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FOR COMPUTER GRAPHICS

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Preface

This issue of the Computer Graphics Forum contains the technical full papers program of the Eurographics Association 44th annual conference, held in Saarbrücken, Germany from May 8th-12th 2023. The Eurographics annual venue presents a unique opportunity to present outstanding technical contributions in computer graphics. The full papers selected for publication in the Computer Graphics Forum journal are arguably the most prestigious feature of the conference.

The technical paper selection process involved a group of 68 experts forming the International Program Committee (IPC). We invited experts without more than three consecutive years of participation in the IPC, so that the committee can be regularly renewed. We received a total of 111 full submissions. A sorting committee, consisting of the two Chairs and five advisory board members (Pierre Alliez, Theodore Kim, Sylvain Lefebvre, Belen Masia, Michael Wimmer), subsequently assigned each paper to two IPC members, as either primary or secondary reviewer, up to five papers, respecting to their preferences, expertise, conflicts, and automatically computed matching scores between IPC members and submitted papers. The primary and secondary reviewers in turn invite three additional tertiary reviewers on each submission.

After the initial five reviews per submission were collected, the authors had seven days to consult these reviews and write a 1000-word rebuttal, addressing key questions and potential misinterpretations. Two submissions were withdrawn by their authors who decided to forgo the rebuttal. Finally, all reviewers assigned to a paper read the rebuttal and all reviews and together reached an initial decision.

This year, we continued a tradition that began in 2012 and has since been continuously improved. Instead of holding an in-person IPC meeting, we opted for a one-week virtual asynchronous meeting. The IPC members engaged in off-line discussions via a bulletin board and other forms of personal communication, resulting in thorough deliberations about the papers and reviews, with other IPC members acting as additional readers when necessary. Each paper had a discussion board, and every IPC member contributed to the discussions that they felt qualified to participate in, resulting in extensive debates. Other IPC and advisory board members were acting as additional readers when necessary.

All papers conditionally accepted with minor revisions went through a short second review cycle, with evaluations from the primary reviewer, and sometimes the secondary reviewer, before being finally accepted. In the end, 34 papers out of the 111 full submissions were accepted with minor revisions for a 30.06 with major revisions to be considered for publication in a future issue of Computer Graphics Forum (CGF). In addition to the full papers submitted directly to Eurographics, the full paper program includes 12 papers to be presented from the CGF highlighting the synergy between Eurographics and CGF. This year we had papers on a diverse range of topics including machine learning, neural rendering, generative modeling, computational photography, geometry, meshes, appearance and shading, texture, rendering, 3D scans analysis, physical simulation, visualization, human animation and motion capture, simulation of clothes and crowds, editing, 3D printing, fabrication.

All accepted full papers are published as open-access Computer Graphics Journal papers. It is worth noting that for all submissions conflict-of-interest was managed on all levels, from reviewers, committee, advisory board, best paper committee, up to the chairs. The review process was double-blind and in case the original set of reviewers did not conclude with a decision, additional reviewers were invited to perform a full review and assist the decision process.

We extend our sincere gratitude to all those who contributed to making this possible. First and foremost, we are grateful to all the members of the IPC who dedicated a remarkable amount of their time to finding tertiaries, reviewing and discussing papers, and subsequently shepherded the accepted papers undergoing the minor revision cycle. We wish to thank all the reviewers, who provided 564 high-quality and thoughtful reviews and, of course, all the authors for their efforts in preparing and revising the submitted papers. We are especially grateful to Michael Wimmer who shared with us the insights from previous years and was indefatigable with his help and assistance. We would like to express strong appreciation to the advisory board for their support with paper sorting, help with emergency reviews, and their participation in the virtual IPC meeting. Lastly, we thank Stefanie Behnke from Eurographics Publishing for her remarkable support in managing SRM functionality and her responsiveness, which played a critical role in the successful paper selection process. As for the on-site conference in Saarbrücken, we were thrilled that a significant proportion of the computer graphics community could come together once more, fostering an environment that would inspire future computer graphics research.

We are very happy to present the full paper proceedings of Eurographics 2023. We believe that these papers reflect the extraordinary variety of computer graphics research and its best contributions. It was both an honor and a pleasure for us to lead this selection process and we hope that you will find both the papers and the entire conference thought-provoking and inspiring of your future endeavors.

Karol Myszkowski and Matthias Niessner
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Eurographics Outstanding Technical Contribution Award 2023: Michael Wimmer

Prof. Michael Wimmer heads the Rendering and Modeling Group at the Technical University of Vienna and leads the Center for Geometry and Computational Design. He is also the Special Research Program "Advanced Computational Design" coordinator. He received his Ph.D. in Computer Science from TU Wien in 2001. He was elected a Fellow of the EUROGRAPHICS Association in 2018.

Michael Wimmer has made several pioneering contributions in advancing the field of computer graphics through his research in real-time rendering, physically based rendering, computer games, point-based graphics, procedural modeling, shape modeling, and computational fabrication. He is one of the early pioneers in point-based graphics and procedural modeling of cities. He received the Eurographics Best Paper award for the "Instant Visibility" work in 2001. He is well known for his seminal "Instant Architecture" paper, which eventually established the subarea of procedural modeling.

Beyond procedural and shape modeling, Michael is widely rec-

ognized for his contributions to real-time shadow rendering, where he co-authored the standard textbook on this topic. His work on visibility computation, point-based rendering, and fast algorithms for computer games have paved the way for significant advancements in the field.

Michael has recently heavily contributed to computational fabrication, combining concepts from shape modeling, form finding, and function-aware geometric optimization. His work has resulted in the development of the Center for Geometry and Computational Design.

Michael Wimmer is a prolific researcher and has published 200+ papers. He is regularly serving on major program committees and the editorial boards of many leading journals. He co-chaired the Eurographics conference in 2015 and is part of the papers advisory board for Eurographics and SIGGRAPH, and Assistant Chair of SIGGRAPH 2023.

In addition to his groundbreaking research, Michael is also an exceptional leader, heading one of Europe's most noted computer graphics groups. His leadership and guidance have enabled his team to achieve sustained and remarkable results, profoundly influencing the European research landscape. This has been foundational for both computer games and rendering-related industries.

Michael is known for his tireless and extensive community service and dedication to sharing his knowledge and ability with others. He has been a mentor and advisor to many students and young researchers, has significantly contributed to improving the organization of Eurographics at various levels, and his contributions to the community continue to have a lasting impact on the field of computer graphics.

Eurographics is pleased to recognize Michael Wimmer with the 2023 Outstanding Technical Contributions Award.

Eurographics Young Researcher Award 2023:
Simone Melzi

Simone Melzi receives the EUROGRAPHICS Young Researcher Award 2023 for his outstanding and multi-faceted contribution to geometry processing and 3D shape analysis.

Simone is a tenure track Assistant Professor at the University of Milano-Bicocca, Dept. on Informatics, Systems and Communication (DISCo). He did his Ph.D. at the University of Verona in 2018 and spent time as a postdoc at La Sapienza University, Ecole Polytechnique, and the University of Verona.

Simone has done outstanding and impactful research in the broader area of geometry processing and 3D shape analysis, at the intersection with artificial intelligence. Here, Simone contributed several highly innovative and widely cited works on spectral shape processing, functional maps, shape correspondence, and general shape processing. In particular, in his later work, he contributed state-of-the-art machine learning-based solutions to the aforementioned highly challenging research problems. In his very early work, he also made widely cited contributions to hard computer vision problems, e.g. visual object tracking.

Simone received several prestigious awards for his work, such as a Marie-Curie Individual Fellowship in 2020 and the EUROGRAPHICS Italy Ph.D. Award. His work was published in a high number of top-tier conferences and journal papers in computer graphics, computer vision, and machine learning. He has already contributed to the scientific management of many scientific events, under the role of IPC member and chair.

EUROGRAPHICS is pleased to recognize Simone Melzi with the 2023 Young Researcher Award.

Eurographics Young Researcher Award 2023:
Ana Serrano

Ana Serrano receives the EUROGRAPHICS Young Researcher Award 2023 for her outstanding and multi-faceted contributions to virtual reality, computational imaging and material appearance perception.

Ana is a tenure track Assistant Professor at the University of Zaragoza, Spain. She obtained her Ph.D. from the University of Zaragoza in 2019 and spent time as a postdoc at the Max-Planck Institute for Informatics.

Ana has greatly impacted the research in virtual reality, especially on perceptually-related issues and users' interaction with VR. She has a widely cited paper on this topic that investigates saliency in VR. Ana has also introduced a generative model for realistic scan paths of 360 images, that model how users explore a VR environment. This paper has received the best journal paper award at IEEE VR 2022. Another impactful topic that Ana has worked on is movie editing in VR and its effects on the perception of continuity. Ana additionally has influential papers on perception-based material modeling, including gloss management, and the effects of shape and illumination on the perception of material appearance.

Ana has received several prestigious awards for her work, including an Nvidia graduate fellowship, the Ph.D. award by the University of Zaragoza, the Eurographics Ph.D. award, and some best paper awards. Her work was published in a high number of top tier conferences and journal papers in computer graphics, computer vision and virtual reality. She has served as a technical paper committee member in the main computer graphics venues.

EUROGRAPHICS is pleased to recognize Ana Serrano with the 2023 Young Researcher Award.

Zooming into the Details

Elmar Eisemann

TU Delft

Abstract

For realistic image synthesis, simulating complex environments in all detail can lead to prohibitive rendering costs. In visual analytics, large-scale datasets pose significant challenges for analysis, and a simple subsampling can result in missing structures. While seemingly different contexts, both scenarios require scalable solutions. In this talk, we will discuss several principles to handle complexity and will show examples for how data representations, algorithms, but also perception can be key in overcoming such computationally intensive challenges.

Biography

Elmar Eisemann is a professor at TU Delft, heading the Computer Graphics and Visualization Group. Before he was an associated professor at Telecom ParisTech (until 2012) and a senior scientist heading a research group in the Cluster of Excellence (Saarland University / MPI Informatik) (until 2009). He studied at the Ecole Normale Superieure in Paris (2001-2005) and received his PhD from the University of Grenoble at INRIA Rhone-Alpes (2005-2008). He spent several research visits abroad; at the Massachusetts Institute of Technology (2003), University of Illinois Urbana-Champaign (2006), Adobe Systems Inc. (2007,2008).

His interests include real-time and perceptual rendering, visualization, alternative representations, shadow algorithms, global illumination, and GPU acceleration techniques.

He coauthored the book "Real-time shadows" and participated in various committees and editorial boards. He was local organizer of EGSR 2010, 2012, HPG 2012, and paper chair of HPG 2015, EGSR 2016, GI 2017, and general chair of Eurographics 2018 in Delft. His work received several distinction awards and he was honored with the Eurographics Young Researcher Award 2011 and the Netherlands Prize for ICT Research 2019.

A Trip Down the Generative Neural Graphics Pipeline

Gordon Wetzstein

Stanford University

Abstract

Generative neural radiance fields offer unprecedented capabilities for photorealistic scene representation, generation, novel-view synthesis, among other tasks. In this talk, we discuss expressive scene representation network architectures, efficient neural rendering approaches, and generative AI strategies that allow us to create photorealistic multi-view-consistent digital humans.

Biography

Gordon Wetzstein is an Associate Professor of Electrical Engineering and, by courtesy, of Computer Science at Stanford University. He is the leader of the Stanford Computational Imaging Lab and a faculty co-director of the Stanford Center for Image Systems Engineering. At the intersection of computer graphics and vision, artificial intelligence, computational optics, and applied vision science, Prof. Wetzstein's research has a wide range of applications in next-generation imaging, wearable computing, and neural rendering systems.

Prof. Wetzstein is a Fellow of Optica and the recipient of numerous awards, including an NSF CAREER Award, an Alfred P. Sloan Fellowship, an ACM SIGGRAPH Significant New Researcher Award, a Presidential Early Career Award for Scientists and Engineers (PECASE), an SPIE Early Career Achievement Award, an Electronic Imaging Scientist of the Year Award, an Alain Fournier Ph.D. Dissertation Award as well as several Best Paper and Demo Awards.

Capturing, Compressing, and Creating Neural Radiance Fields

Ben Mildenhall

Google

Abstract

Over the past few years, neural volumetric rendering has proven to be a flexible and useful framework for a wide variety of 3D reconstruction and inverse rendering scenarios. In this talk, I will discuss our work toward creating and engaging with high-quality digital 3D content. To start, we extend NeRF's ability to capture larger and richer spaces, allowing for the realistic recreation of full immersive environments. Given that these high-fidelity models can be slow to render, we also investigate methods for real-time rendering on consumer hardware. Finally, we explore how it is possible to harness the power of 2D generative models to create new 3D content from only a text prompt.

Biography

Ben Mildenhall is a research scientist at Google, where he works on problems at the intersection of graphics and computer vision, specializing in view synthesis and inverse rendering. He completed his PhD in computer science from UC Berkeley in 2020, advised by Ren Ng and supported by a Hertz Fellowship, and received the ACM Doctoral Dissertation Award Honorable Mention and David J. Sakrison Memorial Prize for his thesis work on neural radiance fields. He has received Best Paper Honorable Mentions at ECCV 2020, ICCV 2021, and CVPR 2022.

From Curved to Flat and Back Again: Mesh Processing for Fabrication

Mirela Ben-Chen

Technion

Abstract

Assume that for a craft project you were given a task: create a (doubly) curved surface. What are your options? With applications varying from art and space exploration to health care and architecture, making shapes is a fundamental problem. In this talk we will explore the challenges of creating curved shapes from different materials, and describe the math and practice of a few solutions. We will additionally consider the limitations of existing approaches, and conclude with a few open problems.

Biography

Prof. Ben-Chen is an Associate Professor at the Center for Graphics and Geometric Computing of the CS Department at the Technion. She received her Ph.D. from the Technion in 2009, was a Fulbright postdoc at Stanford from 2009-2012, and then started as an Assistant Prof. at the Technion in 2012.

Prof. Ben Chen is interested in modeling and understanding the geometry of shapes. She uses mathematical tools, such as discrete differential geometry, numerical optimization and harmonic analysis, for applications such as animation, shape analysis, fluid simulation on surfaces and computational fabrication. She has won an ERC Starting grant, the Henry Taub Prize for Academic Excellence, the Science Prize of the German Technion Society and multiple best paper awards.