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Interactive exploration of gigantic geometric models on commodity graphics platforms

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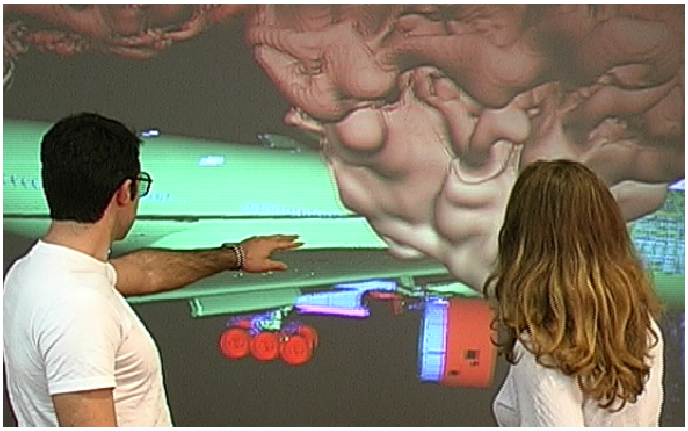
ABSTRACT

Many important application domains, including remote sensing, 3D scanning, computer aided design, and numerical simulation, require the interactive inspection of huge geometric models. Despite the rapid improvement in hardware performance, rendering today's multi-gigabyte datasets at interactive rates largely overloads the performance and memory capacity of state-of-the-art hardware platforms. To overcome this limitation, researchers have proposed a wide variety of output-sensitive rendering algorithms, i.e., rendering techniques whose runtime and memory footprint is proportional to the number of image pixels, not to the total model complexity. In this contribution, we illustrate our work on a new breed of techniques that are particularly well suited to harness the power of current graphics hardware.

1. Contribution Synopsis



Subjects covered will include GPU-friendly multi-triangulations (BDAM [EG2003], P-BDAM [IEEEViz03], Adaptive Tetrapuzzles [SIGGRAPH2004]), batched point-based models (Layered Point Clouds [ACM SPBG 2004, C&G 2004]), and multi-resolution view-dependent volumetric approximations (FarVoxels [SIGGRAPH2005]). We illustrate the various techniques with the real-time inspection of a variety of complex scenes containing complex objects from representative domains. Demonstrations include the real-time exploration of the St. Matthew 0.25mm dataset (373M triangles), the LLNL Richtmyer-Meshkov simulation isosurface (472M triangles), and the full Boeing 777 CAD model (350M triangles) presented at 1pixel accuracy on desktop and geowall displays driven by a single low-cost desktop PC.

2. Acknowledgments

The source 3D datasets are provided by and used with permission of the Boeing Company, the Digital Michelangelo project, and the Lawrence Livermore National Laborarories. Work on batched multiresolution triangulations is done research is carried out in cooperation with ISTI-CNR.

References

More information on this research is available on the web at the following URL

- http://www.crs4.it/vic/ - CRS4 Visual Computing Group