BIOMEDICAL FRONTIERS

David Mayerich

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CPRIT Scholar

Publications

1. Rupali Mankar, Carlos Bueso-Ramos, C. Cameron Yin, Juliana E. Hidalgo-Lopez, Sebastian Berisha, Mustafa Kansiz, David Mayerich, "Automated osteosclerosis grading of clinical biopsies using infrared spectroscopic imaging," Analytical Chemistry, 92(1), 749-757 [DOI]

2. Jiaming Guo, Camille Artur, Tasha Womack, Jason Eriksen, David Mayerich, "Multiplex protein-specific microscopy with ultraviolet surface excitation," Biomedical Optics Express, 11(1), 99-108 (2020) [DOI]

3. Jiaming Guo, Camille Artur, Jason Eriksen, David Mayerich, "Three-Dimensional Microscopy by Milling with Ultraviolet Excitation," Nature Scientific Reports, 9:14578 (October 2019) [DOI]

Dr. Mayerich conducts research in high performance computing and biomedical microscopy. His work enables three-dimensional whole-organ biomedical imaging at sub-micrometer resolution. His laboratory is currently developing instrumentation and algorithms to generate large-scale multi-dimensional and hyperspectral data sets to advance current understanding of disease progression, diagnosis, and precision medicine. He was recruited to the University of Houston as a CPRIT Scholar through the Cancer Prevention and Research Institute of Texas and is a recipient of both an NIH K99/R00 Fellowship and the NSF CAREER Award. Select highlights of research in the Mayerich laboratory is provided below.

SCALABLE MICROVASCULAR IMAGING AND MODELING

Dr. Mayerich's research leverages data-parallel processing, such as graphics processors, to efficiently and accurately segment cells and vessels to quantify cell microstructures in high resolution microscopy images. Whole brain phenotyping is important for understanding neurological function and behavior, particularly when studying the impact of neurodegenerative disease on tissue structure and protein composition. The Mayerich laboratory has developed high-throughput imaging methods that allow practical three-dimensional imaging of samples on the order of a cubic centimeter. Their resulting data sets contain densely-packed cells with heterogeneous structures highlighted by punctate protein distribution. When combined with complex interconnected neural and microvascular networks, the resulting data sets are far superior than existing segmentation algorithms.

Fig. 1

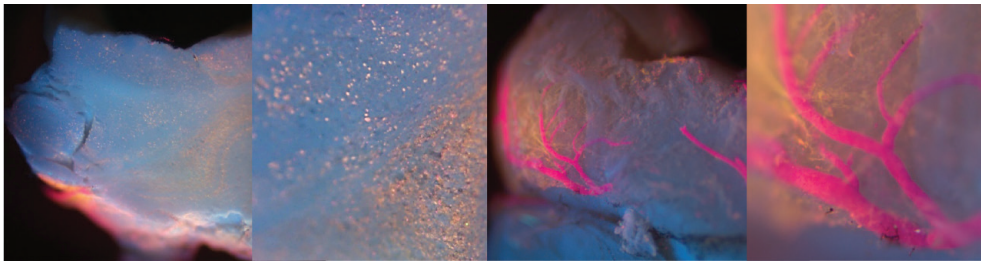

Fig. 2

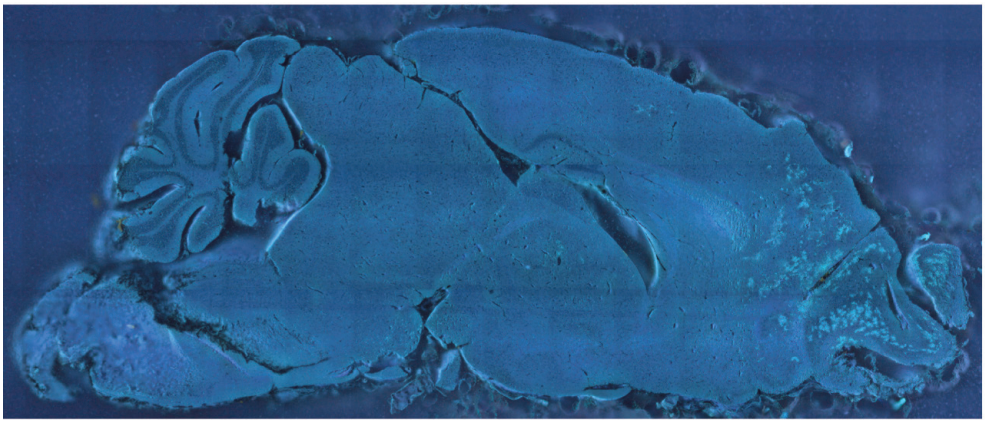

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Fig. 3

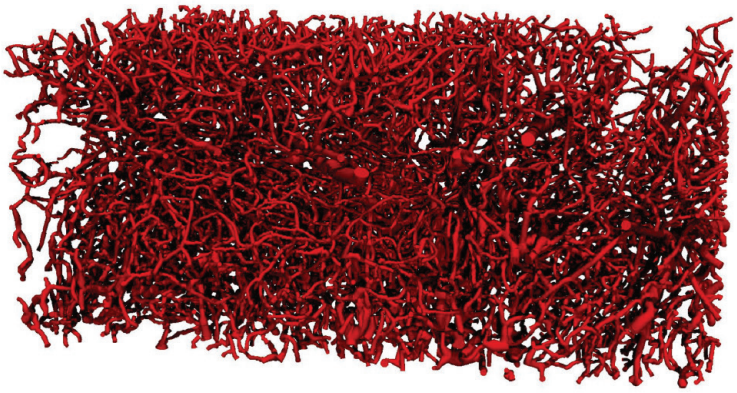

Fig. 4A

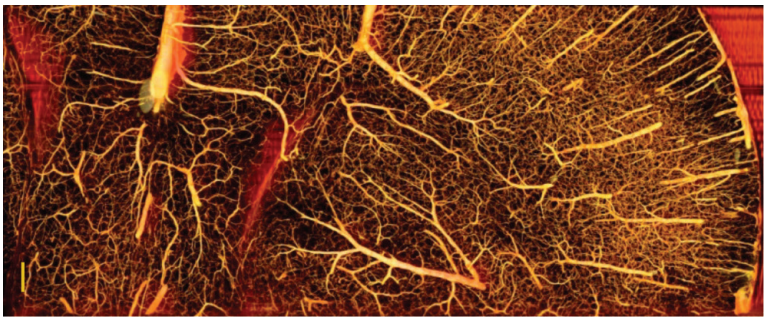

Fig. 4B

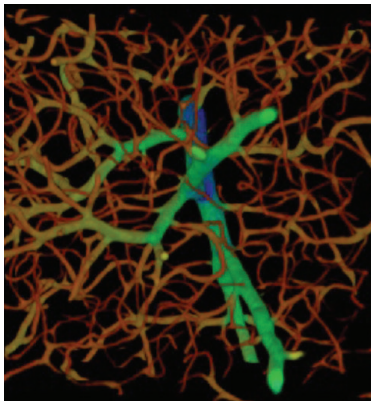

Fig. 4C

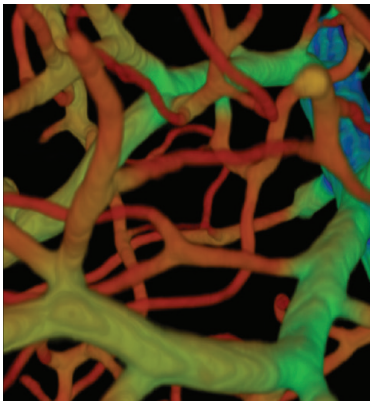

Figure 3: *Reconstructed microvessels acquired from sequential imaging of mouse brain tissue perfused with India ink*
Figure 4A: *Large brain region (0.5mm thick) perfused with India ink and imaged using iterative serial ablation;*
Figure 4B: *Small region of Figure 4A reconstructed using an isosurface to isolate microvascular components;*
Figure 4C: *A closer close-up of Figure 4B.*