Lecture Notes in Artificial Intelligence 4840

Edited by J. G. Carbonell and J. Siekmann

Subseries of Lecture Notes in Computer Science

Lucas Paletta Erich Rome (Eds.)

Attention in Cognitive Systems

Theories and Systems from an Interdisciplinary Viewpoint

4th International Workshop
on Attention in Cognitive Systems, WAPCV 2007
Hyderabad, India, January 8, 2007
Revised Selected Papers

Springer

Series Editors

Jaime G. Carbonell, Carnegie Mellon University, Pittsburgh, PA, USA
Jörg Siekmann, University of Saarland, Saarbrücken, Germany

Volume Editors

Lucas Paletta
Joanneum Research
Institute of Digital Image Processing
Computational Perception Group
Wastiangasse 6, 8010 Graz, Austria
E-mail: lucas.paletta@joanneum.at

Erich Rome
Fraunhofer-Institut für Intelligente Analyse- und Informationssysteme
Adaptive Reflective Teams (IAIS.ART)
Schloss Birlinghoven, 53754 Sankt Augustin, Germany
E-mail: erich.rome@iais.fraunhofer.de

Library of Congress Control Number: 2007941804

CR Subject Classification (1998): I.2, I.4, I.5, I.3

LNCS Sublibrary: SL 7 – Artificial Intelligence

ISSN 0302-9743
ISBN-10 3-540-77342-8 Springer Berlin Heidelberg New York
ISBN-13 978-3-540-77342-9 Springer Berlin Heidelberg New York

Typesetting: Camera-ready by author, data conversion by Scientific Publishing Services, Chennai, India
Printed on acid-free paper SPIN: 12205806 06/3180 5 4 3 2 1 0

Preface

Attention has been representing a core scientific topic in the design of AI-enabled systems within the last decades. Today, in the ongoing debate, design, and computational modeling of artificial cognitive systems, attention has gained a central position as a focus of research. For instance, attentional methods are considered in investigating the interfacing of sensory and cognitive information processing, for the organization of behaviors, and for the understanding of individual and social cognition in reflection of infant development.

While visual cognition plays a central role in human perception, findings from neuroscience and experimental psychology have provided strong evidence about the perception-action nature of cognition. The embodied nature of sensory-motor intelligence requires a continuous and focused interplay between the control of motor activities and the interpretation of feedback from perceptual modalities. Decision making about the selection of information from the incoming sensory stream – in tune with contextual processing on a current task and an agent's global objectives – becomes a further challenging issue in attentional control. Attention must operate at interfaces between bottom-up driven world interpretation and top-down driven information selection, thus acting at the core of artificial cognitive systems. These insights have already induced changes in AI-related disciplines, such as the design of behavior-based robot control and the computational modeling of animats.

Today, the development of enabling technologies such as autonomous robotic systems, miniaturized mobile – even wearable – sensors, and ambient intelligence systems involves the real-time analysis of enormous quantities of data. These data have to be processed in an intelligent way to provide "on time delivery" of the required relevant information. Knowledge has to be applied about what needs to be attended to, and when, and what to do in a meaningful sequence, in correspondence with visual feedback.

The individual contributions of this book deal with these scientific and technological challenges on the design of attention and present the latest state of the art in related fields. This book evolved out of the 4th International Workshop on Attention in Cognitive Systems (WAPCV 2007) that was held in Hyderabad, India, as an associated workshop of the 20th International Joint Conference on Artificial Intelligence (IJCAI 2007). The goal of this workshop was to provide an interdisciplinary forum to communicate computational models of attention in cognitive systems from an interdisciplinary viewpoint, including computer vision, psychology, robotics and neuroscience. The workshop was held as a single-day, single-track event, consisting of high-quality podium and poster presentations. Revised selected papers from WAPCV 2007 together with contributions from invited speakers – Tom Ziemke on embodied dynamics of emotion and attention, and Jochen Triesch on learning of attention – add to this collection. To enable

a broad overview of the state of the art, the editors decided to add some revised papers from WAPCV 2005 and to invite additional contributions about current relevant research themes.

WAPCV 2007 and the editing of this collection was supported in part by The European Network for the Advancement of Artificial Cognitive Systems (euCognition), and the EC-funded projects MOBVIS (FP6-511051) and MACS (FP6-004328). We are very thankful to David Vernon (co-ordinator of euCognition) and Colette Maloney of the European Commission's ICT Program on Cognition for their financial and moral support. Finally, we wish to thank Katrin Amlacher for her efforts in assembling these proceedings.

October 2007

Lucas Paletta
Erich Rome

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