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This book provides a unique view of human activity recognition, especially fine-grained human activity structure learning, human-interaction recognition, RGB-D data based action recognition, temporal decomposition, and causality learning in unconstrained human activity videos. The techniques discussed give readers tools that provide a significant improvement over existing methodologies of video content understanding by taking advantage of activity recognition. It links multiple popular research fields in computer vision, machine learning, human-centered computing, human-computer interaction, image classification, and pattern recognition. In addition, the book includes several key chapters covering multiple emerging topics in the field. Contributed by top experts and practitioners, the chapters present key topics from different angles and blend both methodology and application, composing a solid overview of the human activity recognition techniques. 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 thorougly 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. There are many problems that exist within the relatively new field of action recognition that make it difficult for the immediate use of existing models for specific applications. My work at the MIT-IBM Watson lab revolved around utilizing existing assets and optimizing performance for achieving action detection in construction-centric videos. There were several pretrained general action recognition models at our disposal, each one with its own limitations. In addition to fine-tuning, there are other computer vision methods and processing techniques that were explored for performance optimization including background subtraction, optical flow, and frame selection algorithms. Though raw accuracy

score gains through adopting these modalities were marginal, other improvements like faster training time and the potential for faster prediction time were observed. The process of building this experimental pipeline and the results obtained offered insight into what was feasible and effective with current technology in this unique problem space. This includes proof of concept with regards to a real-time action detection tool as well as potential modifications to optimize the tool's performance in this context. This book constitutes the thoroughly refereed post-workshop proceedings of the Fourth IAPR TC9 Workshop on Pattern Recognition of Social Signals in Human-Computer-Interaction, MPRSS 2016, held in Cancun, Mexico, in December 2016. The 13 revised papers presented focus on pattern recognition, machine learning and information fusion methods with applications in social signal processing, including multimodal emotion recognition, user identification, and recognition of human activities. This book offer clear descriptions of the basic structure for the recognition and classification of human activities using different types of sensor module and smart devices in e.g. healthcare, education, monitoring the elderly, daily human behavior, and fitness monitoring. In addition, the complexities, challenges, and design issues involved in data collection, processing, and other fundamental stages along with datasets, methods, etc., are discussed in detail. The book offers a valuable resource for readers in the fields of pattern recognition, human–computer interaction, and the Internet of Things. 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). Human action analysis and recognition is a relatively mature field, yet one which is often not well understood by students and researchers. The large number of possible variations in human motion and appearance, camera viewpoint, and environment, present considerable challenges. Some important and common problems remain unsolved by the computer vision community. However, many valuable approaches have been proposed over the past decade, including the motion history image (MHI) method. This method has received significant attention, as it offers greater robustness and performance than other techniques. This work presents a comprehensive review of these state-of-the-art approaches and their applications, with a particular focus on the MHI method and its variants. 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. This book constitutes refereed proceedings of the 27th International Workshop Frontiers of Computer Vision, IW-FCV 2021, held in Daegu, South Korea, in February 2021. The 17 full papers and 8 short papers presented were thoroughly reviewed and selected from 44 submissions. The papers in the volume are organized according to the following topics: real-world applications; segmentation / object tracking; recognition; human behaviour; algorithm / application. Humans are social beings that interact with others in their surroundings. In a public space, for example on a train platform, one can observe the wide array of social actions humans express in their daily lives. There are for instance people hugging each other, waving to one another or shaking hands. A large part of our social behavior consists of carrying out such social actions and the recognition of those actions facilitates our interactions with other people. Therefore, action recognition has become more and more popular as a research topic over the years. Actions do not only appear at our point of fixation but also in the peripheral visual field. The current Ph.D. thesis aims at understanding action recognition in the human central and peripheral vision. To this end, action recognition processes have been investigated under more naturalistic conditions than has been done so far. This thesis extends the knowledge about action recognition processes into more realistic scenarios and the far visual periphery. In four studies, life size action stimuli were used (I) to examine the action categorization abilities of central and peripheral vision, (II) to investigate the viewpoint-dependency of peripheral action representations, (III) to behaviorally measure the perceptive field sizes of action sensitive channels and (IV) to investigate the influence of additional actors in the visual scene on action recognition processes. The main results of the different studies can be summarized as follows. In Study I a high categorization performance for social actions throughout the visual field with a nonlinear performance decline towards the visual periphery was shown. Study II revealed a viewpoint-dependence of action recognition only in far visual periphery. In Study III large perceptive fields for action recognition were measured that decrease in size towards the periphery. And in Study IV no influence of a surrounding crowd of people on the recognition of actions in central vision and the visual periphery was shown. In sum, this thesis provides evidence

that the abilities of peripheral vision have been underestimated and that peripheral vision might play a more important role in daily life than merely triggering gaze saccades to events in our environment. Human action analysis and recognition is a relatively mature field, yet one which is often not well understood by students and researchers. The large number of possible variations in human motion and appearance, camera viewpoint, and environment, present considerable challenges. Some important and common problems remain unsolved by the computer vision community. However, many valuable approaches have been proposed over the past decade, including the motion history image (MHI) method. This method has received significant attention, as it offers greater robustness and performance than other techniques. This work presents a comprehensive review of these state-of-the-art approaches and their applications, with a particular focus on the MHI method and its variants. This book comprises the proceedings of the International Conference on Machine Vision and Augmented Intelligence (MAI 2021) held at IIIT, Jabalpur, in February 2021. The conference proceedings encapsulate the best deliberations held during the conference. The diversity of participants in the event from academia, industry, and research reflects in the articles appearing in the volume. The book theme encompasses all industrial and non-industrial applications in which a combination of hardware and software provides operational guidance to devices in the execution of their functions based on the capture and processing of images. This book covers a wide range of topics such as modeling of disease transformation, epidemic forecast, COVID-19, image processing and computer vision, augmented intelligence, soft computing, deep learning, image reconstruction, artificial intelligence in healthcare, brain-computer interface, cybersecurity, and social network analysis, natural language processing, etc. Deep learning algorithms have brought a revolution to the computer vision community by introducing non-traditional and efficient solutions to several image-related problems that had long remained unsolved or partially addressed. This book presents a collection of eleven chapters where each individual chapter explains the deep learning principles of a specific topic, introduces reviews of up-to-date techniques, and presents research findings to the computer vision community. The book covers a broad scope of topics in deep learning concepts and applications such as accelerating the convolutional neural network inference on field-programmable gate arrays, fire detection in surveillance applications, face recognition, action and activity recognition, semantic segmentation for autonomous driving, aerial imagery registration, robot vision, tumor detection, and skin lesion segmentation as well as skin melanoma classification. The content of this book has been organized such that each chapter can be read independently from the others. The book is a valuable companion for researchers, for postgraduate and possibly senior undergraduate students who are taking an advanced course in related topics, and for those who are interested in deep learning with applications in computer vision, image processing, and pattern recognition. User care at home is a matter of great concern since unforeseen circumstances might occur that affect people's well-being. Technologies that assist people in independent

living are essential for enhancing care in a cost-effective and reliable manner. Assisted care applications often demand real-time observation of the environment and the residents activities using an event-driven system. As an emerging area of research and development, it is necessary to explore the approaches of the user care system in the literature to identify current practices for future research directions. Therefore, this book is aimed at a comprehensive review of data sources (e.g., sensors) with machine learning for various smart user care systems. To encourage the readers in the field, insights of practical essence of different machine learning algorithms with sensor data (e.g., publicly available datasets) are also discussed. Some code segments are also included to motivate the researchers of the related fields to practically implement the features and machine learning techniques. It is an effort to obtain knowledge of different types of sensor-based user monitoring technologies in-home environments. With the aim of adopting these technologies, research works, and their outcomes are reported. Besides, up to date references are included for the user monitoring technologies with the aim of facilitating independent living. Research that is related to the use of user monitoring technologies in assisted living is very widespread, but it is still consists mostly of limited-scale studies. Hence, user monitoring technology is a very promising field, especially for long-term care. However, monitoring of the users for smart assisted technologies should be taken to the next level with more detailed studies that evaluate and demonstrate their potential to contribute to prolonging the independent living of people. The target of this book is to contribute towards that direction. This book provides a unique view of human activity recognition, especially fine-grained human activity structure learning, human-interaction recognition, RGB-D data based action recognition, temporal decomposition, and causality learning in unconstrained human activity videos. The techniques discussed give readers tools that provide a significant improvement over existing methodologies of video content understanding by taking advantage of activity recognition. It links multiple popular research fields in computer vision, machine learning, human-centered computing, human-computer interaction, image classification, and pattern recognition. In addition, the book includes several key chapters covering multiple emerging topics in the field. Contributed by top experts and practitioners, the chapters present key topics from different angles and blend both methodology and application, composing a solid overview of the human activity recognition techniques. Action recognition technology has many real-world applications in human-computer interaction, surveillance, video retrieval, retirement home monitoring, and robotics. The commoditization of depth sensors has also opened up further applications that were not feasible before. This text focuses on feature representation and machine learning algorithms for action recognition from depth sensors. After presenting a comprehensive overview of the state of the art, the authors then provide in-depth descriptions of their recently developed feature representations and machine learning techniques, including lower-level depth and skeleton features, higher-level representations to model the temporal structure and human-object interactions, and feature selection techniques for

occlusion handling. This work enables the reader to quickly familiarize themselves with the latest research, and to gain a deeper understanding of recently developed techniques. It will be of great use for both researchers and practitioners. The book focuses on new theoretical results and techniques in the field of intelligent systems and control. It provides in-depth studies on a number of major topics such as Multi-Agent Systems, Complex Networks, Intelligent Robots, Complex System Theory and Swarm Behavior, Event-Triggered Control and Data-Driven Control, Robust and Adaptive Control, Big Data and Brain Science, Process Control, Intelligent Sensor and Detection Technology, Deep learning and Learning Control Guidance, Navigation and Control of Flight Vehicles and so on. Given its scope, the book will benefit all researchers, engineers, and graduate students who want to learn about cutting-edge advances in intelligent systems, intelligent control, and artificial intelligence. This book constitutes the refereed proceedings of the 11th International Conference on Computer Vision Systems, ICVS 2017, held in Shenzhen, China, in July 2017. The 61 papers presented were carefully reviewed and selected from 92 submissions. The papers are organized in topical sections on visual control, visual navigation, visual inspection, image processing, human robot interaction, stereo system, image retrieval, visual detection, visual recognition, system design, and 3D vision / fusion. Research Paper (postgraduate) from the year 2018 in the subject Computer Science - Internet, New Technologies, , course: Machine Learning, language: English, abstract: Human Action Recognition is the task of recognizing a set of actions being performed in a video sequence. Reliably and efficiently detecting and identifying actions in video could have vast impacts in the surveillance, security, healthcare and entertainment spaces. The problem addressed in this paper is to explore different engineered spatial and temporal image and video features (and combinations thereof) for the purposes of Human Action Recognition, as well as explore different Deep Learning architectures for non-engineered features (and classification) that may be used in tandem with the handcrafted features. Further, comparisons between the different combinations of features will be made and the best, most discriminative feature set will be identified. In the paper, the development and implementation of a robust framework for Human Action Recognition was proposed. The motivation behind the proposed research is, firstly, the high effectiveness of gradient-based features as descriptors - such as HOG, HOF, and N-Jets - for video-based human action recognition. They are capable of capturing both the salient spatial and temporal information in the video sequences, while removing much of the redundant information that is not pertinent to the action. Combining these features in a hierarchical fashion further increases performance. This book contains the papers presented at the 20th UK Workshop on Computational Intelligence (UKCI 2021), held virtually by Aberystwyth University, 8–10th September 2021. This marks the 20th anniversary of UKCI; a testament to the increasing role and importance of Computational Intelligence (CI) and the continuing interest in its development. UKCI provides a forum for the academic community and industry to share ideas and experience in this field. EDMA 2021, the 4th

International Engineering Data- and Model-Driven Applications workshop, is also incorporated and held in conjunction with UKCI 2021. Paper submissions were invited in the areas of fuzzy systems, neural networks, evolutionary computation, machine learning, data mining, cognitive computing, intelligent robotics, hybrid methods, deep learning and applications of CI. This proceedings focus on selected aspects of recent advances and experiences, emerging technology trends that have positively impacted our world from operators, authorities and associations from around the world to help address the world's computing, control and industrial engineering. Meanwhile, although the group that studies Computing, Control and Industrial Engineering is very large, the topics included into this proceedings have the extremely high research value. The program chair, speakers, and editors of this conference are well-known person in the industry, and CCIE2021 will also strictly select articles when calling for papers. Human action analyses and recognition are challenging problems due to large variations in human motion and appearance, camera viewpoint and environment settings. The field of action and activity representation and recognition is relatively old, yet not well-understood by the students and research community. Some important but common motion recognition problems are even now unsolved properly by the computer vision community. However, in the last decade, a number of good approaches are proposed and evaluated subsequently by many researchers. Among those methods, some methods get significant attention from many researchers in the computer vision field due to their better robustness and performance. This book will cover gap of information and materials on comprehensive outlook – through various strategies from the scratch to the state-of-the-art on computer vision regarding action recognition approaches. This book will target the students and researchers who have knowledge on image processing at a basic level and would like to explore more on this area and do research. The step by step methodologies will encourage one to move forward for a comprehensive knowledge on computer vision for recognizing various human actions. 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. Action recognition technology has many real-world applications in human-computer interaction, surveillance, video retrieval, retirement home monitoring, and robotics. The commoditization of depth sensors has also opened up further applications that were not feasible before. This text focuses on feature representation and machine learning algorithms for action recognition from depth sensors. After presenting a comprehensive overview of the state of the art, the authors then provide in-depth descriptions of their recently developed feature representations and machine

learning techniques, including lower-level depth and skeleton features, higher-level representations to model the temporal structure and human-object interactions, and feature selection techniques for occlusion handling. This work enables the reader to quickly familiarize themselves with the latest research, and to gain a deeper understanding of recently developed techniques. It will be of great use for both researchers and practitioners. Recurrent Neural Network (RNN) is a great tool to do video action recognition. This book built an RNN (Recurrent Neural Network) with an LSTM (Long-Short Term Memory) layer and a fully connected layer to do video action recognition; the RNN was trained and evaluated with VGG16 Features that were saved in .mat files; the features were extracted from images with a modified pretrained VGG16 network; the images were converted from videos in the UCF101 dataset, which has 101 different actions including 13,320 videos; the dataset was developed by researchers from the University of Central Florida; please notice that only the first 15 actions rather than the whole 101 actions in this dataset were used to do the recognition; the codes were implemented step by step with Python in Jupyter Notebook, and they could be executed on both CPUs and GPUs; free GPUs on Google Colaboratory were used as hardware accelerator to do most of the calculations; for the purpose of getting a higher testing accuracy, the architecture of the network was regulated, and parameters of the network and its optimizer were fine-tuned; for comparison purpose only, an SVM (Support Vector Machines) classifier was trained and tested. For the first 15 actions in the UCF101 dataset, the highest testing accuracy from the RNN is 86.97%, which is a little higher than that from the SVM classifier (86.09%). In conclusion, the performances of the RNN and the SVM classifier are approximately the same for the task in this book, which is a little embarrassed. However, RNN does have its own advantages in many other cases in the fields of Computer Vision and Machine Learning, and the implementation in this book can be an introduction to this topic in order to throw out a minnow to catch a whale. Human Action Recognition is a challenging area presently. The vigor of research effort directed towards this domain is self indicative of this. With the ever-increasing involvement of Computational Intelligence in our day to day applications, the necessity of human activity recognition has been able to make its presence felt to the concerned research community. The primary drive of such an effort is to equip the computing system capable of recognizing and interpreting human activities from posture, pose, gesture, facial expression etc. The intent of human activity recognition is a formidable component of cognitive science in which researchers are actively engaged of late. Features: A systematic overview of the state-of-the-art in computational intelligence techniques for human action recognition. Emphasized on different intelligent techniques to recognize different human actions. Discussed about the automation techniques to handle human action recognition. Recent research results and some pointers to future advancements in this arena. In the present endeavour the editors intend to come out with a compilation that reflects the concerns of relevant research community. The readers would be able to come across some of the latest findings of active researchers of the concerned

field. It is anticipated that this treatise shall be useful to the readership encompassing students at undergraduate and postgraduate level, researchers active as well as aspiring, not to speak of the senior researchers. This book constitutes the refereed proceedings of the 17th Iberoamerican Congress on Pattern Recognition, CIARP 2012, held in Buenos Aires, Argentina, in September 2012. The 109 papers presented, among them two tutorials and four keynotes, were carefully reviewed and selected from various submissions. The papers are organized in topical sections on face and iris: detection and recognition; clustering; fuzzy methods; human actions and gestures; graphs; image processing and analysis; shape and texture; learning, mining and neural networks; medical images; robotics, stereo vision and real time; remote sensing; signal processing; speech and handwriting analysis; statistical pattern recognition; theoretical pattern recognition; and video analysis. This book is a truly comprehensive, timely, and very much needed treatise on the conceptualization of analysis, and design of contactless & multimodal sensor-based human activities, behavior understanding & intervention. From an interaction design perspective, the book provides views and methods that allow for more safe, trustworthy, efficient, and more natural interaction with technology that will be embedded in our daily living environments. The chapters in this book cover sufficient grounds and depth in related challenges and advances in sensing, signal processing, computer vision, and mathematical modeling. It covers multi-domain applications, including surveillance and elderly care that will be an asset to entry-level and practicing engineers and scientists.(See inside for the reviews from top experts) In this work, an intelligent human-machine interface (HMI) for human worker activity recognition in industrial environments is presented. The interface consists of components for robust and accurate 3D position estimation in workspace environments, the recognition of task-related worker activities and human-computer interaction via gestures. All components of the presented HMI are flexible with respect to applications and can be transferred to other activity recognition problems, as well. Human action analyses and recognition are challenging problems due to large variations in human motion and appearance, camera viewpoint and environment settings. The field of action and activity representation and recognition is relatively old, yet not well-understood by the students and research community. Some important but common motion recognition problems are even now unsolved properly by the computer vision community. However, in the last decade, a number of good approaches are proposed and evaluated subsequently by many researchers. Among those methods, some methods get significant attention from many researchers in the computer vision field due to their better robustness and performance. This book will cover gap of information and materials on comprehensive outlook – through various strategies from the scratch to the state-of-the-art on computer vision regarding action recognition approaches. This book will target the students and researchers who have knowledge on image processing at a basic level and would like to explore more on this area and do research. The step by step methodologies will encourage one to move forward for a comprehensive

knowledge on computer vision for recognizing various human actions. Focusing on the vision-based and sensor-based recognition and analysis of human activity and behavior, this book gathers extended versions of selected papers presented at the International Conference on Activity and Behavior Computing (ABC 2020), held in Kitakyushu, Japan on August 26 – 29, 2020. The respective chapters cover action recognition, action understanding, gait analysis, gesture recognition, behavior analysis, emotion and affective computing, and related areas. The book addresses various challenges and aspects of human activity recognition in both the sensor-based and vision-based domains, making it a unique guide to the field. It is almost impossible to imagine life today without the electronics, communications and networks we have all come to take for granted. The 6G network is currently under development and some chips able to operate at the Terahertz (THz) scale have already been introduced, so the next decade will probably see the consolidation of 6G-based technology, as well as many compliant devices. This book presents the proceedings of the 11th International Conference on Electronics, Communications and Networks (CECNet 2021), initially planned to be held from 18-21 November 2021 in Beijing, China, but ultimately held as an online event due to ongoing COVID-19 restrictions. The CECNet series is now an established annual event attracting participants in the interrelated fields of electronics, computers, communications and wireless communications engineering and technology from around the world. Careful review by program committee members, who took into consideration the breadth and depth of those research topics that fall within the scope of CECNet, resulted in the selection of the 88 papers presented here from the 325 submissions received. This represents an acceptance rate of around 27%. Providing an overview of current research and developments in these rapidly evolving fields, the book will be of interest to all those working with digital communications networks. * Updated in August, 2019 with color printing! * Research fields: Computer Vision and Machine Learning. * Book Topic: Action recognition from videos. * Recognition Tool: Recurrent Neural Network (RNN) with LSTM (Long-Short Term Memory) layer and fully connected layer. * Programming Language: Step-by-step implementation with Python in Jupyter Notebook. * Major Steps: Building a network, training the network, testing the network, comparing the network with an SVM (Support Vector Machines) classifier. * Processing Units to Execute the Codes: CPU and GPU (on Google Colaboratory). * Image Feature Extraction Tool: Pretrained VGG16 network. * Dataset: UCF101 (the first 15 actions, 2010 videos). * Main Results: For the testing data, the highest prediction accuracy from the RNN is 86.97%, which is a little higher than that from the SVM classifier (86.09%). * Detailed Description: Recurrent Neural Network (RNN) is a great tool to do video action recognition. This book built an RNN with an LSTM (Long-Short Term Memory) layer and a fully connected layer to do video action recognition. The RNN was trained and evaluated with VGG16 Features that were saved in .mat files; the features were extracted from images with a modified pretrained VGG16 network; the images were converted from videos in the UCF101

dataset, which has 101 different actions including 13,320 videos; please notice that only the first 15 actions in this dataset were used to do the recognition. The codes were implemented step-by-step with Python in Jupyter Notebook, and they could be executed on both CPUs and GPUs; free GPUs on Google Colaboratory were used as hardware accelerator to do most of the calculations. For the purpose of getting a higher testing accuracy, the architecture of the network was regulated, and parameters of the network and its optimizer were fine-tuned. For comparison purpose only, an SVM (Support Vector Machines) classifier was trained and tested. For the first 15 actions in the UCF101 dataset, the highest prediction accuracy of the testing data from the RNN is 86.97%, which is a little higher than that from the SVM classifier (86.09%). In conclusion, the performances of the RNN and the SVM classifier are approximately the same for the task in this book, which is a little embarrassed. However, RNN does have its own advantages in many other cases in the fields of Computer Vision and Machine Learning, and the implementation in this book can be an introduction to this topic in order to throw out a minnow to catch a whale. 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 two-volume set LNCS 11662 and 11663 constitutes the refereed proceedings of the 16th International Conference on Image Analysis and Recognition, ICIAR 2019, held in Waterloo, ON, Canada, in August 2019. The 58 full papers presented together with 24 short and 2 poster papers were carefully reviewed and selected from 142 submissions. The papers are organized in the following topical sections: Image Processing; Image Analysis; Signal Processing Techniques for Ultrasound Tissue Characterization and Imaging in Complex Biological Media; Advances in Deep Learning; Deep Learning on the Edge; Recognition; Applications; Medical Imaging and Analysis Using Deep Learning and Machine Intelligence; Image Analysis and Recognition for Automotive Industry; Adaptive Methods for Ultrasound Beamforming and Motion Estimation. The classification of human action or behavior patterns is very important for analyzing situations in the field and maintaining social safety. This book focuses on recent research findings on

recognizing human action patterns. Technology for the recognition of human action pattern includes the processing technology of human behavior data for learning, technology of expressing feature values ??of images, technology of extracting spatiotemporal information of images, technology of recognizing human posture, and technology of gesture recognition. Research on these technologies has recently been conducted using general deep learning network modeling of artificial intelligence technology, and excellent research results have been included in this edition. This work proposes a real-time markerless strategy to track human full-body movements for a pseudo 3D motion reconstruction using a single standard camera, at a low computational cost. This method allows a continuous depth warping of the tracked body parts based on pose recognition, and obtains realistic reconstructions when the considered actions are already known. A strategy to recognize combined actions, based on proper database storage of human motion patterns and poses, is also described. Experimental results show that taking advantage of the reconstructed poses it can be easily adapted to the different anthropometries of users without changing the known databases. This strategy allows more complex interactions between the subject and computer in human-computer interaction applications, as motor actions can easily be recognized in a wider set of poses, than those offered by holistic procedures.