WSCG 2014 Keynote speaker

Manuel M. Oliveira: Performing High-Dimensional Filtering in Low-Dimensional Spaces
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Abstract

High-dimensional filtering is a key component for many graphics, image, and video processing applications. Edge-preserving filters (an important class of high-dimensional ones), for instance, are essential for tasks like global-illumination filtering, tone mapping, denoising, detail enhancement, and non-photorealistic effects, among many others. Edge-preserving filtering can be implemented as a convolution with a spatially-varying kernel in image space, or with a spatially-invariant kernel in high-dimensional space. Performing the operation either way is computationally expensive, preventing its use in interactive and real-time scenarios. The talk will present two recent techniques we have developed for efficiently performing edge-aware filtering. The first one is based on a domain transform that allows high-dimensional geodesic filtering to be performed in linear time as a sequence of 1-D filtering steps using a spatially-invariant kernel. The second technique works by sampling and filtering the input signal using a set of 2-D manifolds adapted to the original data. Its cost is linear in the number of pixels and in the dimensionality of the space in which the filter operates. These techniques are significantly faster than previous approaches, supporting high-dimensional filtering of images, videos, and global illumination effects in real time. In the talk, I will present several examples illustrating their use in graphics, image, and video processing applications.

Short Bio

Manuel M. Oliveira is an Associate Professor of Computer Science at the Federal University of Rio Grande do Sul (UFRGS), in Brazil. He received his PhD from the University of North Carolina at Chapel Hill, in 2000. Before joining UFRGS in 2002, he was an Assistant Professor of Computer Science at the State University of New York at Stony Brook (2000 to 2002). In the 2009-2010 academic year, he was a Visiting Associate Professor at the MIT Media Lab. His research interests cover most aspects of computer graphics, but especially the frontiers among graphics, image processing, and vision (both human and machine). In these areas, he has contributed a variety of techniques including relief texture mapping, real-time filtering in high-dimensional spaces, efficient algorithms for Hough transform, new physiologically-based models for color perception and pupil-light reflex, and novel interactive techniques for measuring visual acuity. His work has been marked by a quest for solutions that produce high-quality results in real time.

Manuel M. Oliveira was program co-chair of the ACM SIGGRAPH Symposium on Interactive 3D Graphics and Games 2010 (I3D 2010), and general co-chair of ACM I3D 2009. He was also program co-chair of the WSCG 2013 and SIBGRAPI 2006. He received the ACM Recognition of Service Award in 2009 and 2010