Guest Editors' Introduction: Special Section on The International Symposium on Mixed and Augmented Reality (ISMAR)

Mark A. Livingston, Ronald T. Azuma, Oliver Bimber, and Hideo Saito

THE International Symposium on Mixed and Augmented Reality (ISMAR) is pleased to again this year present a special section of the best papers from the annual conference. Mixed and augmented reality continue to show dramatic improvements in capabilities and the reach of applications; this year's award winning papers demonstrate this progress quite well. The ISMAR submission process continues to increase in competitiveness, with 25 percent of the submitted papers accepted to the 2008 conference; among those, the following three papers are extended versions of those that were considered to be the best of the program.

One critical technology for augmented reality (AR) is tracking of the viewpoint; computer vision techniques often form the basis for algorithms. But in order to take advantage of camera phones as AR platforms, one must modify the (traditionally expensive) vision processing to run with limited computational resources. In "Real-Time Detection and Tracking for Augmented Reality on Mobile Phones," Daniel Wagner, Gerhard Reitmayr, Alessandro Mulloni, Tom Drummond, and Dieter Schmalstieg adapt the SIFT and Ferns descriptors and a template-based tracker, achieving increased robustness of the tracking while still enabling real-time application performance (15 Hz). They further analyze the performance of the vision algorithms to guide future research.

We have all seen computer graphics in movies that were too obviously different from the background video to be considered a part of the same image. In "Simulating Low-Cost Cameras for Augmented Reality Compositing," Georg Klein and David W. Murray attack the analogous problem for mixed reality: matching the appearance of the overlaid graphics to the appearance of the background video. They present an analysis of the image capture pipeline in small video cameras, entailing lens effects, color mask, sensor properties, in-camera processing, and color space conversion. They continue by demonstrating algorithms that degrade the image quality of the augmenting graphics to include these same effects, resulting in a much more convincing mixture of the real and virtual imagery.

Another long-standing goal for AR is the improvement of the capabilities of optical see-through displays. One common complaint is that the focus of most such displays is fixed, thus preventing the user from being able to focus on both the real and virtual information presented at a range of distances from the user. In "A Novel Prototype for an Optical See-Through Head-Mounted Display with Addressable Focus Cues," Sheng Liu, Hong Hua, and Dewen Cheng present a prototype display that enables addressable focus cues in the presentation of graphics. They describe two implementations, enabled by a liquid lens. They present results from two studies of users' perceptual understanding of depth as well as accomodative response, both of which demonstrate the natural interaction of the user with the augmenting graphics.

We would like to thank a number of people who were instrumental in the award process for ISMAR: D'nardo Colucci, Dean DeJong, Stephen DiVerdi, Steven Feiner, Jan Fischer, Hirokazu Kato, Kiyoshi Kiyokawa, Vincent Lepetit, David Marimon, David Mizell, Nassir Navab, Ulrich Neumann, Alex Olwal, Dirk Reiners, Gilles Simon, Andrei State, Hideyuki Tamura, and Suya You.

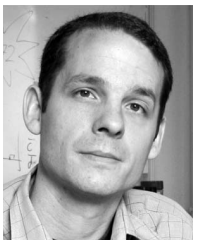
Mark A. Livingston
Ronald T. Azuma
Oliver Bimber
Hideo Saito
Guest Editors

- *M. Livingston is with the Naval Research Laboratory, 4555 Overlook Ave SW, Code 5580, Washington, DC 20375. E-mail: mark.livingston@nrl.navy.mil.*
- *R. Azuma is with the Nokia Research Center Hollywood, 2400 Broadway, D-500, Santa Monica, CA 90404. E-mail: ronald.azuma@nokia.com.*
- *O. Bimber is with the Institute for Computer Graphics, Johannes Kepler University Linz, Science Park I, MT0321, Altenberger Straße 69, 4040 Linz, Austria. E-mail: oliver.bimber@jku.at.*
- *H. Saito is with the Department of Information and Computer Science, Keio University, 3-14-1 Hiyoshi, Kohoku-ku, Yokohama, Kanagawa, 223-8522, Japan. E-mail: saito@hvrl.ics.keio.ac.jp.*

For information on obtaining reprints of this article, please send e-mail to: tvcg@computer.org.

Mark A. Livingston received the AB degree in computer science and mathematics in 1993 from Duke University and the MS and PhD degrees in computer science in 1996 and 1998 from the University of North Carolina at Chapel Hill, where he helped develop the augmented reality ultrasound and laparoscopic visualization system. He is a research scientist in the Information Technology Division at the Naval Research Laboratory. He directs and conducts research on interactive graphics, including AR, visualization metaphors, mathematical representations, perceptual and cognitive factors, and applications. He has published several papers in ISMAR and 12 papers on perceptual and cognitive factors in AR, two of which won awards: an Alan Berman Research Publication Award at NRL in 2003 and an Honorable Mention for Best Paper at IEEE Virtual Reality 2006. He was a program cochair for ISMAR 2007 and 2008.

Ronald T. Azuma received the BS degree in computer science from the University of California at Berkeley and the MS and PhD degrees in computer science from the University of North Carolina at Chapel Hill. He is a Research Leader at Nokia Research Center Hollywood, where he leads a team exploring how to make entertainment content more compelling on mobile devices through the use of augmented and mixed reality technologies. He has published 25 papers and has seven granted patents. He served as program cochair for the International Symposium on Augmented Reality 2001 and the International Symposium on Mixed and Augmented Reality 2002 and 2005, as well as award chair for ISMAR 2008, and is the current leader of the ISMAR Steering Committee.



Oliver Bimber received the PhD degree (2002) in engineering from the Darmstadt University of Technology, Germany, and the Habilitation degree (2007) in computer science (Informatik) from the Munich University of Technology. He became head of the Institute of Computer Graphics at Johannes Kepler University Linz in October 2009. From 2003-2010, he served as a junior professor of augmented reality in the Media System Science Department at Bauhaus-University Weimar, and as an interim professor of computer graphics in the Computer Science Department of the Brandenburg University of Technology, Cottbus (2008 and 2009). See www.jku.at/cg for more details.

Hideo Saito received the BE, ME, and PhD degrees in electrical engineering from Keio University, Japan, in 1987, 1989, and 1992, respectively. He is a professor in the Department of Information and Computer Science at Keio University, Japan. His research interests include computer vision, mixed reality, virtual reality, and 3D video analysis and synthesis. He has been on the faculty of the Department of Electrical Engineering, Keio University, since 1992. From 1997 to 1999, he was with the Virtualized Reality Project in the Robotics Institute at Carnegie Mellon University as a visiting researcher. He recently served as the general chair of ICAT 2008 (International Conference on Artificial Reality and Telexistence, December 2008), MVA 2009 (IAPR International Conference on Machine Vision Applications, May 2009), and AH 2010 (The First Augmented Human International Conference). He was also a program cochair for ISMAR 2008 and 2009.