ADVANCES FOR QUANTITATIVE ANALYSIS OF BIG MICROSCOPY IMAGES: BILLION TRIANGLE SURFACE MODEL

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As a result of new microscopy techniques and modalities that offer increased resolution across vast temporal and spatial scales, the size of imaging data has rapidly increased in recent years. Researchers are now confronted with the task of analysing these extremely large and complex images. Building on Imaris' strong foundation of large image visualization, we address this need with a solution to calculate and interactively render 3D Surface models of large and complex images.

Surfaces in Imaris are 3D models computed from 3D images by a sequence of pre-processing, segmentation, and connected component labelling steps. Surfaces are used to identify relevant entities within an image, to visualize them and to get measurements of interesting structures (Area, Volume, Intensity, Position, Ellipticity and many more). Calculation and interactive rendering of Surfaces from very large images poses a technical challenge when the size of the models exceeds the capabilities of PC hardware. To facilitate interactive rendering we have built a multi-resolution rendering pipeline that can interactively render extremely large models on commodity hardware. The technology that enables fast rendering of very large surfaces is based on the following features:

- Multi-resolution format in 3D block-wise layout
- Renderer loads optimal surface resolution levels to match screen resolution
- Data Caching in VRAM (GPU) and RAM
- Multi-threading of rendering, decompression and loading

Another simpler challenge posed by large images is the efficient computation of Surface models from the original image data. To facilitate efficient calculation we have built a large data capable computation pipeline that processes image data in a block-wise cache-aware fashion and employs parallel processing. In combination, these features enable efficient computation and fast rendering of Surfaces from large images using commodity hardware and tools that are widely available.