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# Augmented Environments for Computer-Assisted Interventions

6th International Workshop, AE-CAI 2011
Held in Conjunction with MICCAI 2011
Toronto, ON, Canada September 22, 2011
Revised Selected Papers

Springer

Volume Editors

Cristian A. Linte
David R. Holmes III
Mayo Clinic
Biomedical Imaging Resource
200 First Street SW
Rochester, MN 55905, USA
E-mail: {linte.cristian, holmes.david3}@mayo.edu

John T. Moore
Elvis C.S. Chen
Robarts Research Institute
Imaging Research Laboratories
100 Perth Dr.
London, ON, Canada, N6A 5K8
E-mail: jmoore@robarts.ca
E-mail: chene@imaging.robarts.ca

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# Preface

As organizers of the 6$^{\text{th}}$ MICCAI Workshop on Augmented Environments for Computer-Assisted Interventions (AE-CAI 2011), and editors of this volume, it is our pleasure to present to you the first edition of the Springer LNCS AE-CAI 2011 proceedings. This volume includes selected papers from those presented at the AE-CAI 2011 workshop held in conjunction with the Medical Image Computing and Computer-Assisted Interventions (MICCAI) 2011 conference, held on September 22, 2011, in, Toronto, Ontario, Canada.

AE-CAI 2011 was the sixth in a series of workshops formerly known as Augmented Medical Imaging and Augmented Realities for Computer-Aided Surgery (AMI-ARCS), following AMI-ARCS 2003, 2004, 2006, 2008 and 2009, and the Tutorial on Augmented Reality in 2007. Over the past several years, the satellite workshops and tutorials at MICCAI have experienced increased popularity. Their registration numbers in 2011 (over 900 registrants) competed with the registration numbers for the main conference ($\sim$ 1040 registrants). The 2011 edition of AE-CAI reached a record number of 42 registrants, not including the members of the Organizing and Program Committees. There was also a record number of attendees ($\sim$ 70 attendees), making AE-CAI one of the best received and best attended workshops at MICCAI 2011.

The 2011 edition of the workshop was a joint effort between the Biomedical Imaging Resource at Mayo Clinic (Rochester, MN, USA) and the Imaging Research Laboratories at Robarts Research Institute, Western University (London, ON, Canada). Both groups have had a long-standing tradition in medical image analysis and image-guided intervention research and have been at the forefront of technological and translational development in this field for the past three decades. In addition, a Program Committee consisting of 25 international experts served as reviewers for the submitted papers.

In medical imaging, virtual and augmented reality environments aim to provide the physician with enhanced visualization and perception of the patient, either by fusing various imaging modalities or by presenting image-derived information overlaid on the physician's view, establishing a direct relation between the image and the patient. The objective of the AE-CAI workshop is to attract scientific contributions that offer solutions to the technical problems in the area of augmented and virtual environments for computer-assisted interventions, and to provide a venue for dissemination of papers describing both complete systems and clinical applications. AE-CAI 2011 attracted researchers in computer science, biomedical engineering, physics, and clinical medicine engaged in the development of virtual and augmented environments for medical image visualization and image-guided interventions. As clinical impact is a core element of

the workshop, authors described their work in the context of necessary developments, research questions, and potential obstacles that must be overcome to enable and facilitate effective translation of the proposed work from lab to clinic. The scientific program focused on the dissemination of innovative research in image registration and fusion, calibration, visualization and 3D perception, hardware and optical design, real-time implementation, as well as validation, clinical applications, and clinical evaluation. Live demonstrations of image-guided therapy systems were also featured by Northern Digital Inc. (Waterloo, Canada) and the University of Bern (Bern, Switzerland).

This workshop has traditionally included keynote addresses from leading figures in the field and 2011 was no exception. Matthew Gettman (Mayo Clinic, Rochester MN) spoke on the current status, successes, and challenges in image-guided robot-assisted prostate interventions. Nassir Navab (Technical University of Munich, Munich, Germany) described state-of-the-art developments in augmented and virtual reality systems for intra-operative guidance. Christopher Schlachta (London Health Sciences Centre, London, Canada) shared his expertise and challenged the attendees on how augmented and virtual environments may shape the future of minimally invasive therapy, while emphasizing what the surgeons are looking forward to seeing in operating rooms of the future. The workshop concluded with an interactive panel discussion on the encountered successes and challenges of augmented, virtual, and image-guided intervention platforms toward their clinical translation and implementation.

AE-CAI 2011 attracted 21 paper submissions from ten countries. The submissions were distributed for review to the Program Committee, ensuring all potential conflicts of interest were eliminated. Each paper was critically evaluated by at least three reviewers, who provided detailed critiques and constructive comments to the authors and workshop editorial board. Based on the reviews, 12 papers were selected for oral presentation (according to the reviewers' scores and suitability of the work for oral/poster presentation) and six were selected as poster presentations. The authors were asked to revise their initial submissions for publication in the Electronic Workshop Proceedings – made available to the workshop registrants on USB flash drives. Following the workshop, 13 of the papers presented at the meeting (representing 61% of all submitted papers) were selected for consideration of publication in this Springer LNCS volume. The authors were asked to include both the reviewers' suggestions, as well as the feedback received during the workshop, and resubmit their manuscripts, along with their response to reviewers, for a final review process toward publication in this volume. Each revised paper was reviewed by the volume editors to ensure that all reviewers' comments were properly addressed and incorporated into the final version of the manuscripts enclosed in this collection.

On behalf of the AE-CAI 2011 Organizing Committee, we would like to extend our sincere thanks all Program Committee members for providing detailed and timely reviews of the submitted manuscripts. We greatly appreciate their support in providing valuable feedback. We also thank all authors, presenters, and attendees at AE-CAI 2011 for their scientific contribution, enthusiasm, and support. We look forward to their continuing participation in AE-CAI 2012 in Nice, France. We hope that all will enjoy reading this volume.

Cristian A. Linte
John T. Moore
Elvis C.S. Chen
David R. Holmes III

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## AE-CAI 2011 Workshop Affiliates

Richard A. Robb
Biomedical Imaging Resource
Mayo Clinic
Rochester MN USA

Terry M. Peters
Robarts Research Institute
University of Western Ontario
London ON Canada

Tammy Dockery
The Personal
Home and Auto Insurance group
Toronto ON Canada

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