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Vision, Modeling, and Visualization

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Invited Speaker

Visual Analytics: Machine Learning and the Human in the Loop

Anna Vilanova

Abstract

Visual Analytics wants to foster the strengths of humans and computers effectively through the combination of automatic data analysis methods, visualization, and interaction. Visual analytics is an extension of machine learning methods. It is also a complement to the already existing visualization techniques by the introduction of the concepts of reasoning and machine learning. Machine learning has successfully developed models that outperform humans in several tasks. However, this success is limited when it comes to increasing knowledge, and providing new understanding based on new data. Humans uniquely understand the world through intuition, common sense, creativity, and emotion, capabilities that are required for many multi-faceted tasks. In this talk, I will present our work and my view on embedding the human in the loop in the machine learning context through the concepts of visual analytics. In particular, we focus on data exploration, and hypothesis generation relying on dimensionality reduction methods as an effective visual analytics component for large high-dimensional data. Furthermore, I will discuss the promise, challenges, and current research in visual analytics to open the black box of machine learning models.

Biographical Note

Prof.Dr. Anna Vilanova is full professor in visual analytics (vis.win.tue.nl) since October 2019, at the department of Mathematics and Computer Science, at the Eindhoven University of Technology (TU/e). Previously she was associate professor for 6 years at the Computer Graphics & Visualization Group at EEMCS at the University of Delft, the Netherlands. From 2002 to August 2013, she was Assistant Professor at the Biomedical Image Analysis group of the Biomedical Engineering Department at TU/e. She is leading a research group in the subject of visual analytics and multivalued image analysis and visualization, focusing on visual analytics for high dimensional complex data and explainable AI. She focuses on Biomedical applications such as: Diffusion Weighted Imaging, 4D Flow and Pan-genomics. She was member of the steering committee of EuroVis (2014 -2018) and VCBM (2018-2022). She is elected member of the EUROGRAPHICS executive committee since 2015, vice president (2019-2022), and currently president of EUROGRAPHICS. She also became EUROGRAPHICS fellow in 2019. She is elected member of IEEE VIS Steering Committee (VSC) since 2021.

Invited Speaker

Boundary Diffusion Problems in Computer Graphics

Jean – Marc Thiery

Abstract

Many problems in Computer Graphics are addressed using diffusion of scalar and vectorial data from the boundary of a domain to its interior.

Such problems include shape deformation in 2D and 3D, physics simulation, image blending and cloning, texture mapping, or a variety of modeling techniques such as diffusion curves and surfaces.

We will cover in this talk the core mathematical tools (including Boundary Elements Methods, Finite Elements Methods, and random walks) that are necessary to comprehend the theory and implement some applications in practice, and discuss the merits and limitations of the most common approaches.

Biographical Note

Jean-Marc Thiery is a Senior Research Scientist at Adobe Research in Paris. Before that he was an associate professor in Computer Graphics at Telecom Paris, and a post-doctoral researcher at TU Delft. His main topics of research include Geometric Modeling, Shape Modeling, Animation and Geometry Processing. He regularly publishes his work at major conferences including SIGGRAPH, SIGGRAPH Asia, Eurographics and others.

Invited Speaker

Ultimate Visualizations in Extended Realities

Frank Steinicke

Abstract

In his essay “The Ultimate Display” from 1965, Ivan E. Sutherland states that “The ultimate display would [...] be a room within which the computer can control the existence of matter [...]”. This general notion of a computer-mediated or virtual reality, in which synthetic objects or the entire virtual environment get indistinguishable from the real world, dates back to Plato’s “The Allegory of the Cave” and has been reconsidered again and again in science fiction literature as well as the movie industry.

As a matter of fact, even with current display technologies, we cannot let a computer fully control the existence of matter. However, we can fool our senses and give a user the illusion that the computer can after all.

In my talk I will show how interactive ultimate visualisations for extended realities can be implemented with current state-of-the-art technology by exploiting limitations and imperfections of human perception, cognition and action.

Biographical Note

Frank Steinicke is professor for Human-Computer Interaction at the Department of Informatics at the Universität Hamburg. His research is driven by understanding the human perceptual, cognitive and motor abilities and limitations in order to reform the interaction as well as the experience in computer-mediated realities.

He studied Mathematics with a minor in Computer Science at the University of Münster, from which he received his Ph.D. in 2006, and the Venia Legendi in 2010, both in Computer Science. He published about 300 peer-reviewed scientific publications and served as program chair for several XR and HCI-related conferences. Furthermore, he is chair of the steering committee of the ACM SUI Symposium, and member of the steering committee of GI SIG VR/AR. Furthermore, he is a member of the editorial boards of IEEE Transactions on Visualization and Computer Graphics (TVCG) as well as Frontiers Section on Virtual Reality and Human Behaviour.