computer graphics & vision
Inffeldgasse 16/2, A-8010 Graz
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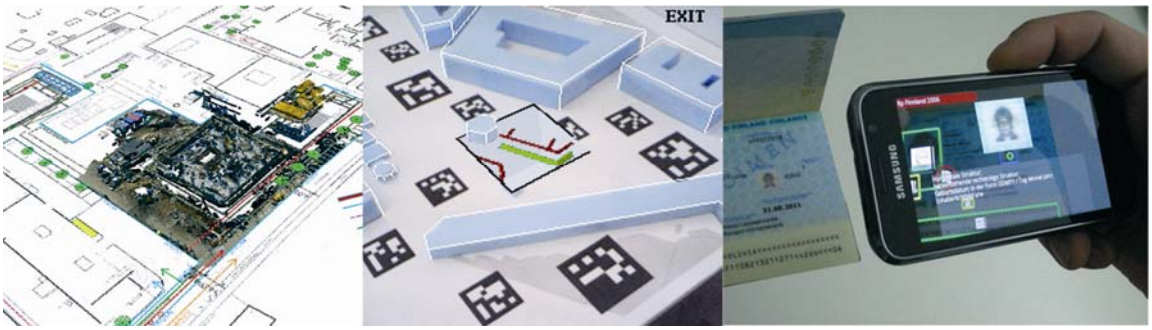
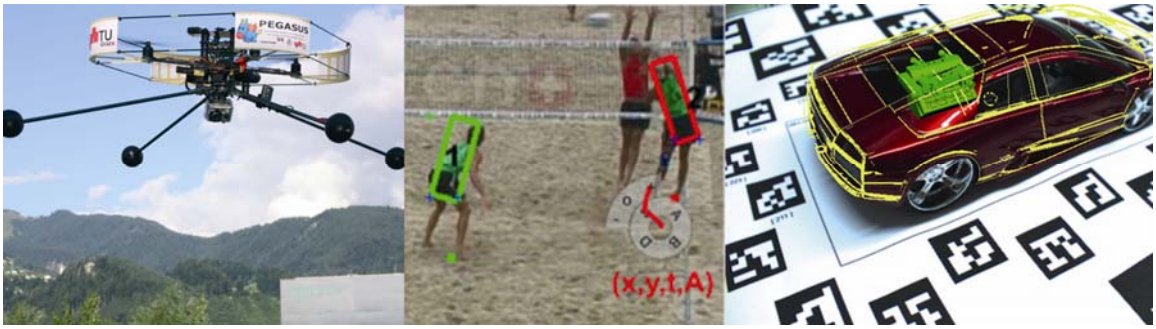


1992 – 2012

20 Year Anniversary

Institute for
Computer Graphics and Vision

Graz University of Technology



4 October 2012

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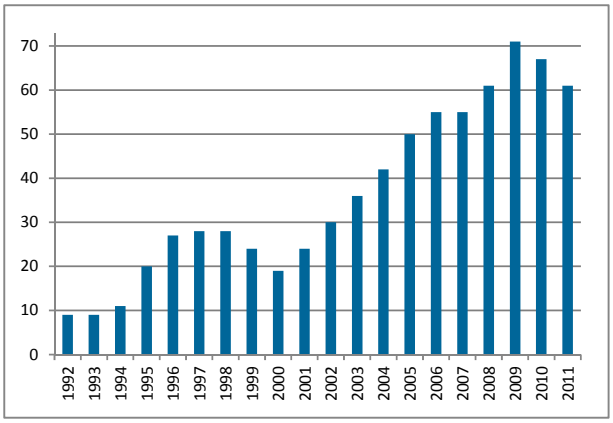
The Institute of Computer Graphics and Vision is celebrating its 20 year anniversary.

We are the only Austrian academic group with the charter to address both Computer Vision and Computer Graphics, and are carefully nurturing a culture of Digital Visual Information Processing to resolve the artificial boundaries between Computer Graphics and Computer Vision. Our research is focused on Computer Graphics, Visualization, Medical Computer Vision, Object Recognition, Object Reconstruction, Robotics, Virtual Reality and Augmented Reality.

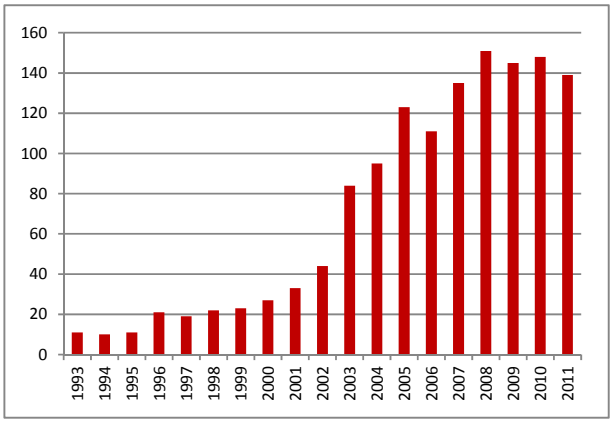
O.Univ.-Prof. Dipl.-Ing. Dr.techn. Franz Leberl
Univ.-Prof. Dipl.-Ing. Dr.techn. Horst Bischof
Univ.-Prof. Dipl.-Ing. Dr.techn. Dieter Schmalstieg
Univ.-Prof. Dipl.-Ing. Dr.techn. Gerhard Reitmayr

Staff Members



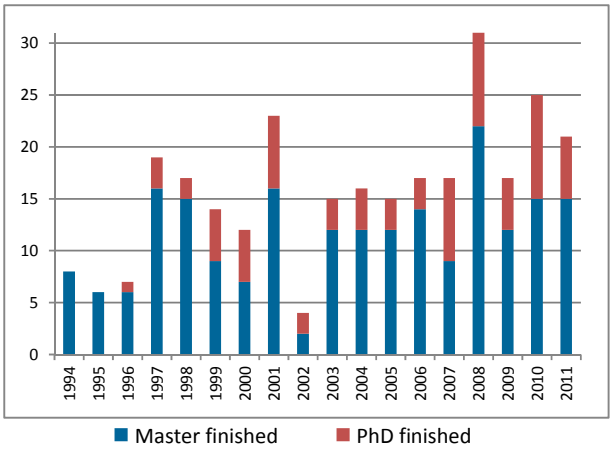
In the last 20 years, 191 persons were employed with us. Furthermore we had 34 guest researchers, 31 young women at internships and 16 international stipends.

Publications



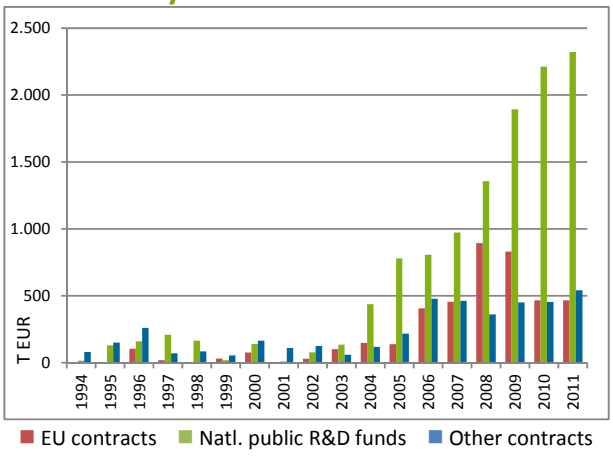
1352 Publications were written and submitted to various journals and conferences such as CVPR, ECCV, ICCV, ISMAR, IEEE VisWeek, ACM CHI, ACM-SIGSPATIAL, just to name a few.

Theses



In the last 20 years we have completed 208 Master theses and 86 doctoral projects. Additionally, there are currently 27 Master theses and 40 PhD theses in progress.

Soft Money

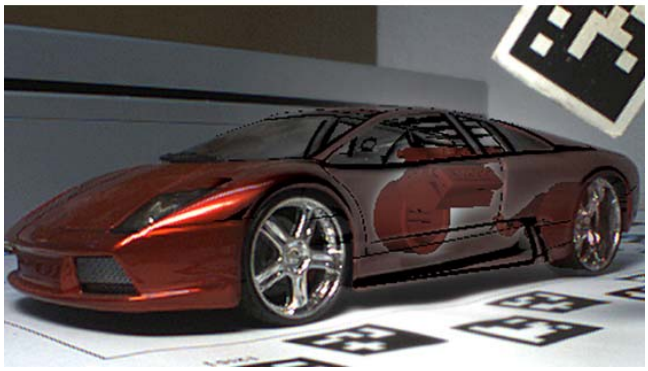


In total we have a turnover of EUR 20.3 Mio on soft money for the last 20 years. The average yearly turnover in the last years (2007-2011) was EUR 2.8 Mio.

Mobile Augmented Reality…

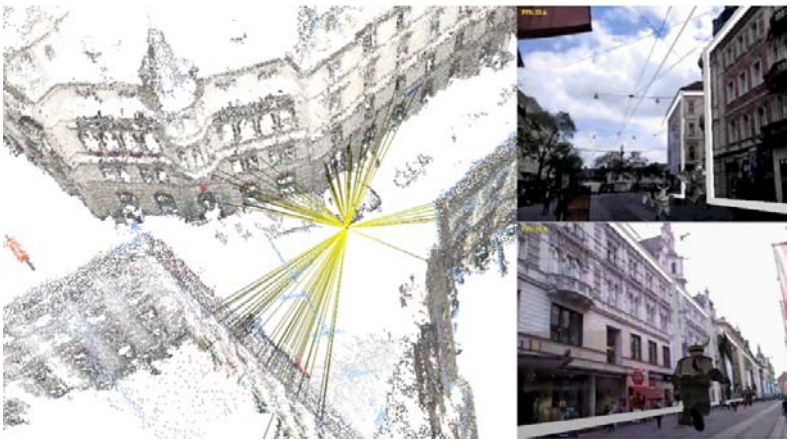
…is the topic of the Christian Doppler Laboratory for Handheld Augmented Reality, one of the premier research groups for mobile Augmented Reality. Augmented Reality is a promising interface technology, changing the way we access information. Ubiquitous handheld devices such as mobile phones allow users to access information anywhere, anytime. The Handheld Augmented Reality team has made major contributions to the field of mobile Augmented Reality. We were the first to introduce Augmented Reality on PDAs in 2003 and were the first to demonstrate real-time Natural Feature Tracking on mobile phones in 2007. Our industry partner Qualcomm, a world leading provider of wireless and mobile technology, has transformed our technology into a product available to everybody as part of the Vuforia SDK.

Augmented Reality Visualization…



…is one aspect of the computer graphics side of Augmented Reality and is concerned with the problem of comprehensibly presenting supplemental information to a human user through computer-generated overlays. To provide effective graphics, we research the automatic creation of digital images which mimic traditional illustration techniques found in textbooks and manuals. Previously, such techniques were mostly targeting still image generation or desktop virtual reality. In contrast, Augmented Reality combines a user's live view of real world objects with computer generated images.

Augmented Reality Tracking…



…investigates efficient algorithms and methods to determine the location of an augmented reality system in real time for many location-based and interactive applications. The combination of computer vision-based approaches with GPS and orientation sensors produces high accuracy and robust operation. The figure shows how the position and orientation of a mobile phone in a city street can be very accurately computed from a panorama recorded on the device and a 3D model of surrounding buildings. The results are accurate computer graphics overlays such as in the images on the right.

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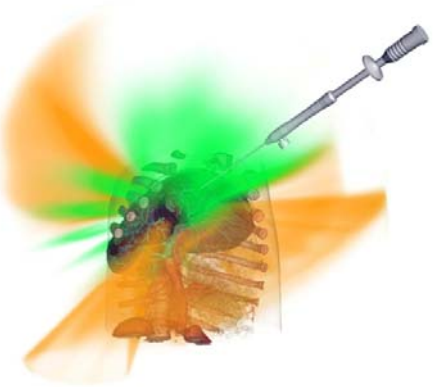
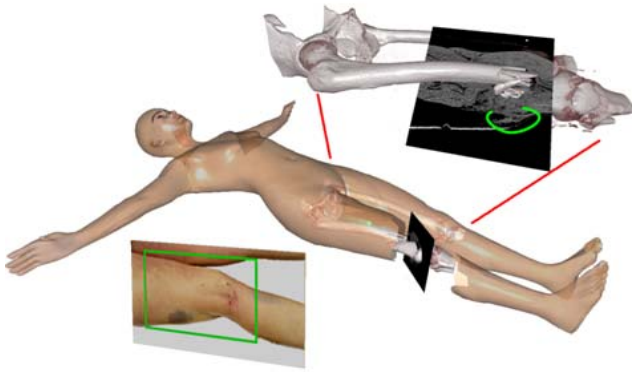
Medical Visualization…



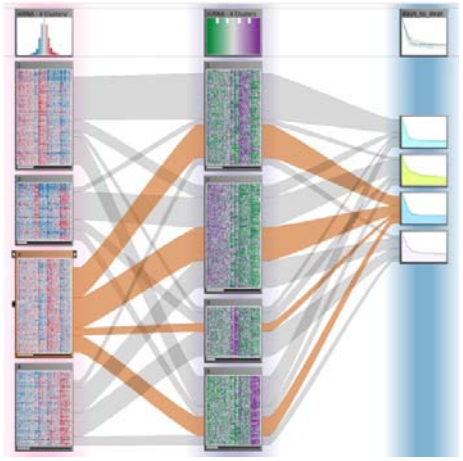
…investigates techniques to facilitate the visual analysis of complex medical imaging information by human beings. It uses computers to create 2D and 3D images from medical scans. These techniques have revolutionised medicine. Many modern medical procedures rely on 3D imaging with magnetic resonance imaging scanners or computed tomography imaging. We focus on technical aspects of real-time visualization as well as the clinical validation of the developed applications. To facilitate these tasks, we use the computational power of modern graphics processing units. For example, virtual liver surgery helps to optimize intervention planning. Virtual ultra-sound and laparoscopic prototypes help to train novice physicians on new clinical methods. Combined simulation and visualization of different ablation strategies increase the success rate of minimally invasive cancer treatment. The image shows an example for a successful application of medical visualization. This technique helps to find the best possible access paths to a malicious structure in the liver and shows also the possible leeway for the interventionist at the same time.

Medical Computer Vision…



…is concerned with developing algorithms for post-processing of X-ray, Computed Tomography (CT) and Magnetic Resonance (MR) image data sets. A number of successful projects have been performed, ranging from basic methodological research on statistical shape model segmentation, extraction of vascular structures, and deformable registration of data sets at distinct time-points, to very innovative examples of applied research, like automated detection and quantification of rheumatoid arthritis, or virtual reality and augmented reality interfaces for liver surgery planning. The latter project has received a lot of international attention. Recently, our research is focused on a project with the Ludwig-Boltzmann Institute for Clinical Forensic Imaging, where our aims are the analysis, segmentation/quantification and in-court presentation of 3D MR and CT data from forensic cases.

Information Visualization…



…is the topic of the InfoVis team, researching how large amounts of abstract data can be effectively analyzed and explored by visual means. We focus on genetics data and work closely with medical doctors and biologists in finding the genetic causes of complex diseases such as cancer. The main challenge researchers face when analyzing genetics data is its size and complexity. An analysis has to consider data from five to ten different sources with more than 10 million data points each - several thousand values for each gene in our genome. We research how to display such vast amounts of data, how to guide users to relevant parts and how complex relationships in such datasets can be shown. The InfoVis team not only performs basic research but develops and maintains an open-source visualization framework - Caleydo - which is used worldwide for analyzing genetic data.

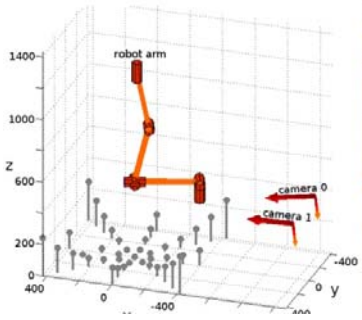
User Interfaces…

…are the space where the interaction between humans and machines occurs. The most common interface for operating with computers is by using windows, menus and a pointer. Our research not only targets traditional setups of a user sitting in front of one - or multiple - screens, we consider every surface to be a possible display, creating a flexible, interactive environment for team work, conference and meeting rooms. For doing so, we have to integrate more flexibility into the operating system. We do not treat windows as basic rectangular shapes but also integrate knowledge about their content and about the environment where they are displayed. This also allows us to use unimportant window and display space for interaction. The image shows a traditional windowing system on the left - our user interface on the right allows one to interact with otherwise occluded content and automatically displays the most important content for the user's current task.

Aerial Vision…

…research addresses visual navigation for micro aerial vehicles and large-scale aerial 3D reconstruction. We bridge the gap between computer vision and aerial robotics with a flight park of currently two quad-rotor and one octo-rotor helicopter, equipped with cameras and on-board computing hardware. We have recently presented significant advances in localization and control based on visual features, online and offline Structure-from-Motion, next view planning, and dense stereo reconstruction. Moreover, we closely collaborate with industrial partners to solve challenging problems in the areas of powerline inspection, construction site monitoring and dense 3D city modeling.

Robot Vision…



…deals with teaching a robot to process visual information, i. e., to "see". We conduct application-driven projects in Optical Metro-logy, Optical Quality Inspection, Mobile Robotics and Industrial Robotics. The overall research goals are mainly given by the development of highly accurate and robust image based measurement methods and algorithms as well as by the design and construction of novel image acquisition systems and measurement instruments. We thus work on several projects in close collaboration with industrial partners.

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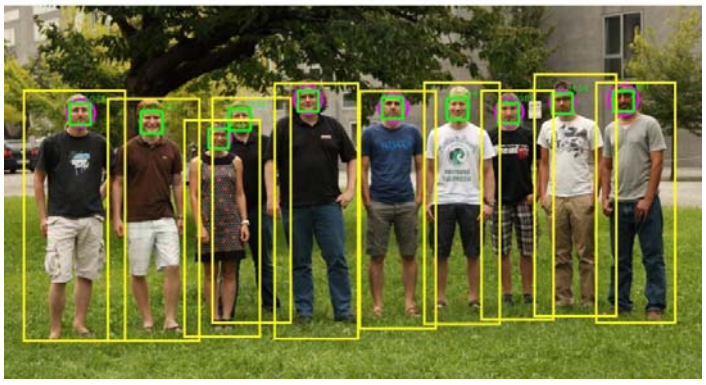
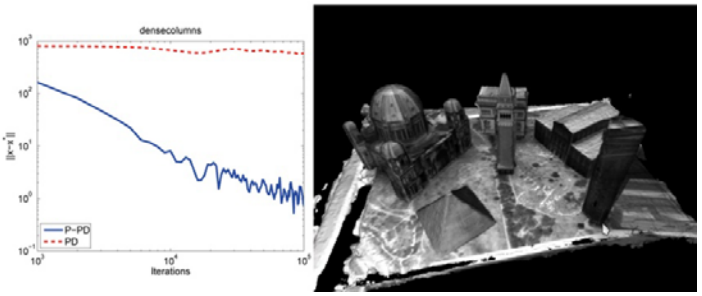
Learning, Recognition, Surveillance…



…deals with topics mainly concerned with visual Learning. Thus, the research goals are on the one hand to adopt existing machine learning techniques in computer vision, on the other hand to develop and establish new methods coping with particular constraints given by image and video data. From the technical point of view, the main research directions are in the context of support vector machines, boosting, decision trees, and metric learning with particular emphasis to online learning and handling of unlabeled data. These techniques are applied to object detection and tracking, person re-identification, action and face recognition. The approaches are not limited to these specific applications and can be applied to more general image and video categorization or even to non-vision related classification tasks.

Variational Methods…



…are mathematical algorithms for continuous energy minimization problems. Our guiding principle is to develop theoretically sound methods that provide excellent results for practical problems. In particular, we focus on the development of new variational models, their efficient solution using convex optimization algorithms as well as high performance implementations on massively parallel hardware. One of the main advantages of variational methods is their flexibility, which allows to apply the methods for numerous problems in computer vision, ranging from simple image restoration over real-time motion estimation to the complete 3D reconstruction of a scenes using a single webcam.

Virtual Habitat…

…is a team focusing on the topic of full reconstruction of the 3D world, i.e. how to build a 3D model of the bald earth and of the 3D natural and man-made objects on its surface, from street-side and aerial imagery. The main computer vision research goals are on efficient 3D modeling from digital images and on complete scene understanding, i. e., how to recognize, localize and segment individual object categories in images. The group extensively analyzed the role of shape in these fields, contributing state-of-the-art methods in diverse computer vision fields like object detection and semantic segmentation. A special emphasis of the group lies on large scale analysis, potentially analyzing millions of images as provided by internet search engines.

Industrial Project Partners

3GSM GmbH
Alicona Imaging GmbH
Audi AG
Austrian Institute of Technology GmbH
AVL List GmbH
Bongfish GmbH
Borealis
Deutsche Bundesdruckerei GmbH
Daimler AG
DIAS Infrared GmbH
Efkon AG
Frequentis AG
Funder Industrie GesmbH
g.tec medical engineering GmbH
Greenfinn Technologies
Hilti AG
HS-Art Digital Service GmbH
Image Diagnost International GmbH
Imagination Computer Services GmbH
Infineon Technologies Austria AG
JCL Logistics
Joanneum Research Forschungs GmbH
Kiwi Security GmbH
Knapp AG
Laser 2000 GmbH
Lego System A/S
M & R Automation GmbH
Meixner Vermessung ZT GmbH
Microsoft Photogrammetry
MVTec Software GmbH
next Sense Mess- und Prüfsysteme GmbH
NUMA Engineering Services Ltd
ÖBB-Infrastruktur AG
OMICRON electronics GmbH
Perception Park - DI(FH) Markus Burgstaller e.U.
Photonfocus AG
Play.FM GmbH
Qualcomm Inc.
Rauscher GmbH
Robert Bosch AG
Salzburg AG
Siemens AG Österreich
SimVis GmbH
Skidata AG
SLR Engineering OG
Sony Net Services GmbH
Spraylight GmbH
SSI Schäfer Peem GmbH
Stemmer Imaging GmbH
STI International
Traficon
Ubisense Ltd.
Velox Werk GmbH
Vexcel Corporation
Vexcel Imaging GmbH
Westcam Projektmanagement GmbH
Wien Energie
Wikitude GmbH

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Awards and Distinctions

[1992] **NASA Achievement Award for Magellan Science** *F. Leberl*
[1996] **Fellow of the IEEE** *F. Leberl*
[1998] **BMVC Best Demonstration Award** *H. Borotschnig*
[2000] **ÖAGM Best Presentation Award** *R. Bolter, F. Leberl*
[2000] **EUSAR Best Presentation Award** *R. Bolter, F. Leberl*
[2000] **ASPRS Presidential Citation** *F. Leberl*
[2001] **ÖAGM Best Paper Award** *J. Bauer*
[2003] **NOVA Award by the Construction Industry Forum** *F. Leberl*
[2003] **ASPRS Certificate of Appreciation** *F. Leberl*
[2003] **ECR Magna Cum Laude Award**
E. Sorantin, G. Werkgartner, R. Wegenkittl, A. Fuhrmann, R. Beichel, M. Riccabona
[2003] **Eurographics Medical Prize**
A. Bornik, R. Beichel, B. Reitinger, E. Sorantin, G. Werkgartner, F. Leberl, and M. Sonka
[2004] **ECR Magna Cum Laude Award** *E. Sorantin, G. Werkgartner, R. Beichel, A. Bornik, B. Reitinger, M. Riccabona, R. Wegenkittl, A. Fuhrmann*
[2004] **ISPRS Certificate of Recognition** *F. Leberl*
[2005] **ÖAGM Best Paper Award** *F. Seifert, L. Paletta, H. Bischof*
[2006] **Grand Decoration of Honor in Silver for Services to the Republic of Austri**a *F. Leberl*
[2007] **Member of the Austrian Academy of Sciences, Young Academy** *D. Schmalstieg*
[2007] **IEEE ISMAR Best Student Paper Award** *D. Kalkofen, E. Mendez, D. Schmalstieg*
[2007] **DAGM Main Prize** *C. Zach, T. Pock, H. Bischof*
[2007] **BMVC Best Science Paper Prize** *R. Donner, G. Langs, H. Bischof*
[2007] **RIVF Best Paper Award** *T. Nguyen, H. Grabner, H. Bischof*
[2007] **CVWW Best Paper Award** *M. Winter, S. Ober, C. Arth, H. Bischof*
[2007] **IEEE CVPR Embedded Computer Vision Best Paper Award** *C. Arth, C. Leistner, H. Bischof*
[2008] **ICPR Best Scientific Paper Award** *H. Bischof, M. Donoser*
[2008] **IEEE CVPR Biometrics Best Paper Award** *R. Surinder, J. Birchbauer, H. Bischof*
[2008] **IEEE ISMAR Best Paper Award**
D. Wagner, G. Reitmayr, A. Mulloni, T. Drummond, D. Schmalstieg
[2009] **Dr. Wolfgang Houska Preis Award Nomination** *G. Schall, D. Schmalstieg*
[2009] **ÖAGM Best Student Paper Award** *H. Riemenschneider, M. Donoser, H. Bischof*
[2009] **IEEE ISMAR 2011 Best Demo Award** *Q. Pan, G. Reitmayr, T. Drummond*
[2010] **ACM-SIGSPATIAL Best fast forward presentation** *P. Meixner, F. Leberl*
[2010] **IEEE AVSS Best Scientific Paper Award** *P. Roth, Horst Bischof*
[2010] **ÖAGM Best Paper Award** *P. Kontschieder, M. Donoser, H. Bischof*
[2010] **Graphics Interface Best Student Paper Award** *A. Lex, W. Puff, M. Streit, M. Waldner, D. Schmalstieg*
[2001] **PIA Best Poster Award** *P. Meixner, F. Leberl, M. Brédif*
[2011] **IEEE CVPR Aerial Video Processing Best Paper Award** *A. Wendel, A. Irschara, H. Bischof*
[2011] **ICVSS Best Oral Presentation** *A. Wendel*
[2011] **ACM CHI Honorable Mention Award** *M. Waldner, M. Steinberger, R. Grasset, D. Schmalstieg*
[2011] **ACM NPAR Best Paper Award**
S. Hauswiesner, B. Kainz, M. Steinberger, R. Khlebnikov, D. Schmalstieg
[2011] **IEEE InfoVis Best Paper Award** *M Steinberger, M. Waldner, M. Streit, A. Lex, D. Schmalstieg*
[2011] **IEEE ISMAR Best Demo Award** *M. Swoboda, T. Nguyen, U. Eck, G. Reitmayr, S. Hauswiesner, R. Ranftl, C. Sandor*
[2012] **IEEE VGTC Virtual Reality Technical Achievement Award** *D. Schmalstieg*
[2012] **ASPRS Outstanding Technical Achievement Award** *F. Leberl*
[2012] **EuroVis 3rd Best Paper Award**
A. Lex, M. Streit, H.-J. Schulz, C. Partl, D. Schmalstieg, P. Park, N. Gehlenborg
[2012] **DAGM ÖAGM Main Prize** *M. Köstinger, P. Roth, H. Bischof*
[2012] **BMVC Best Demo Prize**
C. Hoppe, M. Klopschitz, M. Rumpler, A. Wendel, S. Kluckner, H. Bischof, G. Reitmayr
[2012] **ISPRS Brock Gold Medal** *F. Leberl*
[2012] **IEEE ICRA Runner-up for Best Video Award**
M. Maurer, M. Rumpler, A. Wendel, C. Hoppe, A. Irschara, H. Bischof