Project Title:

Advancing High-Fidelity Volumetric Imaging of the Mouse Brain *in vivo* Through Digital Technologies

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Project Abstract/Proposal Summary:

The brain serves as the information and control center of the body, orchestrating thought, behavior, and physiological processes through intricate networks of interconnected neurons. To understand these structures and functions, it is essential to probe the brain *in vivo*. Optical fluorescence microscopy, particularly two-photon fluorescence microscopy (2PFM), has emerged as a powerful tool for visualizing subcellular brain structures and neuronal activity. However, conventional 2PFM faces challenges in capturing fast neural dynamics across large brain volumes, primarily due to low signal-to-noise ratio (SNR) and motion-induced artifacts. This proposed research aims to address these challenges by developing two novel technologies: (1) a self-supervised learning-based denoising approach for high-SNR volumetric imaging and (2) a robotic, real-time brain motion correction module for stable brain imaging.