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Human Activity Recognition

Using Wearable Sensors
and Smartphones

Miguel A. Labrador
Oscar D. Lara Yejas

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Human Activity Recognition Using Wearable Sensors And Smartphones Chapman Hallcrc Computer And Information Science Series

Daniel F McAuley



Human Activity Recognition Using Wearable Sensors And Smartphones Chapman Hallcrc Computer And Information Science Series:

Human Activity Recognition Miguel A. Labrador, Oscar D. Lara Yejas, 2013-12-05 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 **Multicore Computing** Sanguthevar Rajasekaran, Lance Fiondella, Mohamed Ahmed, Reda A. Ammar, 2013-12-12 Every area of science and engineering today has to process voluminous data sets Using exact or even approximate algorithms to solve intractable problems in critical areas such as computational biology takes time that is exponential in some of the underlying parameters Parallel computing addresses this issue and has become affordable with the Plan, Activity, and Intent Recognition Gita Sukthankar, Christopher Geib, Hung Hai Bui, David Pynadath, Robert P. Goldman, 2014-03-03 Plan recognition activity recognition and intent recognition together combine and unify techniques from user modeling machine vision intelligent user interfaces human computer interaction autonomous and multi agent systems natural language understanding and machine learning Plan Activity and Intent Recognition explains the crucial role of these techniques in a wide variety of applications including personal agent assistants computer and network security opponent modeling in games and simulation systems coordination in robots and software agents web e commerce and collaborative filtering dialog modeling video surveillance smart homes In this book follow the history of this research area and witness exciting new developments in the field made possible by improved sensors increased computational power and new application areas Combines basic theory on algorithms for plan activity recognition along with results from recent workshops and seminars Explains how to interpret and recognize plans and activities from sensor data Provides valuable background knowledge and assembles key concepts into one guide for researchers or students studying these disciplines **Smartphone-Based Human Activity Recognition** Jorge Luis Reyes Ortiz, 2015-01-14 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.

Human Activity Sensing Nobuo Kawaguchi, Nobuhiko Nishio, Daniel Roggen, Sozo Inoue, Susanna Pirttikangas, Kristof Van Laerhoven, 2019-09-09. Activity recognition has emerged as a challenging and high impact research field as over the past years smaller and more powerful sensors have been introduced in wide spread consumer devices. Validation of techniques and algorithms requires large scale human activity corpuses and improved methods to recognize activities and the contexts in which they occur. This book deals with the challenges of designing valid and reproducible experiments, running large scale dataset collection campaigns, designing activity and context recognition methods that are robust and adaptive, and evaluating activity recognition systems in the real world with real users.

Human Activity Recognition Using Smartphone's Sensors and Machine Learning Enrique Alejandro García Ceja, 2012. **Towards Robust & Realtime Human Activity Recognition Using Wearable Sensors** Delaram Yazdansepa, 2017. 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 elusive 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

Sensor-Based Human Activity Recognition for Assistive Health Technologies Muhammad Adeel Nisar,2023-02-20

The average age of people has increased due to advances in health sciences which has led to an increase in the elderly population This is positive news but it also raises questions about the quality of independent living for older people Clinicians use Activities of Daily Living ADLs to assess older people s ability to live independently In recent years portable computing devices have become more present in our daily lives Therefore a software system that can detect ADLs based on sensor data collected from wearable devices is beneficial for detecting health problems and supporting health care In this context this book presents several machine learning based approaches for human activity recognition HAR using time series data collected by wearable sensors in the home environment In the first part of the book machine learning based approaches for atomic activity recognition are presented which are relatively simple and short term activities In the second part the algorithms for detecting long term and complex ADLs are presented In this part a two stage recognition framework is also presented as well as an online recognition system for continuous monitoring of HAR In the third and final part a novel approach is proposed that not only solves the problem of data scarcity but also improves the performance of HAR by implementing multitask learning based methods The proposed approach simultaneously trains the models of short and long term activities regardless of their temporal scale The results show that the proposed approach improves classification performance compared to single task learning

Human Activity Recognition and Behaviour Analysis Liming Chen,Chris D. Nugent,2019-06-11

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

Human Activity and Behavior Analysis Md Atiqur Rahman Ahad, Sozo Inoue, Guillaume Lopez, Tahera Hossain, 2024-04-29 Human Activity and Behavior Analysis relates to the field of vision and sensor based human action or activity and behavior analysis and recognition The book includes a series of methodologies surveys relevant datasets challenging applications ideas and future prospects The book discusses topics such as action recognition action understanding gait analysis gesture recognition behavior analysis emotion and affective computing and related areas This volume focuses on relevant activities in three main subject areas Healthcare and Emotion Mental Health and Nurse Care Records The editors are experts in these arenas and the contributing authors are drawn from high impact research groups around the world This book will be of great interest to academics students and professionals working and researching in the field of human activity and behavior analysis

Human Activity Recognition with Wearable Sensors Tâm Huynh, 2008
Human Activity Recognition Using Wearable Sensors Jamie O'Halloran, 2020-04-04 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

Vision-Based Human Activity Recognition Zhongxu Hu, Chen Lv, 2022-04-22 This book offers a systematic comprehensive and timely review on V HAR and it covers the related tasks cutting edge technologies and applications of V HAR especially the deep learning based approaches The field of Human Activity Recognition HAR has become one of the trendiest research topics due to the availability of various sensors live streaming of data and the advancement in computer

vision machine learning etc HAR can be extensively used in many scenarios for example medical diagnosis video surveillance public governance also in human machine interaction applications In HAR various human activities such as walking running sitting sleeping standing showering cooking driving abnormal activities etc are recognized The data can be collected from wearable sensors or accelerometer or through video frames or images among all the sensors vision based sensors are now the most widely used sensors due to their low cost high quality and unintrusive characteristics Therefore vision based human activity recognition V HAR is the most important and commonly used category among all HAR technologies The addressed topics include hand gestures head pose body activity eye gaze attention modeling etc The latest advancements and the commonly used benchmark are given Furthermore this book also discusses the future directions and recommendations for the new researchers

Human Activity Recognition and Anomaly Detection Kuan-Chuan Peng, Yizhou Wang, Ziyue Li, Zhenghua Chen, Jianfei Yang, Sungho Suh, Min Wu, 2024-11-16 This book constitutes the refereed proceedings of the 4th International and First International Workshop on Human Activity Recognition and Anomaly Detection Conjunction with IJCAI 2024 held in Jeju South Korea during August 3 9 2024 The 9 full papers included in this book were carefully reviewed and selected from 14 submissions They were organized in topical sections as follows Anomaly Detection with Foundation Models and Deep Learning for Human Activity Recognition Human Activity Recognition Using Smartphone Accelerometer and Machine Learning Mira Kamali, 2017 *Wearable Computing* Giancarlo Fortino, Raffaele Gravina, Stefano Galzarano, 2018-04-06 This book provides the most up to date research and development on wearable computing wireless body sensor networks wearable systems integrated with mobile computing wireless networking and cloud computing This book has a specific focus on advanced methods for programming Body Sensor Networks BSNs based on the reference SPINE project It features an on line website <http://spine.deis.unical.it> to support readers in developing their own BSN application systems and covers new emerging topics on BSNs such as collaborative BSNs BSN design methods autonomic BSNs integration of BSNs and pervasive environments and integration of BSNs with cloud computing The book provides a description of real BSN prototypes with the possibility to see on line demos and download the software to test them on specific sensor platforms and includes case studies for more practical applications Provides a future roadmap by learning advanced technology and open research issues Gathers the background knowledge to tackle key problems for which solutions will enhance the evolution of next generation wearable systems References the SPINE web site <http://spine.deis.unical.it> that accompanies the text Includes SPINE case studies and span topics like human activity recognition rehabilitation of elbow knee handshake detection emotion recognition systems Wearable Systems and Body Sensor Networks from modeling to implementation is a great reference for systems architects practitioners and product developers Giancarlo Fortino is currently an Associate Professor of Computer Engineering since 2006 at the Department of Electronics Informatics and Systems DEIS of the University of Calabria Unical Rende CS Italy He was recently nominated Guest Professor in

Computer Engineering of Wuhan University of Technology on April 18 2012 the term of appointment is three years His research interests include distributed computing and networks wireless sensor networks wireless body sensor networks agent systems agent oriented software engineering streaming content distribution networks distributed multimedia systems GRID computing Raffaele Gravina received the B Sc and M S degrees both in computer engineering from the University of Calabria Rende Italy in 2004 and 2007 respectively Here he also received the Ph D degree in computer engineering He s now a Postdoctoral research fellow at University of Calabria His research interests are focused on high level programming methods for WSNs specifically Wireless Body Sensor Networks He wrote almost 30 scientific technical articles in the area of the proposed Book He is co founder of SenSysCal S r l a spin off company of the University of Calabria and CTO of the wearable computing area of the company Stefano Galzarano received the B S and M S degrees both in computer engineering from the University of Calabria Rende Italy in 2006 and 2009 respectively He is currently pursuing a joint Ph D degree in computer engineering with University of Calabria and Technical University of Eindhoven The Netherlands His research interests are focused on high level programming methods for wireless sensor networks and specifically novel methods and frameworks for autonomic wireless body sensor networks **Activity Recognition in Pervasive Intelligent**

Environments Liming Chen,Chris D. Nugent,Jit Biswas,Jesse Hoey,2011-05-04 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 *Advances in Human Activity Detection and Recognition (HADR)*

Systems Santosh Kumar Tripathy,Roshan Singh,Rajeev Srivastava,Akash Kumar Bhoi,Santosh Kumar Satapathy,2024-03-08 This book provides a comprehensive overview of Human Activity Detection or Recognition HADR systems Detection or recognition of human activities is a prominent research area in the fields of computer vision and artificial intelligence because of its many applications in daily life including monitoring in public transport areas health monitoring anomaly

detection in traffic and smart homes This book divides different activities according to their criticality then discusses the various motivations and challenges that are involved in HADR systems The authors then propose a framework for activity detection or recognition The book also covers ten key applications of HADR systems and the recent developments for each of them The authors also propose areas for future research

Human Activity and Behavior Analysis Md Atiqur Rahman Ahad, Sozo Inoue, Guillaume Lopez, Tahera Hossain, 2024-04-29 Human Activity and Behavior Analysis relates to the field of vision and sensor based human action or activity and behavior analysis and recognition The book includes a series of methodologies surveys relevant datasets challenging applications ideas and future prospects The book discusses topics such as action recognition action understanding gait analysis gesture recognition behavior analysis emotion and affective computing and related areas This volume focuses on two main subject areas Movement and Sensors and Sports Activity Analysis The editors are experts in these arenas and the contributing authors are drawn from high impact research groups around the world This book will be of great interest to academics students and professionals working and researching in the field of human activity and behavior analysis

Wearable Sensors Edward Sazonov, 2014-08-14 Written by industry experts this book aims to provide you with an understanding of how to design and work with wearable sensors Together these insights provide the first single source of information on wearable sensors that would be a valuable addition to the library of any engineer interested in this field Wearable Sensors covers a wide variety of topics associated with the development and application of various wearable sensors It also provides an overview and coherent summary of many aspects of current wearable sensor technology Both industry professionals and academic researchers will benefit from this comprehensive reference which contains the most up to date information on the advancement of lightweight hardware energy harvesting signal processing and wireless communications and networks Practical problems with smart fabrics biomonitoring and health informatics are all addressed plus end user centric design ethical and safety issues Provides the first comprehensive resource of all currently used wearable devices in an accessible and structured manner Helps engineers manufacture wearable devices with information on current technologies with a focus on end user needs and recycling requirements Combines the expertise of professionals and academics in one practical and applied source

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