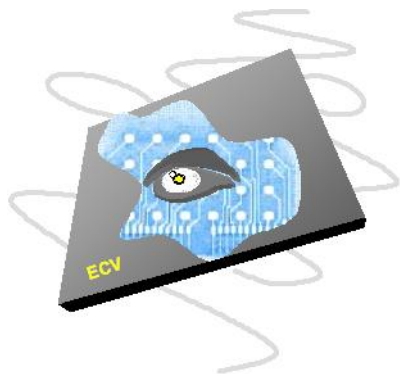


# Sixth IEEE Workshop on Embedded Computer Vision



## The Sixth IEEE Workshop on Embedded Computer Vision

Sunday June 13, 2010 San Francisco, USA (held in conjunction with [CVPR 2010](#) <sup>[1]</sup>) [www.computervisioncentral.com/content/ecvw2010](http://www.computervisioncentral.com/content/ecvw2010) <sup>[2]</sup> Contact: ([ecv10 at computervisioncentral dot com](mailto:ecv10@computervisioncentral.com) <sup>[3]</sup>) Preliminary Program: [pdf](#) <sup>[4]</sup>

## Record attendance at Embedded Computer Vision 2010

Best paper award and news about ECVW2010 ([Click here](#) <sup>[5]</sup>).

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## Preprints

ECVW2010 preprints are available [here](#) <sup>[6]</sup>.

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## Program

([Click here to download PDF](#)) <sup>[4]</sup> Call for papers: [pdf](#) <sup>[7]</sup>

### 08h30 Welcome

(Ahmed Nabil Belbachir, general chair)

**S1: Keynote Session 1 (08h35 -- 09h15) Keynote: Solving Vision Tasks with Variational Methods on GPUs** Dr. Horst Bischof (Technical University Graz)

**chair: Ahmed Nabil Belbachir (AIT Austrian Institute of Technology)** This talk will present novel solutions to long standing computer vision problems by means of variational methods. We present robust methods for optical flow calculation, the correspondence problem for stereo matching, depth map integration and

interactive segmentation methods. The variety of topics that can be handled by these methods demonstrate the wide applicability of variational methods. In addition, modern graphics hardware (GPUs) allow to compute solutions to these problems very efficiently and in some cases (e.g. optical flow) even in real-time. Having real-time solutions opens several new applications areas (e.g. industrial imaging), interactive medical segmentation, etc. Some of these will be presented during the talk.

### **S2: Computer Vision on GPU (09h15 -- 10h15)**

**chair: Norbert Brändle (AIT Austrian Institute of Technology)** 09h15 **GPU Computing with Orientation Maps for Extracting Local Invariant Features**, Naoyuki Ichimura (National Institute of Advanced Industrial Science & Technology, Japan) 09h35 **Comparison of FPGA and GPU implementations of Realtime Stereo Vision**, Ratheesh Kalarot, John Morris (University of Auckland, New Zealand) 09h55 **Efficient Planar Features Matching for Robot Localization using GPU**, Baptiste Charmette, Eric Royer, Frédéric Chausse (LASMEA, France) 10h15 Morning Break

### **S3: Mobile Computer Vision (10h30 -- 11h10)**

**chair: Roman Pflugfelder (AIT Austrian Institute of Technology)** 10h30 **Mobile Photo Collage**, Man Hee Lee, Nitin Singhal, Sungdae Cho, In Kyu Park (Inha University, Korea) 10h50 **Indoor-Outdoor Detector for Mobile Phone Cameras Using Gentle Boosting**, Uri Lipowezky, Ilya Vol (Samsung Semiconductor, Israel)

### **S4: Reconfigurable Computing for Computer Vision (11h10 -- 12h30)**

**chair: Sek Chai (Sarnoff Corporation)** 11h10 **Dynamically reconfigurable architecture for real time adaptation of H264/AVC-SVC video streams**, Michael Guarisco, Hassan Rabah, Yves Berviller, Serge Weber (Nancy University, France), Abbas Amira (University of Ulster, UK) 11h30 **Binary Histogram based Split/Merge Object Detection using FPGAs**, Kofi Appiah, Hongying Meng, Andrew Hunter, Patrick Dickinson (University of Lincoln, UK) 11h50 **FPGA-Based Robust Ellipse Estimation for Circular Road Sign Detection**, Samuele Martelli, Roberto Marzotto, Andrea Colombari, Vittorio Murino (IIT Istituto Italiano di Tecnologia, Italy) 12h10 **FPGA-GPU Architecture for Kernel SVM Pedestrian Detection**, Sebastian Bauer (University Erlangen-Nuremberg, Germany), Sebastian Köhler, Konrad Doll, Ulrich Brunsmann (University of Applied Sciences Aschaffenburg, Germany) 12h30 Lunch Break

### **S5: Keynote Session 2 (13h30 -- 14h10) 13h30 Keynote: Emerging Applications of Embedded Vision, Dr. Branislav Kisacanin (Texas Instruments)**

**chair: Boaz Super, Motorola Inc** In this talk we focus on recent success stories and emerging applications of embedded vision: automotive vision, video analytics, computer games, and human-device interfaces. We look under the hood of several applications and explain algorithmic optimizations that developers may use to move computer vision prototypes from workstations to cost-effective embedded processors.

### **S6: Real-time Stereo Vision and Application (14h10 ? 15h30)**

**chair: Branislav Kisacanin (Texas Instruments)** 14h10 **Fast Locally Consistent Dense Stereo on Multicore**, Stefano Mattocchia (University of Bologna, Italy) 14h30 **A Census-Based Stereo Vision Algorithm Using Modified Semi-Global Matching and Plane-Fitting to Improve Matching Quality**, Martin Humenberger, Tobias Engelke, Wilfried Kubinger (AIT Austrian Institute of Technology, Austria) 14h50 **Real-Time Semi-Global Matching on the CPU**, Stefan K. Gehrig (Daimler, Germany), Clemens Rabe (University of Ulm, Germany) 15h10 **A Real-time Pedestrian Classification Method for Eventbased Dynamic Stereo Vision**, Stephan Schraml, Ahmed Nabil Belbachir, Norbert Brändle (AIT Austrian Institute of

Technology, Austria) 15h30 Afternoon Break

**S7: Invited Talks: Advanced Vision Systems (16h00 -- 17h45)**

**(chair: Ahmed Nabil Belbachir (AIT Austrian Institute of Technology) 16h00 High-Speed Vision Systems and Projectors for Real-Time Perception of the World**, Shingo Kagami (Tohoku University, Japan) 16h35 **Mobile Panoramic Imaging System**, Kari Pulli, Marius Tico, Yingen Xiong (Nokia Research Center, USA) 17h10 **Perception for Manipulation in Robotics with OpenCV**, Gary Bradski (Willow Garage, USA)

**17h45 Paper Award & Closing Remarks**

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## Organizing Committee

**General Chair:** Ahmed Nabil Belbachir, *AIT Austrian Institute of Technology* **Program Chair:** Abbes Amira, *University of Ulster*

**Steering Committee:** Nikolaos Bellas, *University of Thessaly, Greece* Sek Chai, *Sarnoff Corporation / SRI* Branislav Kisa?anin, *Texas Instruments* Boaz J. Super, *Motorola Inc.* **Program Committee:** (tentative) Kristian Ambrosch, *AIT Austrian Institute of Technology* Ahmed Nabil Belbachir, *AIT Austrian Institute of Technology* Nikolaos Bellas, *University of Thessaly, Greece* Shuvra Bhattacharyya, *University of Maryland* Horst Bischof, *TU Graz, Austria* Terry Boult, *University of Colorado at Colorado Springs* Sek Chai, *Sarnoff Corporation / SRI* Goksel Dedeoglu, *Texas Instruments* Khanh Duc, *NVIDIA* Antonio Gentile, *University of Palermo, Italy* Jan-Michael Frahm, *UNC-Chapel Hill* Antonio Haro, *Nokia Research Center* Masatoshi Ishikawa, *University of Tokyo* Branislav Kisa?anin, *Texas Instruments* Reinhard Koch, *University of Kiel* Ajay Kumar, *IIT Delhi, India* Zhu Li, *Hong Kong Polytechnic University, Hong Kong* Abelardo Lopez-Lagunas, *ITESM-Toluca, Mexico* Jiebo Luo, *Kodak* Roberto Manduchi, *University of California, Santa Cruz* Larry Matthies, *Jet Propulsion Laboratory* Hongying Meng, *University of Lincoln* Rajesh Narasimha, *Texas Instruments* Burak Ozer, *Verificon Corporation* Bernhard Rinner, *Klagenfurt University of Austria* Mainak Sen, *Cisco Systems* Vinay Sharma, *Texas Instruments* Yu Shi, *NICTA, Australia* Boaz J. Super, *Motorola Inc* Salvatore Vitabile, *University of Palermo, Italy* Linda Wills, *Georgia Institute of Technology* Marilyn Wolf, *Georgia Institute of Technology* Xing Xie, *Microsoft Research Asia* Ruigang Yang, *U. Kentucky, USA* Tianli Yu, *Like.com* Lin Zhong, *Rice University*

## Keynotes:

**Title:** Solving Vision Tasks with Variational Methods on GPUs **Presenter:** Dr. Horst Bischof **Summary of the**

**Talk:** This talk will present novel solutions to long standing computer vision problems by means of variational methods. We present robust methods for optical flow calculation, the correspondence problem for stereo matching, depth map integration and interactive segmentation methods. The variety of topics that can be handled by these methods demonstrate the wide applicability of variational methods. In addition, modern graphics hardware (GPUs) allow to compute solutions to these problems very efficiently and in some cases (e.g. optical flow) even in real-time. Having real-time solutions opens several new applications areas (e.g. industrial imaging), interactive medical segmentation, etc. Some of these will be presented during the talk.

**Short Bio:**



Horst Bischof received his M.S. and Ph.D. degree in computer science from the Vienna University of Technology in 1990 and 1993, respectively. In 1998 he got his Habilitation (venia docendi) for applied computer science. Currently he is Professor at the Institute for Computer Graphics and Vision at the Technical University Graz, Austria. H. Bischof is member of the scientific boards of the applied research centers ECV, VrVis and KNOW. H. Bischof is board member of the Fraunhofer Inst. für Graphische Datenverarbeitung (IGD). His research interests include object recognition, visual learning, motion and tracking, visual surveillance and biometrics, medical computer vision, and adaptive methods for computer vision where he has published more than 400 peer reviewed scientific papers. Horst Bischof was co-chairman of international conferences (ICANN, DAGM), and local organizer for ICPR'96. He was program co-chair of ECCV2006 and Area chair of CVPR 2007, ECCV2008, CVPR 2009, ACCV 2009. Currently he is Associate Editor for IEEE Trans. on Pattern Analysis and Machine Intelligence, Pattern Recognition, Computer and Informatics and the Journal of Universal Computer Science. Horst Bischof has received several awards among them the 29th Pattern Recognition award in 2002; the main prize of the German Association for Pattern Recognition DAGM in 2007, the Best scientific paper award at the BMCV 2007 and the Best scientific paper award at the ICPR 2008.

**Title:** Emerging Applications of Embedded Vision **Presenter:** Dr. Branislav Kisa?anin **Summary of the Talk:** In this talk we focus on recent success stories and emerging applications of embedded vision: automotive vision, video analytics, computer games, and human-device interfaces. We look under the hood of several applications and explain algorithmic optimizations that developers may use to move computer vision prototypes from workstations to cost-effective embedded processors. **Short Bio:**



Branislav Kisacanin was born in Novi Sad, a quiet university city on the Danube river, in former Yugoslavia. He received his BSEE degree from the University of Novi Sad in 1992 and MS and PhD degrees in EE/CS from the University of Illinois at Chicago in 1994 and 1998, respectively. Since 2007 Branislav has been a member of technical staff at the Vision R&D group in Texas Instruments. Prior to TI, he worked on vision-based automotive safety algorithms and applications at Delphi. Branislav authored, co-authored, or co-edited 5 books on math, control theory, and computer vision, most recently "Embedded Computer Vision" (Springer, 2008). He was a guest co-editor of the special issue of the CVIU Journal dedicated to Vision for Human-Computer Interaction (2007), and is currently a guest co-editor of another special issue of the same journal, this one on Embedded Vision (due in 2010). Branislav co-chaired several computer vision workshops at IEEE CVPR (RTV4HCI in 2004, V4HCI in 2004, and ECV in 2007 and 2008) and held tutorials on embedded vision (at CVPR in 2006, ESC in 2007, TIDC in 2008, and most recently at the 2010 ICASSP). Branislav has 5 US patents and several related patents in EU. For intellectual property contributions at Delphi, he has been inducted into the Delphi Innovation Hall of Fame (2006).

## Invited Talks:

**Title:** High-Speed Vision Systems and Projectors for Real-Time Perception of the World **Presenter:** Dr. Shingo Kagami **Summary of the Talk:** This paper presents a brief overview of high-speed vision systems that enable real-time image acquisition and visual processing at frame rates of several hundreds to thousands of frames per second, which are substantially higher than the standard video rates. High-speed vision systems enable fast measurement and control of dynamic systems, and have been successfully applied in the fields such as robotics, in which real-time perception of dynamic environment is critically important. This paper also presents recent effort to extend the concept of the high-speed vision to projector-camera systems, enabling fast 3D measurement, 3D feature tracking, virtual haptization of 3D objects and enhanced video projection.



**Short Bio:** Shingo Kagami received the B.E., M.E. and Ph.D. degrees in Mathematical Engineering and Information Physics from the University of Tokyo, Tokyo, Japan, in 1998, 2000, and 2003 respectively. He was a Research Fellow at Japan Science and Technology Corporation (JST) in 2003, and was a Research Associate at the University of Tokyo from 2003 to 2005. Since 2005, he has been at Graduate School of Information Sciences, Tohoku University, Sendai, Japan, where he is currently an Associate Professor. His research interests include systems, architectures and algorithms for high-speed

vision processing and real-time sensory information processing.

**Title:** Panoramic Imaging System for Camera Phones **Presenter:** Dr. Kari Pulli **Summary of the Talk:** We introduce a mobile system for creating high resolution panoramic images. The user can rotate the camera arbitrarily and see a miniature preview panorama in real-time. The system automatically captures high resolution images and generates a high-quality wide-view panoramic image. We employ a coarse-to-fine method for high-quality registration, and a seam-finding method to remove ghosting effects due to moving objects. The proposed system has been tested on several camera phones, and the tests reveal that the system can efficiently provide a high quality panoramic image in spite of the low computational power and



memory available in such devices. **Collaborators:** *Marius Tico, Yingen Xiong* **Short Bio:** Kari Pulli is Research Fellow and Member of CEO's Technology Council at Nokia Research Center in Palo Alto, CA, USA, where he heads a research team that has been working on mobile imaging, especially on mobile computational photography and mobile augmented reality. During 2004-06 he was a visiting scientist at MIT, before that he headed Nokia's graphics technology, research, and standardization (he also wrote a book on OpenGL ES and M3G). He is an adjunct faculty at University of Oulu, has a PhD from University of Washington and an MBA from University of Oulu. Before Nokia Kari worked at Stanford University (on Digital Michelangelo Project), Alias|Wavefront, SGI, and Microsoft. He was a guest editor at IEEE Computer Graphics & Applications, is in the editorial board of Computers and Graphics, and is the co-chair for Eurographics 2010.

**Title:** Perception for Manipulation in Robotics with OpenCV **Presenter:** Dr. Gary Bradski **Summary of the Talk:** I will give an overview of the Open Source Computer Vision library, where it is and where its going in terms of complete processing pipelines in 2D features, object recognition, visual odometry, image stitching and others. I will then show some of the current uses of OpenCV in Willow Garage's PR2 robot and in Willow's Teleop robot. I will end with a discussion of a new initiative I am launching in computer vision: Solved Problems in Vision Challenge that has a focus on enabling new robotics functionality via fostering robust



perception capabilities. **Short Bio:** Dr. Gary Rost Bradski is a Senior Scientist at Willow Garage. Gary leverages his experience in robotics, machine learning and computer vision research at Stanford University's AI Lab to Willow Garage's personal robot and the autonomous vehicle programs. Dr. Bradski holds a joint appointment as Consulting Professor in Stanford University's Computer Sciences Department and has more than 50 publications, along with 13 issued patents and 18 pending. He brings more than 15 years of research and robotics experience to Willow Garage. Previously responsible for the Open Source Computer Vision Library (OpenCV) that is used globally in research, government and commercial

applications, Dr. Bradski has also been responsible for the open source statistical Machine Learning Library and the Probabilistic Network Library. More recently Dr. Bradski led the vision team for Stanley, the Stanford robot that won the DARPA Grand Challenge autonomous race in 2005 and most recently helped found the Stanford Artificial Intelligence Robot (STAIR) project under the leadership of Professor Andrew Ng. Dr. Bradski recently published a new book for O'Reilly Press: [Learning OpenCV: Computer Vision with the OpenCV Library](#) [8]

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- [ECVW09](#) [9]
- [ECVW08](#) [10]
- [ECVW07](#) [11]
- [ECVW06](#) [12]
- [ECVW05](#) [13]

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