Human Activity Recognition Using Wearable Sensors and Smartphones Chapman Hall/CRC Computer and Information Science Series

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Human Activity Recognition Challenge

Human Activity Recognition with Wearable Sensors

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Proceedings of the International Conference on Paradigms of Communication, Computing and Data Sciences

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Activity Recognition in Pervasive Intelligent Environments

Advances in Signal and Data Processing

Advanced Information Networking and Applications

Towards Robust & Realtime Human Activity Recognition Using Wearable Sensors

This book presents a collection of state-of-the-art approaches for deep-learning-based biomedical and health-related applications. The aim of healthcare informatics is to ensure high-quality, efficient health care, and better treatment and quality of life by efficiently analyzing abundant biomedical and healthcare data, including patient data and electronic health records (EHRs), as well as lifestyle problems. In the past, it was common to have a domain expert to develop a model for biomedical or health care applications; however, recent advances in the representation of learning algorithms (deep learning techniques) make it possible to automatically recognize the patterns and represent the given data for the development of such model. This book allows new researchers and practitioners working in the field to quickly understand the best-performing methods. It also enables them to compare different approaches and carry forward their research in an important area that has a direct impact on improving the human life and health. It is intended for researchers, academics, industry professionals, and those at technical institutes and R&D organizations, as well as students working in the fields of machine learning, deep learning, biomedical engineering, health informatics, and related fields.

This book constitutes the refereed post-conference proceedings of the 15th International Conference on Body Area Networks, BodyNets 2020, held in Tallinn, Estonia, in October 2020. The conference was held virtually due to the COVID-19 pandemic. The 15 papers presented were selected from 30 submissions and issue new technologies to provide trustable measuring and communications mechanisms from the data source to medical health databases. Wireless body area networks (WBAN) are one major element in this process. Not only on-body devices but also...
technologies providing information from inside a body are in the focus of this conference. Dependable communications combined with accurate localization and behavior analysis will benefit WBAN technology and make the healthcare processes more effective.

This book consists of a number of chapters addressing different aspects of activity recognition, roughly in three main categories of topics. The first topic will be focused on activity modeling, representation and reasoning using mathematical models, knowledge representation formalisms and AI techniques. The second topic will concentrate on activity recognition methods and algorithms. Apart from traditional methods based on data mining and machine learning, we are particularly interested in novel approaches, such as the ontology-based approach, that facilitate data integration, sharing and automatic/automated processing. In the third topic we intend to cover novel architectures and frameworks for activity recognition, which are scalable and applicable to large scale distributed dynamic environments. In addition, this topic will also include the underpinning technological infrastructure, i.e. tools and APIs, that supports function/capability sharing and reuse, and rapid development and deployment of technological solutions. The fourth category of topic will be dedicated to representative applications of activity recognition in intelligent environments, which address the life cycle of activity recognition and their use for novel functions of the end-user systems with comprehensive implementation, prototyping and evaluation. This will include a wide range of application scenarios, such as smart homes, intelligent conference venues and cars.

This Special Issue focused on novel vision-based approaches, mainly related to computer vision and machine learning, for the automatic analysis of human behaviour. We solicited submissions on the following topics: information theory-based pattern classification, biometric recognition, multimodal human analysis, low resolution human activity analysis, face analysis, abnormal behaviour analysis, unsupervised human analysis scenarios, 3D/4D human pose and shape estimation, human analysis in virtual/augmented reality, affective computing, social signal processing, personality computing, activity recognition, human tracking in the wild, and application of information-theoretic concepts for human behaviour analysis. In the end, 15 papers were accepted for this special issue. These papers, that are reviewed in this editorial, analyse human behaviour from the aforementioned perspectives, defining in most of the cases the state of the art in their corresponding field.

This book gathers selected research papers presented at the International Conference on Communication and Intelligent Systems (ICCIIS 2020), organized jointly by Birla Institute of Applied Sciences, Uttarakhand, and Soft Computing Research Society during 26-27 December 2020. This book presents a collection of state-of-the-art research work involving cutting-edge technologies for communication and intelligent systems. Over the past few years, advances in artificial intelligence and machine learning have sparked new research efforts around the globe, which explore novel ways of developing intelligent systems and smart communication technologies. The book presents single- and multi-disciplinary research on these themes in order to make the latest results available in a single, readily accessible source.

This book presents the select peer-reviewed proceedings of the International Conference on Signal and Data Processing (ICSDP) 2019. It examines and deliberates on the recent progresses in the areas of communication and signal processing. The book includes topics on the recent advances in the areas of wired and wireless communication, low complexity architecture of MIMO receivers, applications on wireless sensor networks and internet of things, signal processing, image processing and computer vision, VLSI embedded systems, cognitive networks, power electronics and automation, mechatronics based applications, systems and control, cognitive science and machine intelligence, information security and big data. The contents of this book will be useful for beginners, researchers, and professionals interested in the area of communication, signal processing, and allied fields.

Activity recognition can be an important part of human health awareness. Many benefits can be generated from the recognition results, including knowledge of activity intensity as it relates to wellness over time. Various activity-recognition techniques have been presented in the literature, though most address simple activity-data collection and off-line analysis. More sophisticated real-time identification is less often addressed. Therefore, it is promising to consider the combination of current off-line, activity-detection methods with wearable, embedded tools in order to create a real-time wireless human activity recognition system with improved accuracy. Different from previous work on activity recognition, the goal of this effort is to focus on specific activities that an astronaut may encounter during a
mission. Planetary navigation field test (PNFT) tasks are designed to meet this need. The approach used by the KSU team is to pre-record
data on the ground in normal earth gravity and seek signal features that can be used to identify, and even predict, fatigue associated with
these activities. The eventual goal is to then assess/predict the condition of an astronaut in a reduced-gravity environment using these
predetermined rules. Several classic machine learning algorithms, including the k-Nearest Neighbor, Naïve Bayes, C4.5 Decision Tree, and
Support Vector Machine approaches, were applied to these data to identify recognition algorithms suitable for real-time application.
Graphical user interfaces (GUIs) were designed for both MATLAB and LabVIEW environments to facilitate recording and data analysis. Training
data for the machine learning algorithms were recorded while subjects performed each activity, and then these identification approaches
were applied to new data sets with an identification accuracy of around 86%. Early results indicate that a single three-axis accelerometer
is sufficient to identify the occurrence of a given PNFT activity. A custom, embedded acceleration monitoring system employing ZigBee
transmission is under development for future real-time activity recognition studies. A different GUI has been implemented for this system,
which uses an on-line algorithm that will seek to identify activity at a refresh rate of 1 Hz.

This book presents the proceedings of the 24th European Conference on Artificial Intelligence (ECAI 2020), held in Santiago de Compostela,
Spain, from 29 August to 8 September 2020. The conference was postponed from June, and much of it conducted online due to the COVID-19
restrictions. The conference is one of the principal occasions for researchers and practitioners of AI to meet and discuss the latest
trends and challenges in all fields of AI and to demonstrate innovative applications and uses of advanced AI technology. The book also
includes the proceedings of the 10th Conference on Prestigious Applications of Artificial Intelligence (PAIS 2020) held at the same time. A
record number of more than 1,700 submissions was received for ECAI 2020, of which 1,443 were reviewed. Of these, 361 full-papers and 36
highlight papers were accepted (an acceptance rate of 25% for full-papers and 45% for highlight papers). The book is divided into three
sections: ECAI full papers; ECAI highlight papers; and PAIS papers. The topics of these papers cover all aspects of AI, including Agent-
based and Multi-agent Systems; Computational Intelligence; Constraints and Satisfiability; Games and Virtual Environments; Heuristic
Search; Human Aspects in AI; Information Retrieval and Filtering; Knowledge Representation and Reasoning; Machine Learning;
Multidisciplinary Topics and Applications; Natural Language Processing; Planning and Scheduling; Robotics; Safe, Explainable, and
Trustworthy AI; Semantic Technologies; Uncertainty in AI; and Vision. The book will be of interest to all those whose work involves the use
of AI technology.

This book discusses the current trends in and applications of artificial intelligence research in intelligent systems. Including the
proceedings of the Artificial Intelligence Methods in Intelligent Algorithms Section of the 8th Computer Science On-line Conference 2019
(CSOC 2019), held in April 2019, it features papers on neural networks algorithms, optimisation algorithms and real-world issues related to
the application of artificial methods.

With the proliferation of smartphones and fitness bands that have various sensors such as accelerometers, wearable sensor-based Human
Activity Recognition (HAR) systems have gained wide popularity and researchers have proposed numerous techniques for recognition of these
activities. Human activity recognition has many applications particularly in health care, cognitive assistance, city planning, indoor
localization and tracking, and human-computer interaction. Although there has been some progress, a practical robust HAR system remains
effusive because the collected data are affected by several factors such as noise, data alignment, and other constraints. In addition, the
variability in the sensing equipment and their displacement is a practical challenge for implementing HAR in real-world applications. This
dissertation explores the twin problems of making wearable sensor-based HAR systems robust and real time. Towards enhancing the robustness
of ML-based HAR systems, we adopt feature selection methods on time and frequency domain features and apply classifiers for evaluating the
recognition performance. We show the effect of different feature sets on each of the classifiers and further demonstrate in our results the
impact of decreasing the size of the training set on the accuracy of the classifiers. Towards building an Online HAR system, this thesis
explores the concept of Shapelets to avoid complex feature extraction. We propose a procedure to find the most representative shapelet for
each activity class based on time series distance metrics and dynamic time warping. Furthermore, we generate a personalized shapelet
library database driven from users' activity time series. We evaluate the proposed algorithm and techniques using a dataset comprised of
accelerometer readings of 77 individuals performing various activities such as walking/jogging on treadmill, walking on different surfaces,
climbing stairs, and non-ambulatory activities. Our experiments demonstrate that by using selected features from the time and frequency domain, we can achieve higher accuracy rates if we limit the training and testing sets to specific age groups. Furthermore, while we mainly use a single hip-worn accelerometer sensor as our sensing device, we show our method could support any wearable accelerometer sensor.

Learn How to Design and Implement HAR Systems The pervasiveness and range of capabilities of today's mobile devices have enabled a wide spectrum of mobile applications that are transforming our daily lives, from smartphones equipped with GPS to integrated mobile sensors that acquire physiological data. Human Activity Recognition: Using Wearable Sensors and Smartphones focuses on the automatic identification of human activities from pervasive wearable sensors—a crucial component for health monitoring and also applicable to other areas, such as entertainment and tactical operations. Developed from the authors' nearly four years of rigorous research in the field, the book covers the theory, fundamentals, and applications of human activity recognition (HAR). The authors examine how machine learning and pattern recognition tools help determine a user's activity during a certain period of time. They propose two systems for performing HAR: Centinela, an offline server-oriented HAR system, and Vigilante, a completely mobile real-time activity recognition system. The book also provides a practical guide to the development of activity recognition applications in the Android framework.

This book covers the theory, design and applications of computer networks, distributed computing and information systems. Networks of today are going through a rapid evolution, and there are many emerging areas of information networking and their applications. Heterogeneous networking supported by recent technological advances in low-power wireless communications along with silicon integration of various functionalities such as sensing, communications, intelligence and actuations is emerging as a critically important disruptive computer class based on a new platform, networking structure and interface that enable novel, low-cost and high-volume applications. Several of such applications have been difficult to realize because of many interconnections problems. To fulfill their large range of applications, different kinds of networks need to collaborate, and wired and next-generation wireless systems should be integrated in order to develop high-performance computing solutions to problems arising from the complexities of these networks. The aim of the book "Advanced Information Networking and Applications" is to provide latest research findings, innovative research results, methods and development techniques from both theoretical and practical perspectives related to the emerging areas of information networking and applications.

This book constitutes refereed proceedings of the Second International Workshop on Deep Learning for Human Activity Recognition, DL-HAR 2020, held in conjunction with IJCAI-PRICAI 2020, in Kyoto, Japan, in January 2021. Due to the COVID-19 pandemic the workshop was postponed to the year 2021 and held in a virtual format. The 10 presented papers were thoroughly reviewed and included in the volume. They present recent research on applications of human activity recognition for various areas such as healthcare services, smart home applications, and more.

This book presents best selected research papers presented at the International Conference on Computer Networks, Big Data and IoT (ICCBI 2020), organized by Vaigai College Engineering, Madurai, Tamil Nadu, India, during 15-16 December 2020. The book covers original papers on computer networks, network protocols and wireless networks, data communication technologies and network security. The book is a valuable resource and reference for researchers, instructors, students, scientists, engineers, managers and industry practitioners in those important areas.

The second volume of the book series highlights works presented at the 2nd International Conference on Real Time Intelligent Systems, held in Casablanca on October 18-20, 2017. The book offers a comprehensive, practical review of the state-of-the-art in designing and implementing real-time intelligent computing for the areas within the conference's scope such as robotics, intelligent alert systems, IoT, remote access control, multi-agent systems, networking, mobile smart systems, crowdsourcing, broadband systems, cloud computing, streaming data and many other applications. Research in real-time computing supports decision making in dynamic environments. Some examples include ABS, FBW flight control, automatic air-conditioning, etc. Intelligent computing relies heavily on artificial intelligence (AI) to make computers act for humans. The authors are confident that the solutions discussed in this book will provide a unique source of information and inspiration for researchers working in AI, distributed coding algorithms or smart services and platforms, and for IT professionals, who
can integrate the proposed methods into their practice.

Learn How to Design and Implement HAR Systems The pervasiveness and range of capabilities of today’s mobile devices have enabled a wide spectrum of mobile applications that are transforming our daily lives, from smartphones equipped with GPS to integrated mobile sensors that acquire physiological data. Human Activity Recognition: Using Wearable Sensors and Smartphones focuses on the automatic identification of human activities from pervasive wearable sensors—a crucial component for health monitoring and also applicable to other areas, such as entertainment and tactical operations. Developed from the authors’ nearly four years of rigorous research in the field, the book covers the theory, fundamentals, and applications of human activity recognition (HAR). The authors examine how machine learning and pattern recognition tools help determine a user’s activity during a certain period of time. They propose two systems for performing HAR: Centinela, an offline server-oriented HAR system, and Vigilante, a completely mobile real-time activity recognition system. The book also provides a practical guide to the development of activity recognition applications in the Android framework.

This book constitutes the refereed post-conference proceedings of the 4th International Conference on Intelligence Science, ICIS 2020, held in Durgapur, India, in February 2021 (originally November 2020). The 23 full papers and 4 short papers presented were carefully reviewed and selected from 42 submissions. One extended abstract is also included. They deal with key issues in brain cognition; uncertain theory; machine learning; data intelligence; language cognition; vision cognition; perceptual intelligence; intelligent robot; and medical artificial intelligence.

Technological advancements in healthcare can contribute unquestionably in reducing healthcare strains by ensuring clinicians, doctors and other medical staff operate and conduct their daily activities more efficiently in the hospital vicinity. Since the turn of the 21st century, Human Activity Recognition (HAR) has undergone significant research in the healthcare domain. HAR utilised with powerful technologies can benefit remote patient monitoring, the elderly, patients suffering from chronic illness and ambient assisted living. Human activity recognition has shown to be effective in benefiting clinicians in the treatment and remote monitoring of patients. This field is not only vital for diagnosis and treatment, but also an assessment of how likely a medical patient will fall ill or die from certain diseases or health problems. To show the great importance of activity recognition in the health sector, analytically driving an improvement in accuracy in classifying patients' activities improves the relationship of patients and clinicians as well as reducing the possibility of a fatality. With Artificial Intelligence at the forefront of its revolutionary capabilities, a bright future is in store if we can implement it beneficially into our healthcare service. This book reveals how.

Understanding the behavior of groups or crowds in real time can provide valuable information to crowd management systems, helping prevent or avoid human tragedy in crowd emergencies. Wearable devices provide a powerful platform for understanding human behavior, however the infrastructure required to communicate data from these devices is often the first casualty in emergency situations. Peer-to-peer (P2P) methods for recognizing group behavior are therefore necessary, but the behavior of the group cannot be observed at any single location, creating an intriguing problem. This dissertation provides the tools to (1) understand which information is best for behavior recognition, (2) to detect different groups who may be in the same environment, and (3) to recognize the physical behavior or activities of the group, all in a P2P fashion. Furthermore, all of this is done while (4) respecting the limited resources and primary functions of the sensing devices, e.g. wearables and mobile phones. The combined contribution of this dissertation is the knowledge, algorithms and methods necessary for recognition of group behavior using only the wearable devices of its constituents.

The book introduces some challenging methods and solutions to solve the human activity recognition challenge. This book highlights the challenge that will lead the researchers in academia and industry to move further related to human activity recognition and behavior analysis, concentrating on cooking challenge. Current activity recognition systems focus on recognizing either the complex label (macro-activity) or the small steps (micro-activities) but their combined recognition is critical for analysis like the challenge proposed in this book. It has 10 chapters from 13 institutes and 8 countries (Japan, USA, Switzerland, France, Slovenia, China, Bangladesh, and Columbia).
The book reports on the author’s original work to address the use of today’s state-of-the-art smartphones for human physical activity recognition. By exploiting the sensing, computing and communication capabilities currently available in these devices, the author developed a novel smartphone-based activity-recognition system, which takes into consideration all aspects of online human activity recognition, from experimental data collection, to machine learning algorithms and hardware implementation. The book also discusses and describes solutions to some of the challenges that arose during the development of this approach, such as real-time operation, high accuracy, low battery consumption and unobtrusiveness. It clearly shows that it is possible to perform real-time recognition of activities with high accuracy using current smartphone technologies. As well as a detailed description of the methods, this book also provides readers with a comprehensive review of the fundamental concepts in human activity recognition. It also gives an accurate analysis of the most influential works in the field and discusses them in detail. This thesis was supervised by both the Universitat Politècnica de Catalunya (primary institution) and University of Genoa (secondary institution) as part of the Erasmus Mundus Joint Doctorate in Interactive and Cognitive Environments.

The Internet of Things (IoT) networks have revolutionized the world and have innumerable real-time applications on automation. A few examples include driverless cars, remote monitoring of the elderly, remote order of tea or coffee of your choice from a vending machine, and home/industrial automation amongst others. Fundamentals of Internet of Things build the foundations of IoT networks by leveraging the relevant concepts from signal processing, communications, net-works, and machine learning. The book covers two fundamental components of IoT networks, namely, the Internet and Things. In particular, the book focuses on networking concepts, protocols, clustering, data fusion, localization, energy harvesting, control optimization, data analytics, fog computing, privacy, and security including elliptic curve cryptography and blockchain technology. Most of the existing books are theoretical and without many mathematical details and examples. In addition, some essential topics of the IoT networks are also missing in the existing books. Features: • The book covers cutting-edge research topics • Provides mathematical understanding of the topics in addition to relevant theory and insights • Includes illustrations with hand-solved numerical examples for visualization of the theory and testing of understanding • Lucid and crisp explanation to lessen the study time of the reader The book is a complete package of the fundamentals of IoT networks and is suitable for graduate-level students and researchers who want to dive into the world of IoT networks.

Smart mobile systems such as microsystems, smart textiles, smart implants, and sensor-controlled medical devices, together with their related networks, have become important enablers for telemedicine and ubiquitous pervasive health to become next-generation health services. This book presents the proceedings of pHealth 2020, held as a virtual conference from 14 – 16 September 2020. This is the 17th in a series of international conferences on wearable or implantable micro and nano technologies for personalized medicine, which bring together expertise from medical, technological, political, administrative, and social domains, and cover subjects including technological and biomedical facilities, legal, ethical, social, and organizational requirements and impacts, and the research necessary to enable future-proof care paradigms. The 2020 conference also covers AI and robots in healthcare; bio-data management and analytics for personalized health; security, privacy and safety challenges; integrated care; and the intelligent management of specific diseases including the Covid-19 pandemic. Communication and cooperation with national and regional health authorities and the challenges facing health systems in developing countries were also addressed. The book includes 1 keynote, 5 invited talks, 25 oral presentations, and 8 short poster presentations from 99 international authors. All submissions were carefully and critically reviewed by at least two independent experts and at least one member of the Scientific Program Committee; a highly selective review process resulting in a full-paper rejection rate of 36%. The book will be of interest to all those involved in the design and provision of healthcare and also to patients and citizen representatives.

The book first defines the problems, various concepts and notions related to activity recognition, and introduces the fundamental rationale and state-of-the-art methodologies and approaches. It then describes the use of artificial intelligence techniques and advanced knowledge technologies for the modelling and lifecycle analysis of human activities and behaviours based on real-time sensing observations from sensor networks and the Internet of Things. It also covers inference and decision-support methods and mechanisms, as well as
personalization and adaptation techniques, which are required for emerging smart human-machine pervasive systems, such as self-management and assistive technologies in smart healthcare. Each chapter includes theoretical background, technological underpinnings and practical implementation, and step-by-step information on how to address and solve specific problems in topical areas. This monograph can be used as a textbook for postgraduate and PhD students on courses such as computer systems, pervasive computing, data analytics and digital health. It is also a valuable research reference resource for postdoctoral candidates and academics in relevant research and application domains, such as data analytics, smart cities, smart energy, and smart healthcare, to name but a few. Moreover, it offers smart technology and application developers practical insights into the use of activity recognition and behaviour analysis in state-of-the-art cyber-physical systems. Lastly, it provides healthcare solution developers and providers with information about the opportunities and possible innovative solutions for personalized healthcare and stratified medicine.

In the past decade, Human Activity Recognition (HAR) has been an important part of the regular day to day life of many people. Activity recognition has wide applications in the field of health care, remote monitoring of elders, sports, biometric authentication, e-commerce and more. Each HAR application needs a unique approach to provide solutions driven by the context of the problem. In this dissertation, we are primarily discussing two application of HAR in different contexts. First, we design a novel approach for in-home, fine-grained activity recognition using multimodal wearable sensors on multiple body positions, along with very small Bluetooth beacons deployed in the environment. State-of-the-art in-home activity recognition schemes with wearable devices are mostly capable of detecting coarse-grained activities (sitting, standing, walking, or lying down), but cannot distinguish complex activities (sitting on the floor versus on the sofa or bed). Such schemes are not effective for emerging critical healthcare applications for example, in remote monitoring of patients with Alzheimer's disease, Bulimia, or Anorexia because they require a more comprehensive, contextual, and fine-grained recognition of complex daily user activities. Second, we introduced Watch-Dog a self-harm activity recognition engine, which attempts to infer self-harming activities from sensing accelerometer data using wearable sensors worn on a subject's wrist. In the United States, there are more than 35,000 reported suicides with approximately 1,800 of them being psychiatric inpatients every year. Staff perform intermittent or continuous observations in order to prevent such tragedies, but a study of 98 articles over time showed that 20% to 62% of suicides happened while inpatients were on an observation schedule. Reducing the instances of suicides of inpatients is a problem of critical importance to both patients and healthcare providers. Watch-dog uses supervised learning algorithm to model the system which can discriminate the harmful activities from non-harmful activities. The system is not only very accurate but also energy efficient. Apart from these two HAR systems, we also demonstrated the difference in activity pattern between elder and younger age group. For this experiment, we used 5 activities of daily living (ADL). Based on our findings we recommend that a context aware age-specific HAR model would be a better solution than all age-mixed models. Additionally, we find that personalized models for each individual elder person perform better classification than mixed models.

This book presents a collection of comprehensive research articles on data analytics and applications of wearable devices in healthcare. This Special Issue presents 28 research studies from 137 authors representing 37 institutions from 19 countries. To facilitate the understanding of the research articles, we have organized the book to show various aspects covered in this field, such as eHealth, technology-integrated research, prediction models, rehabilitation studies, prototype systems, community health studies, ergonomics design systems, technology acceptance model evaluation studies, telemonitoring systems, warning systems, application of sensors in sports studies, clinical systems, feasibility studies, geographical location based systems, tracking systems, observational studies, risk assessment studies, human activity recognition systems, impact measurement systems, and a systematic review. We would like to take this opportunity to invite high quality research articles for our next Special Issue entitled “Digital Health and Smart Sensors for Better Management of Cancer and Chronic Diseases” as a part of Sensors journal.

This book presents research papers from diverse areas on novel Intelligent Systems and Interactive Systems and Applications. It gathers selected research papers presented at the 2nd International Conference on Intelligent and Interactive Systems and Applications (IISA2017), which was held on June 17–18, 2017 in Beijing, China. Interactive Intelligent Systems (IIS) are systems that interact with human beings, media or virtual agents in intelligent computing environments. The emergence of Big Data and the Internet of Things have now opened new
opportunities in both academic and industrial research for the successful design and development of intelligent interactive systems. This book explores how novel interactive systems can be used to overcome various challenges and limitations previously encountered by human beings by combining machine learning algorithms and the analysis of recent trends. The book presents 125 contributions, which have been categorized into seven sections, namely: i) Autonomous Systems; ii) Pattern Recognition and Vision Systems; iii) E-Enabled Systems; iv) Mobile Computing and Intelligent Networking; v) Internet and Cloud Computing; vi) Intelligent Systems, and vii) Various Applications. It not only offers readers extensive theoretical information on Intelligent and Interactive Systems, but also introduces them to various applications in different domains.

The disciplines of science and engineering rely heavily on the forecasting of prospective constraints for concepts that have not yet been proven to exist, especially in areas such as artificial intelligence. Obtaining quality solutions to the problems presented becomes increasingly difficult due to the number of steps required to sift through the possible solutions, and the ability to solve such problems relies on the recognition of patterns and the categorization of data into specific sets. Predictive modeling and optimization methods allow unknown events to be categorized based on statistics and classifiers input by researchers. The Handbook of Research on Predictive Modeling and Optimization Methods in Science and Engineering is a critical reference source that provides comprehensive information on the use of optimization techniques and predictive models to solve real-life engineering and science problems. Through discussions on techniques such as robust design optimization, water level prediction, and the prediction of human actions, this publication identifies solutions to developing problems and new solutions for existing problems, making this publication a valuable resource for engineers, researchers, graduate students, and other professionals.

This 8-volumes set constitutes the refereed of the 25th International Conference on Pattern Recognition Workshops, ICPR 2020, held virtually in Milan, Italy and rescheduled to January 10 – 11, 2021 due to Covid-19 pandemic. The 416 full papers presented in these 8 volumes were carefully reviewed and selected from about 700 submissions. The 46 workshops cover a wide range of areas including machine learning, pattern analysis, healthcare, human behavior, environment, surveillance, forensics and biometrics, robotics and egovision, cultural heritage and document analysis, retrieval, and women at ICPR2020.

In recent years, many technologies for gait and posture assessments have emerged. Wearable sensors, active and passive in-house monitors, and many combinations thereof all promise to provide accurate measures of physical activity, gait, and posture parameters. Motivated by market projections for wearable technologies and driven by recent technological innovations in wearable sensors (MEMs, electronic textiles, wireless communications, etc.), wearable health/performance research is growing rapidly and has the potential to transform future healthcare from disease treatment to disease prevention. The objective of this Special Issue is to address and disseminate the latest gait, posture, and activity monitoring systems as well as various mathematical models/methods that characterize mobility functions. This Special Issue focuses on wearable monitoring systems and physical sensors, and its mathematical models can be utilized in varied environments under varied conditions to monitor health and performance.

This book presents the latest developments in both qualitative and quantitative computational methods for reliability and statistics, as well as their applications. Consisting of contributions from active researchers and experienced practitioners in the field, it fills the gap between theory and practice and explores new research challenges in reliability and statistical computing. The book consists of 18 chapters. It covers (1) modeling in and methods for reliability computing, with chapters dedicated to predicted reliability modeling, optimal maintenance models, and mechanical reliability and safety analysis; (2) statistical computing methods, including machine learning techniques and deep learning approaches for sentiment analysis and recommendation systems; and (3) applications and case studies, such as modeling innovation paths of European firms, aircraft components, bus safety analysis, performance prediction in textile finishing processes, and movie recommendation systems. Given its scope, the book will appeal to postgraduates, researchers, professors, scientists, and practitioners in a range of fields, including reliability engineering and management, maintenance engineering, quality management, statistics, computer science and engineering, mechanical engineering, business analytics, and data science.
This volume presents the proceedings of the Brazilian Congress on Biomedical Engineering (CBEB 2018). The conference was organised by the Brazilian Society on Biomedical Engineering (SBEB) and held in Armação de Buzios, Rio de Janeiro, Brazil from 21-25 October, 2018. Topics of the proceedings include these 11 tracks: • Bioengineering • Biomaterials, Tissue Engineering and Artificial Organs • Biomechanics and Rehabilitation • Biomedical Devices and Instrumentation • Biomedical Robotics, Assistive Technologies and Health Informatics • Clinical Engineering and Health Technology Assessment • Metrology, Standardization, Testing and Quality in Health • Biomedical Signal and Image Processing • Neural Engineering • Special Topics • Systems and Technologies for Therapy and Diagnosis

This book features a collection of high-quality, peer-reviewed research papers presented at the 8th International Conference on Innovations in Computer Science & Engineering (ICICSE 2020), held at Guru Nanak Institutions, Hyderabad, India, on 28-29 August 2020. It covers the latest research in data science and analytics, cloud computing, machine learning, data mining, big data and analytics, information security and privacy, wireless and sensor networks and IoT applications, artificial intelligence, expert systems, natural language processing, image processing, computer vision and artificial neural networks.

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