Data-Driven Computer Graphics

Hanspeter Pfister, MERL

The field of computer graphics abounds with modeling and simulation problems. Among these are the representation of surface shape, the description of surface reflectance, the probabilistic modeling of small-scale variations, and the application of physics for simulating the dynamics of rigid and elastic materials. During its formative years, computer graphics has focused largely on developing algorithms and systems for performing efficient simulations that transform these analytic representations into images and animations. At present, the simulation framework for computer graphics is very mature. In last ten years, we have also witnessed significant technological developments in the areas of high-quality sensors and measurement devices. However, the data provided from these devices are frequently incompatible with the representations assumed by most computer graphics systems.

In this talk I will explore new approaches to computer graphics that attempt to bridge the dichotomy between parametric and empirical modeling. These approaches differ from the classical "simulation-based" computational model that pervades today's computer graphics, and instead depends more on the tools of interpolation and signal processing for synthesis. I will discuss three specific computer graphics applications of data-driven modeling in this talk. The first, called image-based 3D photography, addresses the problem of creating and rendering high-quality computer graphics models of arbitrary real-world objects. In a second application, I will discuss the problem of interpolating and extrapolating new reflectance models (specifically isotropic BRDFs) from a collection of acquired samples. Finally, I will discuss how our data-driven reflectance model can be used to efficiently acquire new BRDFs.

Biography:

Hanspeter Pfister is Associate Director and Senior Research Scientist at MERL - Mitsubishi Electric Research Laboratories - in Cambridge, MA. His research interests include computer graphics, computer vision, and scientific visualization. His work spans a range of topics, including point-based graphics, 3D photography, volume graphics, and computer graphics hardware. He is the chief architect of VolumePro, Mitsubishi Electric's real-time volume rendering hardware for PCs. Hanspeter Pfister received his Ph.D. in Computer Science in 1996 from the State University of New York at Stony Brook. He received his M.S. in Electrical Engineering from the Swiss Federal Institute of Technology (ETH) Zurich, Switzerland, in 1991. Dr. Pfister has taught courses at major graphics conferences including SIGGRAPH, IEEE Visualization, and Eurographics. He is Associate Editor of the IEEE Transactions on Visualization and Computer Graphics (TVCG), member of the Executive Committee of the IEEE Technical Committee on Graphics and Visualization (TCVG), and has served as a member of international program committees of major graphics conferences. Dr. Pfister was the general chair of the IEEE Visualization 2002 conference in Boston. He is member of the ACM, ACM SIGGRAPH, IEEE, the IEEE Computer Society, and the Eurographics Association.

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