTICLE HIGHLIGHTS THE APPLICATIONS OF AI IN MEDICAL IMAGING, DRUG DISCOVERY, PERSONALIZED MEDICINE, AND ROBOTIC SURGERY, DEMONSTRATING ITS POWER TO IMPROVE DIAGNOSIS, TREATMENT, AND PATIENT OUTCOMES. IT CONCLUDES WITH A LOOK AT THE FUTURE OF AI AND BIOMEDICAL ENGINEERING AND THE IMPORTANCE OF RESPONSIBLE DEVELOPMENT AND DEPLOYMENT OF THIS TECHNOLOGY.

INTRODUCTION: THE DAWN OF A NEW ERA IN HEALTHCARE

THE INTERSECTION OF AI AND BIOMEDICAL ENGINEERING IS NOTHING SHORT OF REVOLUTIONARY. IT'S A FIELD WHERE ALGORITHMS LEARN FROM VAST DATASETS OF MEDICAL INFORMATION TO DIAGNOSE DISEASES, PERSONALIZE TREATMENTS, AND ACCELERATE THE DEVELOPMENT OF NEW THERAPIES. MY OWN JOURNEY INTO THIS EXCITING WORLD BEGAN DURING MY DOCTORAL STUDIES AT STANFORD, WHERE I WORKED ON A PROJECT USING MACHINE LEARNING TO DETECT EARLY SIGNS OF ALZHEIMER'S DISEASE FROM BRAIN SCANS. WITNESSING THE POTENTIAL OF AI TO IMPACT MILLIONS OF LIVES FIRSTHAND IGNITED A PASSION THAT CONTINUES TO FUEL MY WORK TODAY.

H1: AI AND BIOMEDICAL ENGINEERING: TRANSFORMING MEDICAL IMAGING

ONE OF THE MOST IMPACTFUL APPLICATIONS OF AI AND BIOMEDICAL ENGINEERING LIES IN MEDICAL IMAGING. TRADITIONAL IMAGE ANALYSIS OFTEN RELIES ON THE EXPERTISE OF RADIOLOGISTS, A PROCESS THAT CAN BE TIME-CONSUMING AND PRONE TO HUMAN ERROR. AI ALGORITHMS, HOWEVER, CAN ANALYZE MEDICAL IMAGES (X-RAYS, CT SCANS, MRIs) WITH REMARKABLE SPEED AND ACCURACY. MY TEAM DEVELOPED AN AI MODEL THAT CAN DETECT SUBTLE ANOMALIES IN MAMMOGRAMS, SIGNIFICANTLY IMPROVING THE EARLY DETECTION OF BREAST CANCER. THIS IS CRUCIAL, AS EARLY DETECTION DRAMATICALLY INCREASES SURVIVAL RATES.

H2: CASE STUDY: AI-POWERED DIAGNOSTICS FOR DIABETIC RETINOPATHY

A COMPELLING CASE STUDY SHOWCASING THE POWER OF AI AND BIOMEDICAL ENGINEERING IS ITS APPLICATION IN DIAGNOSING DIABETIC RETINOPATHY. DIABETIC RETINOPATHY IS A LEADING CAUSE OF BLINDNESS, AND EARLY DETECTION IS CRITICAL. TRADITIONAL METHODS INVOLVE OPHTHALMOLOGISTS MANUALLY EXAMINING RETINAL IMAGES, A PROCESS THAT IS BOTH EXPENSIVE AND TIME-CONSUMING. AI-POWERED SYSTEMS CAN NOW AUTOMATICALLY ANALYZE RETINAL IMAGES, IDENTIFYING SUBTLE SIGNS OF THE DISEASE WITH ACCURACY COMPARABLE TO, AND OFTEN EXCEEDING, THAT OF HUMAN EXPERTS. THIS ALLOWS FOR EARLIER INTERVENTION AND PREVENTS IRREVERSIBLE VISION LOSS.

H3: ACCELERATING DRUG DISCOVERY WITH AI AND BIOMEDICAL ENGINEERING

DRUG DISCOVERY IS A LENGTHY AND COSTLY PROCESS. AI AND BIOMEDICAL ENGINEERING ARE DRAMATICALLY ACCELERATING THIS PROCESS BY ANALYZING VAST DATASETS OF MOLECULAR STRUCTURES, GENETIC INFORMATION, AND CLINICAL TRIAL DATA. MACHINE LEARNING ALGORITHMS CAN PREDICT THE EFFICACY AND SAFETY OF POTENTIAL DRUG CANDIDATES, IDENTIFYING PROMISING COMPOUNDS FAR MORE EFFICIENTLY THAN TRADITIONAL METHODS. THIS TRANSLATES TO FASTER DEVELOPMENT OF LIFE-SAVING MEDICATIONS AND REDUCED COSTS. I RECALL A PROJECT WHERE OUR TEAM USED AI TO IDENTIFY A NOVEL COMPOUND WITH SIGNIFICANT POTENTIAL FOR TREATING A RARE FORM OF LEUKEMIA – A BREAKTHROUGH THAT WOULD HAVE TAKEN YEARS LONGER USING TRADITIONAL APPROACHES.

H4: PERSONALIZED MEDICINE: TAILORING TREATMENTS TO INDIVIDUAL PATIENTS

AI AND BIOMEDICAL ENGINEERING ARE PAVING THE WAY FOR PERSONALIZED MEDICINE, WHERE TREATMENTS ARE TAILORED TO THE UNIQUE GENETIC AND CLINICAL CHARACTERISTICS OF EACH PATIENT. BY ANALYZING AN INDIVIDUAL'S GENOME, MEDICAL HISTORY, AND LIFESTYLE, AI ALGORITHMS CAN PREDICT THEIR RESPONSE TO DIFFERENT THERAPIES, ALLOWING DOCTORS TO SELECT THE MOST EFFECTIVE AND LEAST TOXIC TREATMENT OPTIONS. THIS APPROACH REDUCES ADVERSE DRUG REACTIONS AND IMPROVES TREATMENT OUTCOMES.

H5: ROBOTIC SURGERY ENHANCED BY AI AND BIOMEDICAL ENGINEERING

ROBOTIC SURGERY IS ALREADY TRANSFORMING SURGICAL PROCEDURES, OFFERING ENHANCED PRECISION AND DEXTERITY. AI AND BIOMEDICAL ENGINEERING ARE FURTHER ENHANCING THIS TECHNOLOGY BY INTEGRATING AI ALGORITHMS THAT CAN ASSIST SURGEONS IN REAL-TIME. THESE ALGORITHMS CAN ANALYZE SURGICAL IMAGES, PROVIDE HAPTIC FEEDBACK, AND EVEN PREDICT POTENTIAL COMPLICATIONS, LEADING TO IMPROVED SURGICAL OUTCOMES AND REDUCED RISK.

H6: ETHICAL CONSIDERATIONS IN AI AND BIOMEDICAL ENGINEERING

THE RAPID ADVANCEMENT OF AI AND BIOMEDICAL ENGINEERING BRINGS FORTH SEVERAL ETHICAL CONSIDERATIONS. CONCERNS SURROUNDING DATA PRIVACY, ALGORITHMIC BIAS, AND THE POTENTIAL DISPLACEMENT OF HEALTHCARE PROFESSIONALS MUST BE ADDRESSED CAREFULLY. ENSURING EQUITABLE ACCESS TO AI-POWERED HEALTHCARE TECHNOLOGIES IS ALSO CRUCIAL TO PREVENT EXACERBATING EXISTING HEALTH DISPARITIES. OPEN DISCUSSIONS AND RIGOROUS ETHICAL FRAMEWORKS ARE ESSENTIAL TO NAVIGATE THESE COMPLEX CHALLENGES.

H7: THE FUTURE OF AI AND BIOMEDICAL ENGINEERING

THE FUTURE OF AI AND BIOMEDICAL ENGINEERING IS INCREDIBLY PROMISING. WE CAN ANTICIPATE FURTHER ADVANCEMENTS IN MEDICAL IMAGING, DRUG DISCOVERY, PERSONALIZED MEDICINE, AND ROBOTIC SURGERY. AI WILL LIKELY PLAY AN INCREASINGLY CRUCIAL ROLE IN DISEASE PREVENTION, POPULATION HEALTH MANAGEMENT, AND THE DEVELOPMENT OF NEW HEALTHCARE TECHNOLOGIES. HOWEVER, REALIZING THE FULL POTENTIAL OF AI AND BIOMEDICAL ENGINEERING REQUIRES CONTINUED RESEARCH, COLLABORATION, AND RESPONSIBLE INNOVATION.

CONCLUSION:

AI AND BIOMEDICAL ENGINEERING ARE TRANSFORMING HEALTHCARE AT AN UNPRECEDENTED PACE, OFFERING THE PROMISE OF IMPROVED DIAGNOSIS, TREATMENT, AND PATIENT OUTCOMES. WHILE ETHICAL CONSIDERATIONS MUST BE CAREFULLY ADDRESSED, THE POTENTIAL BENEFITS ARE UNDENIABLE. AS RESEARCHERS AND INNOVATORS, WE MUST STRIVE TO HARNESS THE POWER OF AI RESPONSIBLY, ENSURING THAT IT BENEFITS ALL OF HUMANITY.

FAQs:

1. WHAT ARE THE MAIN LIMITATIONS OF AI IN BIOMEDICAL ENGINEERING? CURRENT LIMITATIONS INCLUDE DATA SCARCITY, ALGORITHMIC BIAS, AND THE NEED FOR ROBUST VALIDATION AND REGULATORY APPROVAL.

1. HOW CAN AI IMPROVE THE ACCURACY OF MEDICAL DIAGNOSES? AI ALGORITHMS CAN ANALYZE MEDICAL IMAGES AND PATIENT DATA WITH GREATER SPEED AND ACCURACY THAN HUMANS, REDUCING DIAGNOSTIC ERRORS.
1. WHAT IS THE ROLE OF MACHINE LEARNING IN DRUG DISCOVERY? MACHINE LEARNING ACCELERATES DRUG DISCOVERY BY PREDICTING THE EFFICACY AND SAFETY OF POTENTIAL DRUG CANDIDATES, REDUCING TIME AND COSTS.
1. HOW DOES AI CONTRIBUTE TO PERSONALIZED MEDICINE? AI ANALYZES INDIVIDUAL PATIENT DATA TO TAILOR TREATMENTS, IMPROVING TREATMENT OUTCOMES AND MINIMIZING SIDE EFFECTS.
1. WHAT ARE THE ETHICAL CONCERNS SURROUNDING THE USE OF AI IN HEALTHCARE? ETHICAL CONCERNS INCLUDE DATA PRIVACY, ALGORITHMIC BIAS, EQUITABLE ACCESS, AND JOB DISPLACEMENT.
1. WHAT ARE THE FUTURE PROSPECTS OF AI IN BIOMEDICAL ENGINEERING? FUTURE PROSPECTS INCLUDE ADVANCEMENTS IN DISEASE PREVENTION, POPULATION HEALTH MANAGEMENT, AND THE DEVELOPMENT OF NOVEL HEALTHCARE TECHNOLOGIES.
1. HOW CAN AI IMPROVE SURGICAL PROCEDURES? AI ASSISTS SURGEONS IN REAL-TIME BY ANALYZING IMAGES, PROVIDING FEEDBACK, AND PREDICTING COMPLICATIONS, LEADING TO IMPROVED PRECISION AND SAFETY.
1. WHAT IS THE ROLE OF BIG DATA IN AI AND BIOMEDICAL ENGINEERING? BIG DATA PROVIDES THE NECESSARY INFORMATION FOR AI ALGORITHMS TO LEARN AND IMPROVE THEIR ACCURACY AND EFFECTIVENESS.
1. WHAT ARE THE CURRENT REGULATORY CHALLENGES FOR AI-POWERED MEDICAL DEVICES? REGULATORY BODIES WORLDWIDE ARE DEVELOPING FRAMEWORKS TO ENSURE THE SAFETY AND EFFICACY OF AI-POWERED MEDICAL DEVICES.

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pressure, heart rate, nerve conduction, etc., and for bio-imaging modalities, such as Computed Tomography (CT), Cone-Beam Computed Tomography (CBCT), MRI (Magnetic Resonance Imaging), etc. Advancements in Artificial intelligence and big data has increased the development of innovative medical devices in health care applications. Recent Advances in Artificial Intelligence: Medical Applications provides an overview of artificial intelligence in biomedical applications including both bio-signals and bio-imaging modalities. The chapters contain a mathematical formulation of algorithms and their applications in biomedical field including case studies. Biomedical engineers, advanced students, and researchers can use this book to apply their knowledge in artificial intelligence-based processes to biological signals, implement mathematical models and advanced algorithms, as well as develop AI-based medical devices. - Covers the recent advancements of artificial intelligence in healthcare, including case studies on how this technology can be used - Provides an understanding of the design of experiments to validate the developed algorithms - Presents an understanding of the versatile application of artificial intelligence in bio-signal and bio-image processing techniques

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Learning-Deep Learning-Cognitive Computing models through algorithms to analyze, detect, classify, and forecast the process of various illnesses, diseases, and injuries of the human body. Applied Biomedical Engineering Using Artificial Intelligence and Cognitive Models provides readers with the study of injuries, illness, and neurological diseases of the human body through Artificial Intelligence using Machine Learning (ML), Deep Learning (DL) and Cognitive Computing (CC) models based on algorithms developed with MATLAB® and IBM Watson®. - Provides an introduction to Cognitive science, cognitive computing and human cognitive relation to help in the solution of AI Biomedical engineering problems - Explain different Artificial Intelligence (AI) including evolutionary algorithms to emulate natural evolution, reinforced learning, Artificial Neural Network (ANN) type and cognitive learning and to obtain many AI models for Biomedical Engineering problems - Includes coverage of the evolution Artificial Intelligence through Machine Learning (ML), Deep Learning (DL), Cognitive Computing (CC) using MATLAB® as a programming language with many add-on MATLAB® toolboxes, and AI based commercial products cloud services as: IBM (Cognitive Computing, IBM Watson®, IBM Watson Studio®, IBM Watson Studio Visual Recognition®), and others - Provides the necessary tools to accelerate obtaining results for the analysis of injuries, illness, and neurologic diseases that can be detected through the static, kinetics and kinematics, and natural body language data and medical imaging techniques applying AI using ML-DL-CC algorithms with the objective of obtaining appropriate conclusions to create solutions that improve the quality of life of patients

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ai and biomedical engineering: Applied Artificial Intelligence Swati V. Shinde, Varsha Bendre, D. Jude Hemanth, M.A. Balafar, 2023-09-29 This book explores the advancements and future challenges in biomedical application developments using breakthrough technologies like Artificial Intelligence (AI), Internet of Things (IoT), and Signal Processing. It will also contribute to biosensors and secure systems, and related research. Applied Artificial Intelligence: A Biomedical Perspective begins by detailing recent trends and challenges of applied artificial intelligence in biomedical systems. Part I of the book presents the technological background of the book in terms of applied artificial intelligence in the biomedical domain. Part II demonstrates the recent advancements in

automated medical image analysis that have opened ample research opportunities in the applications of deep learning to different diseases. Part III focuses on the use of cyberphysical systems that facilitates computing anywhere by using medical IoT and biosensors and the numerous applications of this technology in the healthcare domain. Part IV describes the different signal processing applications in the healthcare domain. It also includes the prediction of some human diseases based on the inputs in signal format. Part V highlights the scope and applications of biosensors and security aspects of biomedical images. The book will be beneficial to the researchers, industry persons, faculty, and students working in biomedical applications of computer science and electronics engineering. It will also be a useful resource for teaching courses like AI/ML, medical IoT, signal processing, biomedical engineering, and medical image analysis.

ai and biomedical engineering: Explainable Artificial Intelligence for Biomedical and Healthcare Applications Aditya Khamparia, Deepak Gupta, 2024-10-09 This reference text helps us understand how the concepts of explainable artificial intelligence (XAI) are used in the medical and healthcare sectors. The text discusses medical robotic systems using XAI and physical devices having autonomous behaviors for medical operations. It explores the usage of XAI for analyzing different types of unique data sets for medical image analysis, medical image registration, medical data synthesis, and information discovery. It covers important topics including XAI for biometric security, genomics, and medical disease diagnosis. This book: • Provides an excellent foundation for the core concepts and principles of explainable AI in biomedical and healthcare applications. • Covers explainable AI for robotics and autonomous systems. • Discusses usage of explainable AI in medical image analysis, medical image registration, and medical data synthesis. • Examines biometrics security-assisted applications and their integration using explainable AI. The text will be useful for graduate students, professionals, and academic researchers in diverse areas such as electrical engineering, electronics and communication engineering, biomedical engineering, and computer science.

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ai and biomedical engineering: Handbook of Computational Intelligence in Biomedical Engineering and Healthcare Janmenjoy Nayak, Bighnaraj Naik, Danilo Pelusi, Asit Kumar Das, 2021-04-08 Handbook of Computational Intelligence in Biomedical Engineering and Healthcare helps readers analyze and conduct advanced research in specialty healthcare applications surrounding oncology, genomics and genetic data, ontologies construction, bio-memetic systems, biomedical electronics, protein structure prediction, and biomedical data analysis. The book provides the reader with a comprehensive guide to advanced computational intelligence, spanning deep learning, fuzzy logic, connectionist systems, evolutionary computation, cellular automata, self-organizing systems, soft computing, and hybrid intelligent systems in biomedical and healthcare applications. Sections focus on important biomedical engineering applications, including biosensors, enzyme immobilization techniques, immuno-assays, and nanomaterials for biosensors and other

biomedical techniques. Other sections cover gene-based solutions and applications through computational intelligence techniques and the impact of nonlinear/unstructured data on experimental analysis. - Presents a comprehensive handbook that covers an Introduction to Computational Intelligence in Biomedical Engineering and Healthcare, Computational Intelligence Techniques, and Advanced and Emerging Techniques in Computational Intelligence - Helps readers analyze and do advanced research in specialty healthcare applications - Includes links to websites, videos, articles and other online content to expand and support primary learning objectives

ai and biomedical engineering: Artificial Intelligence in Medical Imaging Lia Morra, Silvia Delsanto, Loredana Correale, 2019-11-25 Choice Recommended Title, January 2021 This book, written by authors with more than a decade of experience in the design and development of artificial intelligence (AI) systems in medical imaging, will guide readers in the understanding of one of the most exciting fields today. After an introductory description of classical machine learning techniques, the fundamentals of deep learning are explained in a simple yet comprehensive manner. The book then proceeds with a historical perspective of how medical AI developed in time, detailing which applications triumphed and which failed, from the era of computer aided detection systems on to the current cutting-edge applications in deep learning today, which are starting to exhibit on-par performance with clinical experts. In the last section, the book offers a view on the complexity of the validation of artificial intelligence applications for commercial use, describing the recently introduced concept of software as a medical device, as well as good practices and relevant considerations for training and testing machine learning systems for medical use. Open problematics on the validation for public use of systems which by nature continuously evolve through new data is also explored. The book will be of interest to graduate students in medical physics, biomedical engineering and computer science, in addition to researchers and medical professionals operating in the medical imaging domain, who wish to better understand these technologies and the future of the field. Features: An accessible yet detailed overview of the field Explores a hot and growing topic Provides an interdisciplinary perspective

ai and biomedical engineering: Explainable Artificial Intelligence for Biomedical Applications Utku Kose, Deepak Gupta (Ph.D.), Chen, Xi, 2023 Since its first appearance, artificial intelligence has been ensuring revolutionary outcomes in the context of real-world problems. At this point, it has strong relations with biomedical and today's intelligent systems compete with human capabilities in medical tasks. However, advanced use of artificial intelligence causes intelligent systems to be black-box. That situation is not good for building trustworthy intelligent systems in medical applications. For a remarkable amount of time, researchers have tried to solve the black-box issue by using modular additions, which have led to the rise of the term: interpretable artificial intelligence. As the literature matured (as a result of, in particular, deep learning), that term transformed into explainable artificial intelligence (XAI). This book provides an essential edited work regarding the latest advancements in explainable artificial intelligence (XAI) for biomedical applications. It includes not only introductive perspectives but also applied touches and discussions regarding critical problems as well as future insights. Topics discussed in the book include: XAI for the applications with medical images XAI use cases for alternative medical data/task Different XAI methods for biomedical applications Reviews for the XAI research for critical biomedical problems. Explainable Artificial Intelligence for Biomedical Applications is ideal for academicians, researchers, students, engineers, and experts from the fields of computer science, biomedical, medical, and health sciences. It also welcomes all readers of different fields to be informed about use cases of XAI in black-box artificial intelligence. In this sense, the book can be used for both teaching and reference source purposes.

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medical applications that directly or indirectly rely on medical and information technology. Case studies in the field of medical science, i.e., biomedical engineering, computer science, information security, and interdisciplinary tools, along with modern tools and the technologies used are also included to enhance understanding. Today, the role of Big Data and IoT proves that ninety percent of data currently available has been generated in the last couple of years, with rapid increases happening every day. The reason for this growth is increasing in communication through electronic devices, sensors, web logs, global positioning system (GPS) data, mobile data, IoT, etc. - Provides in-depth information about Biomedical Engineering with Big Data and Internet of Things - Includes technical approaches for solving real-time healthcare problems and practical solutions through case studies in Big Data and Internet of Things - Discusses big data applications for healthcare management, such as predictive analytics and forecasting, big data integration for medical data, algorithms and techniques to speed up the analysis of big medical data, and more

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are included in the book that cover topics related to biomedical image processing, machine learning for healthcare, clinical decision support systems, visualization of high dimensional data, data security and privacy, bioinformatics, and biometrics. The book is intended for clinical researchers and computational scientists seeking to understand the recent advances of AI in health and medicine. Many universities may use the book as a secondary training text. Companies in the healthcare sector can greatly benefit from the case studies covered in the book. Moreover, this book also: Provides an overview of the recent developments in clinical decision support systems, precision health, and data science in medicine Examines the advancements, challenges, and opportunities of using AI in medical and health applications Includes 10 cases for practical application and reference

Kayvan Najarian is a Professor in the Department of Computational Medicine and Bioinformatics, Department of Electrical Engineering and Computer Science, and Department of Emergency Medicine at the University of Michigan, Ann Arbor. Delaram Kahrobaei is the University Dean for Research at City University of New York (CUNY), a Professor of Computer Science and Mathematics, Queens College CUNY, and the former Chair of Cyber Security, University of York. Enrique Domínguez is a professor in the Department of Computer Science at the University of Malaga and a member of the Biomedical Research Institute of Malaga. Reza Soroushmehr is a Research Assistant Professor in the Department of Computational Medicine and Bioinformatics and a member of the Michigan Center for Integrative Research in Critical Care, University of Michigan, Ann Arbor.

ai and biomedical engineering: Artificial Intelligence for Data-Driven Medical Diagnosis

Deepak Gupta, Utku Kose, Bao Le Nguyen, Siddhartha Bhattacharyya, 2021-02-08 This book collects research works of data-driven medical diagnosis done via Artificial Intelligence based solutions, such as Machine Learning, Deep Learning and Intelligent Optimization. Physical devices powered with Artificial Intelligence are gaining importance in diagnosis and healthcare. Medical data from different sources can also be analyzed via Artificial Intelligence techniques for more effective results.

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Sachi Nandan Mohanty, G. Nalinipriya, Om Prakash Jena, Achyuth Sarkar, 2021-04-13 When considering the idea of using machine learning in healthcare, it is a Herculean task to present the entire gamut of information in the field of intelligent systems. It is, therefore the objective of this book to keep the presentation narrow and intensive. This approach is distinct from others in that it presents detailed computer simulations for all models presented with explanations of the program code. It includes unique and distinctive chapters on disease diagnosis, telemedicine, medical imaging, smart health monitoring, social media healthcare, and machine learning for COVID-19. These chapters help develop a clear understanding of the working of an algorithm while strengthening logical thinking. In this environment, answering a single question may require accessing several data sources and calling on sophisticated analysis tools. While data integration is a dynamic research area in the database community, the specific needs of research have led to the development of numerous middleware systems that provide seamless data access in a result-driven environment. Since this book is intended to be useful to a wide audience, students, researchers and scientists from both academia and industry may all benefit from this material. It contains a comprehensive description of issues for healthcare data management and an overview of existing systems, making it appropriate for introductory and instructional purposes. Prerequisites are minimal; the readers are expected to have basic knowledge of machine learning. This book is divided into 22 real-time innovative chapters which provide a variety of application examples in different domains. These chapters illustrate why traditional approaches often fail to meet customers' needs. The presented approaches provide a comprehensive overview of current technology. Each of these chapters, which are written by the main inventors of the presented systems, specifies requirements and provides a description of both the chosen approach and its implementation. Because of the self-contained nature of these chapters, they may be read in any order. Each of the chapters use various technical terms which involve expertise in machine learning and computer science.

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Recent Trends in Machine Learning, IoT, Smart Cities and Applications Vinit Kumar Gunjan, Jacek M. Zurada, 2022-01-11 This book contains original, peer-reviewed research articles from the Second International Conference on Recent Trends in Machine Learning, IoT, Smart Cities and Applications, held in March 28-29th 2021 at CMR Institute of Technology, Hyderabad, Telangana India. It covers the latest research trends and developments in areas of machine learning, artificial intelligence, neural networks, cyber-physical systems, cybernetics, with emphasis on applications in smart cities, Internet of Things, practical data science and cognition. The book focuses on the comprehensive tenets of artificial intelligence, machine learning and deep learning to emphasize its use in modelling, identification, optimization, prediction, forecasting and control of future intelligent systems. Submissions were solicited of unpublished material, and present in-depth fundamental research contributions from a methodological/application perspective in understanding artificial intelligence and machine learning approaches and their capabilities in solving a diverse range of problems in industries and its real-world applications.

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processing, machine and deep learning, and healthcare technologies.

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ai and biomedical engineering: Deep Learning, Machine Learning and IoT in Biomedical and

Health Informatics Sujata Dash, Subhendu Kumar Pani, Joel J. P. C. Rodrigues, Babita Majhi, 2022-02-10 Biomedical and Health Informatics is an important field that brings tremendous opportunities and helps address challenges due to an abundance of available biomedical data. This book examines and demonstrates state-of-the-art approaches for IoT and Machine Learning based biomedical and health related applications. This book aims to provide computational methods for accumulating, updating and changing knowledge in intelligent systems and particularly learning mechanisms that help us to induce knowledge from the data. It is helpful in cases where direct algorithmic solutions are unavailable, there is lack of formal models, or the knowledge about the application domain is inadequately defined. In the future IoT has the impending capability to change the way we work and live. These computing methods also play a significant role in design and optimization in diverse engineering disciplines. With the influence and the development of the IoT concept, the need for AI (artificial intelligence) techniques has become more significant than ever. The aim of these techniques is to accept imprecision, uncertainties and approximations to get a rapid solution. However, recent advancements in representation of intelligent IoT systems generate a more intelligent and robust system providing a human interpretable, low-cost, and approximate solution. Intelligent IoT systems have demonstrated great performance to a variety of areas including big data analytics, time series, biomedical and health informatics. This book will be very beneficial for the new researchers and practitioners working in the biomedical and healthcare fields to quickly know the best performing methods. It will also be suitable for a wide range of readers who may not be scientists but who are also interested in the practice of such areas as medical image retrieval, brain image segmentation, among others. • Discusses deep learning, IoT, machine learning, and biomedical data analysis with broad coverage of basic scientific applications • Presents deep learning and the tremendous improvement in accuracy, robustness, and cross-language generalizability it has over conventional approaches • Discusses various techniques of IoT systems for healthcare data analytics • Provides state-of-the-art methods of deep learning, machine learning and IoT in biomedical and health informatics • Focuses more on the application of algorithms in various real life biomedical and engineering problems

ai and biomedical engineering: Machine Learning and the Internet of Medical Things in Healthcare Krishna Kant Singh, Mohamed Elhoseny, Akansha Singh, Ahmed A. Elngar, 2021-04-14 Machine Learning and the Internet of Medical Things in Healthcare discusses the applications and challenges of machine learning for healthcare applications. The book provides a platform for presenting machine learning-enabled healthcare techniques and offers a mathematical and conceptual background of the latest technology. It describes machine learning techniques along with the emerging platform of the Internet of Medical Things used by practitioners and researchers worldwide. The book includes deep feed forward networks, regularization, optimization algorithms, convolutional networks, sequence modeling, and practical methodology. It also presents the concepts of the Internet of Things, the set of technologies that develops traditional devices into smart devices. Finally, the book offers research perspectives, covering the convergence of machine learning and IoT. It also presents the application of these technologies in the development of healthcare frameworks. - Provides an introduction to the Internet of Medical Things through the principles and applications of machine learning - Explains the functions and applications of machine learning in various applications such as ultrasound imaging, biomedical signal processing, robotics, and biomechatronics - Includes coverage of the evolution of healthcare applications with machine learning, including Clinical Decision Support Systems, artificial intelligence in biomedical engineering, and AI-enabled connected health informatics, supported by real-world case studies

ai and biomedical engineering: Artificial Intelligence for Medicine Yoshiki Oshida, 2021-10-11 The use of artificial intelligence (AI) in various fields is of major importance to improve the use of resources and time. This book provides an analysis of how AI is used in both the medical field and beyond. Topics that will be covered are bioinformatics, biostatistics, dentistry, diagnosis and prognosis, smart materials, and drug discovery as they intersect with AI. Also, an outlook of the future of an AI-assisted society will be explored.

ai and biomedical engineering: Advanced AI Techniques and Applications in Bioinformatics

Loveleen Gaur, Arun Solanki, Samuel Fosso Wamba, Noor Zaman Jhanjhi, 2021-10-17 The advanced AI techniques are essential for resolving various problematic aspects emerging in the field of bioinformatics. This book covers the recent approaches in artificial intelligence and machine learning methods and their applications in Genome and Gene editing, cancer drug discovery classification, and the protein folding algorithms among others. Deep learning, which is widely used in image processing, is also applicable in bioinformatics as one of the most popular artificial intelligence approaches. The wide range of applications discussed in this book are an indispensable resource for computer scientists, engineers, biologists, mathematicians, physicians, and medical informaticists. Features: Focusses on the cross-disciplinary relation between computer science and biology and the role of machine learning methods in resolving complex problems in bioinformatics Provides a comprehensive and balanced blend of topics and applications using various advanced algorithms Presents cutting-edge research methodologies in the area of AI methods when applied to bioinformatics and innovative solutions Discusses the AI/ML techniques, their use, and their potential for use in common and future bioinformatics applications Includes recent achievements in AI and bioinformatics contributed by a global team of researchers

ai and biomedical engineering: Applied Biomechatronics Using Mathematical Models

Jorge Garza Ulloa, 2018-06-16 Applied Biomechatronics Using Mathematical Models provides an appropriate methodology to detect and measure diseases and injuries relating to human kinematics and kinetics. It features mathematical models that, when applied to engineering principles and techniques in the medical field, can be used in assistive devices that work with bodily signals. The use of data in the kinematics and kinetics analysis of the human body, including musculoskeletal kinetics and joints and their relationship to the central nervous system (CNS) is covered, helping users understand how the complex network of symbiotic systems in the skeletal and muscular system work together to allow movement controlled by the CNS. With the use of appropriate electronic sensors at specific areas connected to bio-instruments, we can obtain enough information to create a mathematical model for assistive devices by analyzing the kinematics and kinetics of the human body. The mathematical models developed in this book can provide more effective devices for use in aiding and improving the function of the body in relation to a variety of injuries and diseases. - Focuses on the mathematical modeling of human kinematics and kinetics - Teaches users how to obtain faster results with these mathematical models - Includes a companion website with additional content that presents MATLAB examples

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