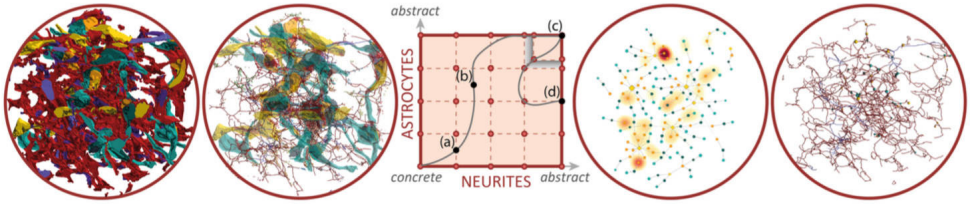
Visualization for Nano-Scale Neuroscience



Project Description

Reconstructing the anatomical and functional connectivity of the brain has become one of the most active research areas in neuroscience. By ultimately mapping and deciphering a human's entire connectome, i.e., the full "wiring diagram" of the brain comprising billions of neurons and their interconnections, scientists hope to gain an understanding of how the brain develops and functions, and how pathologies develop or can be treated. To support these goals, high-throughput methods for neural imaging have been developed. A major challenge going forward, however, is the lack of sufficiently powerful tools for interactive visualization and analysis. We design and develop prototype tools for tackling this challenge and help neuroscientists answer fundamental questions about our brain. Representative examples of our work are Abstractocyte [1] for understanding astroglial cells, NeuroLines [2] for interactive neuronal connectivity analysis, and ConnectomeExplorer [3] for answering domain-specific questions using visual queries.

Your Role in this Project

You will work on the design and implementation of novel visualization methods and visual analysis tools that provide powerful new workflows and analysis capabilities to neuroscientists working in connectomics as well as in understanding the processes of brain energy metabolism.

Requirements

- 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] Haneen Mohammed et al., Abstractocyte: A Visual Tool for Exploring Nanoscale Astroglial Cells, IEEE TVCG 24(1), 2018
[2] Al-Awami et al., NeuroLines: A Subway Map Metaphor for Visualizing Nanoscale Neuronal Connectivity, IEEE TVCG 20(12), 2014
[3] Beyer et al., ConnectomeExplorer: Query-Guided Visual Analysis of Large Volumetric Neuroscience Data, IEEE TVCG 19(12), 2013