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ISSN 0922-6389 (print)
ISSN 1879-8314 (online)

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IOS
Press

Amsterdam • Berlin • Washington, DC

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ISBN 978-1-61499-803-7 (print)

ISBN 978-1-61499-804-4 (online)

Library of Congress Control Number: 2017951663

Publisher

IOS Press BV

Nieuwe Hemweg 6B

1013 BG Amsterdam

Netherlands

fax: +31 20 687 0019

e-mail: order@iospress.nl

For book sales in the USA and Canada:

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PRINTED IN THE NETHERLANDS

Preface

Imagine a future where human environments respond to human preferences and needs. In this world, smart devices equipped with intelligent features and the capability to sense, communicate, and support humans in daily life activities will be unremarkable features. During the last decade, questions were raised on how intelligent were the so called “*smart systems*” or “*Ambient intelligence environments*”. Nowadays, the word *smart* has become a sort of wild card to be attached to any new product introduced to the market.

The research area related to Smart Homes has blended with other areas in Computer Science and expanded in several directions. Popularity has grown exponentially and several fields of applications are now closer to reality rather than science fiction vignettes. There are Smart Cars, Smart Classrooms, Smart Farming and many other smart environments in which technology is changing the way people relate to them. Thus, we will expect cars to warn us of hazards, track our location and provide timely route advice. We will speak to simple machines and hold conversations with more complex systems, such as intelligent homes that will help us monitoring conditions, tracking routine tasks, and programming the behaviour of the heater, lights, garden watering and the entertainment centre.

It was anticipated a decade ago that the analysis of the extent and the way that Artificial Intelligence (AI) can benefit Ambient Intelligence was not obvious, although it was clear that AI seemed in a good position to contribute to this new emerging field. There are still many interesting open questions, for example, “*What is good use of AI in Ambient Intelligence?*”, because there are ethical dimensions to this, and “*How much intelligence is needed to really make a difference?*”, or “*How do people expect to find intelligence in their surroundings?*”.

This book aims at providing a clear picture of what has been achieved after a decade of discussion and, most importantly, what avenues are the most promising for exploration in the next decade. Indeed, this volume aims at creating a reference that field experts may use to be updated and inspired to create better systems for society.

In the chapter “A survey on applying machine learning techniques for behavioural awareness”, the focus is on reviewing the state-of-the-art of the applicability of machine learning techniques for behavioural awareness, considering both individuals and group behavioural recognition.

The chapter “Modelling spatial and temporal context to support activity recognition” introduces the advances in context awareness with the dawn of mobile computing and the Internet of Things. In this sense, new areas such as affective computing and biometrics are emerging as new opportunities for context awareness. Then, the chapter entitled “Affect aware ambient intelligence: current and future directions” provides a review of current research aiming to offer an insight for affective computing by exploring all key aspects relating to development of an affective human-centered system. The chapter entitled “Behavioural biometrics and ambient intelligence: new opportunities for context-aware applications” describes a multi-faceted smart environment for the acquisition of relevant contextual information about users, such as performance, attention, mental fatigue and stress.

Following chapters focus on application of AI to real Ambient Intelligence environments. The chapter “Energy and environmental long-term monitoring system for inhabitants well-being” presents a monitoring system capable of measuring the energy consumed by end-users and a set of environmental parameters and, then, influencing user comfort developing social interaction algorithms. Next two chapters entitled “Behavioural patterns from cellular data streams and outdoor lighting as strong allies for smart urban ecosystems” and “Learning daily routines in smart office environments” present two use cases where AI techniques are used to simplify daily activities of users in two different environments, i.e., respectively, smart cities and smart offices.

Finally, the last two chapters show some of the necessary technological tools that are necessary to develop ambient intelligence environments. In “ECKRUCAmI architecture – applications in healthcare domain” the authors propose an architecture dedicated to a specific domain, which aims to facilitate the development of more efficient healthcare supporting environments. The chapter “A qualitative image descriptor QIDL^N to obtain logics and narratives applied to ambient intelligence systems” presents a model for obtaining a real-world scene description.

This book is part of the outcome of the Workshop on Artificial Intelligence Techniques for Ambient Intelligence (AITAmI) which has run for 10 consecutive editions. The event was created as a way to investigate some of the many open questions on the intelligence features that a place requires to realize the concept of Ambient Intelligence. During a decade we have explored a number of those questions and challenges and we have contributed to progress towards a better understanding of the overall problem. This book is representative of the diversity of approaches and issues which are currently being considered.

Editors: Asier Aztiria, Juan Carlos Augusto, Andrea Orlandini

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