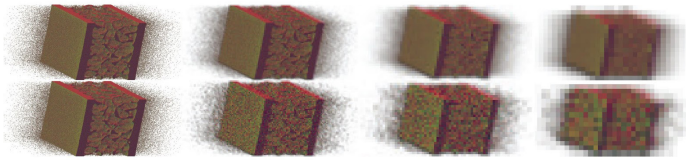


CPU-Based Rendering of Large-Scale Particle Data

Project Description

Molecular dynamics (MD) simulations are crucial to investigating important processes in physics and thermo-

dynamics. The simulated atoms are usually visualized as hard spheres with local lighting, like Phong or Lambert shading, where individual particles and their local density as well as larger structures can be perceived well in close-up views. However, for large-scale simulations with hundreds of millions of particles, the visualization usually suffers from strong aliasing artifacts. The mismatch between data size and output resolution leads to severe under-sampling of the geometry. This makes exploration of unknown data and detection of interesting phenomena via a top-down approach difficult. We introduced the novel concept of screen-space normal distribution functions (S-NDFs) [1] for particle data. S-NDFs represent the distribution of surface normals that map to a given pixel in screen space, which enables high-quality re-lighting without re-rendering particles.



Your Role in this Project

In this project you will work on CPU based algorithms that build on top of Intel's OSPRay [2] which helps us overcome memory limitations of the current GPU based implementation. We expect large performance gains due to the spatial acceleration structures in OSPRay that make the accumulation of normals per pixels significantly faster than the generic streaming approach we are forced to implement on the GPU. Our framework is intended for the rendering of large particle data. However, this project leaves enough freedom to investigate interactive post-lighting as well as image-based lighting approaches of arbitrary geometry.

Requirements

You need to have:

- prior experience in C++ programming
- prior experience in GPU computing (any of CUDA/OpenCL/OpenGL)
- fluent English language skills
- openness for a multicultural environment

References

- [1] <http://vccvisualization.org/research/sndfs/>
- [2] <https://www.ospray.org/>

