

# Tutorials and Workshops

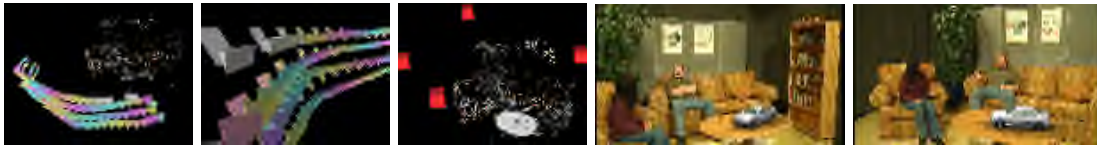
Sunday, October 22, 2006

**ISMAR 2006** THE FIFTH IEEE AND ACM INTERNATIONAL SYMPOSIUM ON MIXED AND AUGMENTED REALITY OCT. 22 - 25, SANTA BARBARA, USA



In cooperation with IEEE, ACM, and Eurographics



**Tutorial 1, 9:00am–1:00pm****Tutorial Computer Vision for Augmented Reality**

Camera based tracking for augmented reality is nowadays frequently done using the marker based AR-Toolkit. In some situations it is not possible to place markers in the scene to track the camera motion one example is TV-broadcasting applications. In recent years the techniques in computer vision have been extended towards markerless high quality camera tracking with interactive frame rates. These techniques can be used for camera pose estimation for augmented reality.

The tutorial will review the algorithms and techniques implemented in AR-Toolkit as the state of the art tool for camera tracking in augmented reality. Afterwards techniques for markerless camera pose estimation in real-time will be introduced. For the markerless tracking the state of the art techniques in computer vision will be explained in detail. The introduced methods include algorithms for detection and tracking of salient image features in the video, the robust estimation of the camera pose from the motion of the salient features. In the final part of the tutorial we will discuss the techniques used to improve the performance of the markerless tracking algorithms to achieve real-time. Throughout the tutorial we will show applications of each of the algorithms to enhance the understanding. These examples are used to build a marker based and markerless augmented reality system.

Schedule:

- Introduction to Multi-view geometry
  - Epipolar geometry
  - Pose estimation
- Overview AR-Toolkit
  - Marker
  - Marker detection
  - Pose estimation from markers
- Feature tracking
  - Markerless feature tracking
  - Wide baseline matching
- Fast robust pose estimation
- Applications

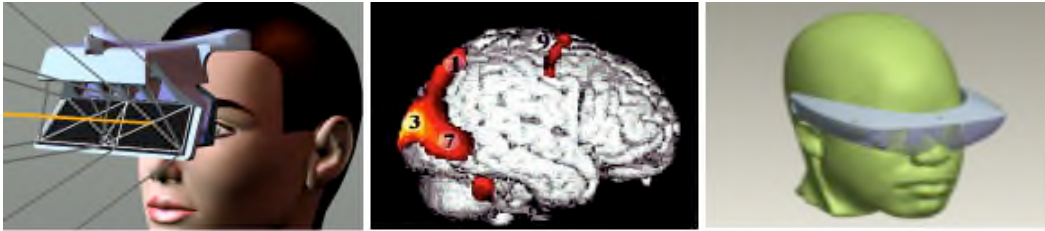
The lecturers of the tutorial are Dr.-Ing. Jan-Michael Frahm from the University of North Carolina at Chapel Hill and Dr. Raphael Grasset from the University of Canterbury. Jan-Michael Frahm is working as post-doctoral research associate in the group of Prof. Marc Pollefeys at UNC on urban reconstruction in real-time. Furthermore he is working in the areas of uncalibrated structure from motion, markerless augmented reality, fast tracking on commodity graphics hardware, robust estimation and self-calibration. Raphael Grasset is a post-doctoral researcher working at the HIT Lab NZ at the University of Canterbury, New Zealand. He has a PhD in Computer Science from Joseph Fourier University of Grenoble (France), and conducts research on augmented reality, mixed reality, 3D interaction, CHI, CSCW or virtual reality. He is an expert on developing AR applications with ARToolKit and has published 12 papers in the area of virtual and augmented reality.

***Student Colloquium, 12:30pm–2:00pm*****Student Colloquium**

The ISMAR Student Colloquium is an opportunity for students pursuing a graduate degree in the general research area of Mixed and Augmented Reality to present their research goals and interactively discuss challenges and ideas among a group of senior researchers and other students. This is a great opportunity for students to make a strong step in conference networking and establish themselves as upcoming mixed reality researchers. During the session, selected students will present short research sketches, discussing their problem area, current results and future avenues of research, with the opportunity to receive input from the audience and inspire potential collaborations. It will also provide excellent conference presentation practice in a low stress setting.

The Student Colloquium will be held on Sunday, Oct. 22, 2006 from 12:30pm to 2:00pm, in conjunction with the International Symposium of Mixed and Augmented Reality (ISMAR), which is held from Oct. 22 to Oct 25, 2006 at University of California, Santa Barbara, CA, USA.

Students selected to present in the colloquium will receive complimentary registration for the two ISMAR tutorial sessions on the same day, "Computer Vision for Augmented Reality" and "Head-worn Displays - Fundamentals and Applications". Lunch will also be provided.

**Tutorial 2, 2:30pm–6:30pm****Head Worn Displays: Fundamentals and Applications**

Trying to develop new applications with HWDs without an associated plan for the development of technology optimized for that application and set of tasks is like trying to swim in a pool with no water.

To enable breakthroughs in the use of HWDs targeted at multiple applications, this tutorial will briefly review the principles of optical imaging for HWDs. We will then explain various perception issues in HWDs which, if understood, can help guide the optimal design and use of the technology across various applications and tasks. We will then detail eyepiece based versus projection optics, including retinal scanning displays which can be thought of as a scanning projection system. Video see-through technology will then be introduced together with some key system aspects related to calibration and applications. Wide field of view optics will then be addressed together with state of the art displays and applications will be reviewed. Finally, we will discuss how free-form optics has already played a key role in HWD design and will help launch the next generation eyeglass displays for "grand public" use as well.

**Schedule:**

- ▶ Introduction & Optics of Head-Worn Displays, Jannick Rolland
- ▶ Perceptual Issues in the Use of Head-Worn Visual Displays, Robert Patterson
- ▶ Video See-Through HMDs: Applications, Technology, Calibration, Andrei State
- ▶ Design examples: Head-Worn Projection Display, Jannick Rolland; Canon Free-Form Prism and CREOL Eyeglass-based Display, Ozan Cakmakci

**Organizers:**

Jannick Rolland (University of Central Florida), coordinator and instructor  
 Andrei State (University of North Carolina at Chapel Hill), instructor  
 Ozan Cakmakci (University of Central Florida, and Intern at Canon Japan), instructor  
 Robert Patterson (Washington State University), instructor

**Contributor:** Shoichi Yamazaki (Canon); Hong Hua (University of Arizona)

**Workshop, 9:00m–6:00pm****Workshop on Industrial Augmented Reality**

Augmented Reality has matured from a pure research field into actual industrial applications. There are still many research questions to solve, and solutions are discussed every year at the ISMAR conference series. However, making systems really work needs usually some more effort, knowledge, and ideas than can be discussed by academia on a purely scientific conference. The goal of this workshop is to bring together all people from industry and academia who use augmented reality technologies in real industrial settings aimed at producing a commercial benefit.

The workshop is a continuation of the very successful one-day event at ISMAR'05. It is intended to provide a platform to jointly discuss the "devils in the detail" and to identify ways to make the leap from research-based demonstrators to fully integrated systems.

**Schedule:**

- Session 1: Information Presentation
  - To what extent will AR be usable for HCI in automotive environments?  
Klaus-Josef Bengler and Robert Passaro (BMW)
  - OSGART - A pragmatic approach to MR  
Julian Looser, Raphael Grasset, Hartmut Seichter and Mark Billinghurst (Human Interface Technology Laboratory New Zealand)
- Session 2: Interaction  
What kinds of interactive concepts, tools and devices are suitable for workers using AR in industrial or leisurely settings?
  - AR as a teaching tool for operators of robots  
Rainer Bischoff (Kuka)
  - Optical tracking of finger positions  
Andreas Werner (Advanced Realtime Tracking GmbH)
  - Interaction requirements for target/actual comparison  
Stefan Nölle and Ralph Rabätje (Volkswagen AG)
- Session 3: Applications  
What simplifications to the "grand general AR solution" are key towards turning AR ideas into pragmatic solutions that could be used in real industrial settings?
  - Industrial application systems using AR technology  
Yuichiro Akatsuka (Olympus)
  - I don't need no new technology, I just want to meet the production quota  
Enylton Machado Coelho and Lukas M. Marti (Bosch Research and Technology Center)
- Session 4: Tracking
  - Requirements for providing tracking support in air planes  
Dominik Willers (Airbus CIMPA)
  - The need for accuracy statements in industrial AR applications  
Katharina Pentenrieder and Peter Meier (Metaio GmbH)
  - A tracking by detection approach for robust markerless tracking  
Chunrong Yuan (Fraunhofer FIT)
  - Commercialization of AR Tag: millenium-3 engineering  
Mark Fiala (U. Toronto)

**Organizers:**

- \* Gudrun Klinker (TU Munich), coordinator
- \* Stefan Nölle (Volkswagen)
- \* Toshikazu Ohshima (Ritsumeikan University, formerly Canon)
- \* Marcus Tönnis (TU Munich)



***Affiliated Workshop, 9:00m–6:00pm***

**Workshop on Mixed Reality Technology for Filmmaking  
--- AR/MR Goes to Hollywood! ---**

Science meets fiction in creating the future of storytelling at the *International Workshop on Mixed Reality Technology for Filmmaking* being held in conjunction with the International Symposium on Mixed and Augmented Reality at the Corwin Pavilion, University of California, Santa Barbara (UCSB) on October 22, 2006. Never before in history have storytellers had access to tools that literally melt the boundaries between dreams and reality unleashing the human imagination of artist and audience alike. The convergence of fantastical virtual reality and hard core reality set the stage for invention of futuristic tools and novel methods for collaboration with Mixed Reality. Computer generated Mixed Reality was invented in the late 1990's in order to apply the dynamics of virtual reality to the real world. Today it is being applied to filmmaking, game shows, video games and educational experiences as powerful tool for prototyping narrative experiences.

“Every talent in Hollywood will be affected by Mixed Reality in the future, whether it is the actor, designer, game developer or advertising agency. It is being applied to Pre-production with visualization, post production in the creation of virtual visual effects (VFX), it is even being applied to the audience experience with experiential movie trailers that can cause an alien invasion at a mall near you.”

---Christopher Stapleton, Mixed Reality Experience Producer

Mixed Reality is a vibrant and diverse area of interdisciplinary research and technology as well as artistic exploration. With an increasing number of applications in a variety of fields, including industrial design, medicine, education, arts and entertainment MR is rapidly becoming more accessible to a wider application.

The workshop will be divided into two parts with invited speakers representing leading entertainment producers who will report on the latest state-of-the-art applications used for pre-visualization, special visual effects. The second session will cover the future development of the art, science and technology to provide a look into the future tools that will continue to revolutionize filmmaking.

***Affiliated Workshop (continued)***

**Technical Program**

**Morning: Invited Talks from Hollywood Side**

1. [Keynote] Virtual Cinematography: Choosing Viewpoint and Lighting in Postproduction  
Paul Debevec (USC)
2. Previsualization - The Movie Before the Movie  
Bud Myrick (Rhythm & Hues)
3. Previsualization - The Cinematic Design Document  
Colin Green (Pixel Liberation Front)

(Lunch Break)

**Afternoon: Presentations from MR Side**

4. The MR-PreViz Project in Japan
  - 4-1 The Project Overview  
Hideyuki Tamura (Ritsumaikan Univ.)
  - 4-2 Design and Prototype Implementation of MR Pre-Visualization Workflow  
Ryuhei Tenmoku & Ryosuke Ichikari (Ritsumeikan Univ.)
  - 4-3 Camera-Work Tracking Method in Outdoor Environment  
Sei Ikeda & Naokazu Yokoya (NAIST)
  - 4-4. 3D Video Technologies: Capturing High Fidelity Full 3D Shape, Motion, and Texture  
Takeshi Takai & Takashi Matsuyama (Kyoto Univ.)
5. Augmented Reality-based Interactive Storyboard  
Jun Park (Hongik Univ.)
6. Augmented Reality Techniques Enhancing the Authoring Workflow of Computer Entertainment  
Istvan Barakonyi & Dieter Schmalstieg (Graz Univ. of Tech.)
7. Mixed Reality Techniques for TV and Their Application for On-Set/Pre-Visualization in Film Production  
Graham Thomas (BBC)
8. Making Memories: Linear vs. Interactive Storytelling Collaboration in Mixed Reality Space  
Christopher Stapleton (Univ. of Central Florida)
9. Overall Discussion



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