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# Distributed Computing and Monitoring Technologies for Older Patients



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ISSN 2191-5768 ISSN 2191-5776 (electronic)  
SpringerBriefs in Computer Science  
ISBN 978-3-319-27023-4 ISBN 978-3-319-27024-1 (eBook)  
DOI 10.1007/978-3-319-27024-1

Library of Congress Control Number: 2015960745

Springer Cham Heidelberg New York Dordrecht London  
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Printed on acid-free paper

Springer International Publishing AG Switzerland is part of Springer Science+Business Media  
([www.springer.com](http://www.springer.com))

# Preface

In this book, we summarize recently deployed monitoring approaches with a focus on automatically detecting health threats for older patients living alone at home. First, in order to give an overview of the problems at hand, we briefly describe older adults who would mostly benefit from healthcare supervision and explain their potential health threats and dangerous situations, which need to be detected timely. Second, we summarize possible scenarios for monitoring an older patient at home and derive common functional requirements for monitoring technology. Third, we identify the realistic state-of-the-art technological monitoring approaches, which are practically applicable to older adults, in general, and to geriatric patients, in particular. In order to uncover the majority of applicable solutions, we survey the interdisciplinary fields of smart homes, telemonitoring, ambient intelligence, ambient assisted living, gerotechnology, and aging-in-place technology among others. Consequently, we discuss the related experimental studies and how they collect and analyze the measured data, focusing on the application of sensor fusion, signal processing, and machine learning techniques whenever possible, which are shown to be useful for improving the detection and identification of situations that can threaten older adults' health. Finally, we discuss future challenges and offer a number of suggestions for further research directions. We conclude the book by highlighting the open issues within automatic healthcare technologies and link them to potential solutions.

**Keywords:** eHealth, Telemonitoring, Home care, Smart homes, Ambient intelligence (AmI), Ambient assisted living (AAL), Machine learning, Sensors, Geriatric conditions

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# Acknowledgments

The writing of this book was supported by the Innovation Fund Denmark and Growth Forum in the Region of Southern Denmark through the project Patient@home.



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# Abbreviations

|      |  |
|------|--|
| AAL  | Ambient Assisted Living  |
| ADLs | Activities of Daily Living   |
| AI   | Artificial Intelligence  |
| ALT  | Assisted Living Technology   |
| AmI  | Ambient Intelligence   |
| ANN  | Artificial Neural Network  |
| ARBF | Augmented Radial Basis Function  |
| AT   | Assistive Technology   |
| BP   | Blood Pressure   |
| CAM  | Confusion Assessment Method  |
| CEN  | European Committee for Standardization                                 |
| CGA  | Comprehensive Geriatric Assessment                                     |
| CHD  | Coronary Heart Disease   |
| COPD | Chronic Obstructive Pulmonary Diseases                                 |
| CRF  | Conditional Random Field   |
| DBN  | Dynamic Bayesian Network or Deep Belief Network (Depending on Context) |
| DS   | Danish Standard  |
| DTs  | Decision Trees   |
| ECG  | Electrocardiography  |
| EEG  | Electroencephalography   |
| EHR  | Electronic Health Records  |
| EMG  | Electromyography   |
| EN   | European Norms   |
| EU   | European Union   |
| FP7  | Seventh Framework Programme  |
| FVC  | Forced Vital Capacity  |
| GMM  | Gaussian Mixture Models  |
| GPs  | Gaussian Processes   |