Preface

The research field of *Visual Computing* encompasses everything graphical in computer science – from the synthesis and processing of graphical content to its human consumption. This broad spectrum includes multiple other fields that constitute research disciplines in their own right, such as perception, visualization, multimedia, virtual and augmented reality, as well as human-computer-interaction. The first International Summer School on Visual Computing held from August 17-21, 2015 at the Fraunhofer IGD Rostock, Germany aimed to give an overview of this broad field to graduate students from Rostock, Germany, and abroad. A week-long program of lectures and research talks by invited speakers introduced participating students into the subjects of visual perception and cognition, eye tracking, raster image databases, multimedia retrieval, computer vision, human-computer-interaction, mobile and wearable computing, and visual analytics. Each afternoon, the participating students had the opportunity to present their own research in posters and talks. Sessions with helpful tips and tricks on how to go about PhD level research, writing, and presentation, as well as an open lab tour rounded off the summer school program.

The post-conference proceedings at hand contain a selection of the research presented by the participants during that week. The 13 papers are grouped into three thematic sections: image generation, image analysis, and image usage. The following overview gives an impression of the breadth of topics they cover.

Part I: Image Generation contains five papers that concern themselves with technical issues and best practices of producing 3D and 2D images. In the first paper, S. Dübel et al. propose a novel flexible ray tracing architecture for terrain heightfields. Unlike conventional fixed pipelines, their architecture is able to renegotiate the tradeoff between rendering quality, rendering time, and available resources as needed. While this approach focuses on the technical aspects of rendering surfaces, the second paper by K. Furmanová addresses conceptual issues of visualizing two surfaces for their interactive comparison. In her case, these surfaces are facial scans that deviate in some parts and align in others, and she explores different means of superimposing these surfaces. The third paper in this part by K. Blumenstein et al. takes the challenge of display scalability to the number of screens and asks what to visualize on a second screen, such as a tablet, if one is available as an additional display device besides a regular TV set. There are a number of interesting technical questions involved in this setup, such as how to synchronize the TV's content with the content shown on the second screen. These are unique issues in the context of visualization and as such require novel solutions. The same holds true when employing visualization in different application domains, as it is exemplified by the fourth paper by C. Niederer et al. They surveyed the state of the art in visualizations for dynamic, weighted, directed, multimodal networks with a particular emphasis on visualizations used in data-driven journalism. In passing, their survey also updates existing surveys on dynamic graph visualization with the latest publications and developments

in this area. Finally, J. Haider et al. give insight into best practices of developing visual analytics solutions from a comprehensive user study that was conducted in the UK. While the identified best practices were derived mainly for the scenario of comparative case analysis in criminal investigations, they are generalizable to the point of being valuable requirements that are applicable to the design of visual analytics solutions in other areas as well.

Part II: Image Analysis features four papers that contribute to the areas of image reconstruction, segmentation, restoration, and recognition. The first paper by T. Dolereit deals with refractive effects that impair the reconstruction of underwater structure from a stereo camera system. For doing so, the author infers additional constraints on the position and orientation of the refractive surface from the physically correct tracing of light rays. In addition to refraction, underwater images are often blurred, because of light scattering due to light attenuation and absorption. The second paper by F. Farhadifard aims to post-process such degraded images using a learned look-up scheme that does not require any prior knowledge about the scene or the water quality. The paper compares the effect of two different look-up schemes, so called dictionaries, that were generated for in-air images and underwater images, respectively. While these papers present image analysis techniques that operate on static images, the third paper by M. Radolko takes on the challenge of analyzing videos with the aim of separating foreground objects from a scene's background. To this end, it proposes an efficient implementation of a background subtraction algorithm that is evaluated with two different spatial models that incorporate assumptions about smooth regions in the scene. Lastly, the fourth paper in this part by A. Dadgar investigates how to detect hand gestures in image sequences. It gives an overview of Hidden-Markov-Model-based gesture recognition approaches and proposes two alternative approaches that hold the promise to overcome the difficulties that these approaches have with hand gesture recognition.

Part III: Image Usage is comprised of four papers that deal with the human factors of utilizing images for various tasks. The first paper by N. Flad et al. takes a measuring approach to gain insights into the information sampling and processing behavior of humans: The authors use eye-tracking and electroencephalography (EEG) to gather data about the sensation and cognition of visual stimuli. In their paper, the authors discuss a number of confounding factors in such data and in particular the side effects of the eye-tracking on the EEG results and how to clean the data from the resulting artifacts. Measurements play also central role in the second paper by J. Trimpop et al., which outlines a concept and architecture for a smart health support system that is based on sensor information gathered with a smartwatch. Depending on the use case scenario for this system, different functionalities are provided – e.g., emergency call features for the elderly, as well as fitness tracker features and accompanying visualizations for the younger generation. Different generations also play a role in the third paper by D. Matthies and A. Meier, which investigates the interaction between pedestrians and technology during navigation tasks. They find that even in the age of smartphones with GPS positioning, many people rely alternatively on

landmarks and street signs, which are thus important features to consider when designing visual navigation aids. The paper by R. Alm and S. Hadlak concludes this part by showcasing a method for integrating and managing textual and pictorial annotations with a focus on manufacturing processes. Their method makes use of an ontological representation to derive contextually relevant annotations to show in certain situations.

For most participants, the paper they wrote for these proceedings was their first scientific paper. Yet from reading through them one could not tell. To a substantial part, this is due to an intensive revision cycle in which the board of reviewers has gone out of its way by providing quality feedback in a short time span, as well as the authors by incorporating the feedback to improve their papers. Together, these papers give an impressive overview of the excitement and incredible drive of the next generation of visual computing researchers that comes with new ideas and new technologies. We are proud that our summer school helped to further shape these ideas and to spark this excitement by giving input and fostering future cooperation between the participants. We wish them the best for their research careers!

Hans-Jörg Schulz, Bodo Urban, and Uwe Freiherr von Lukas

Participants, organizers, and guests of the International Summer School on Visual Computing 2015 in front of the Fraunhofer IGD Rostock.