Extending SimNIBS to integrate non-invasive brain stimulation with functional imaging data and primate head segmentation

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Non-invasive brain stimulation (NIBS) is currently being used as a treatment method for psychiatric disorders such as major depression, obsessive-compulsive disorder, and substance use disorder. NIBS is also increasingly utilized as a research tool for causal manipulations of brain activity. Two of its main methods, Transcranial Magnetic Stimulation (TMS) and Transcranial Electric Stimulation (TES) create electric fields in the brain to modulate neural activity. Precise knowledge of these electric fields is crucial for experimental design and choice of stimulation parameters for precise dosing. Computational modeling has been used extensively to predict the induced electric fields. Due to the growing clinical and research applications of NIBS, there is increasing demand in the accessibility of such tools. SimNIBS is one of the leading platforms for NIBS electric field modeling (simnibs.org). In this Brain Initiative project, we aim to increase the functionality and accessibility of SimNIBS with six projects.

These developments will widen the user pool able to incorporate modeling platforms in their work. Modeling is a crucial part of efforts to understand the NIBS mechanism of action, translate the experimental findings between animals and humans, and to find the optimal targeting and dosing of brain stimulation.

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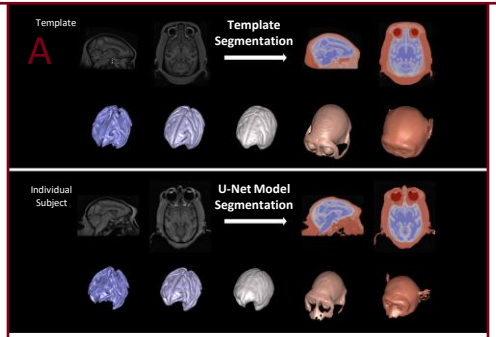
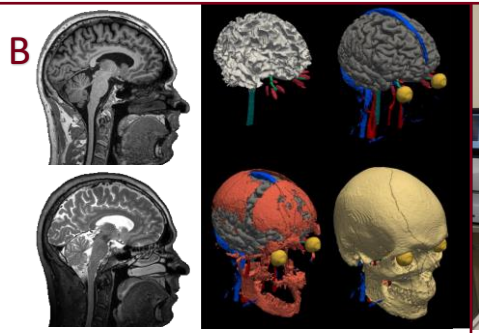
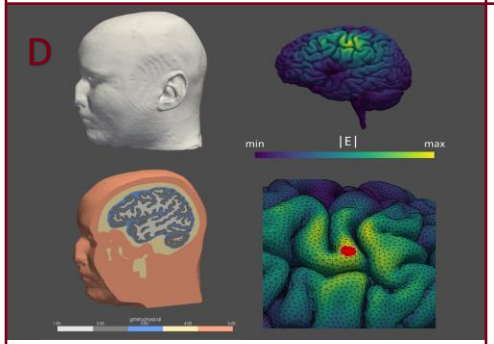


Developing automatic non-human primate head segmentation as a translational tool.

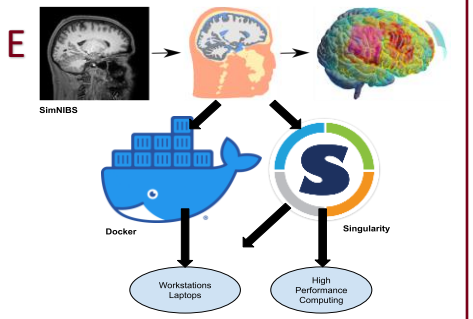


Improving human MRI segmentation to increase accuracy, speed, and robustness of headmodels (Puonti et al Neuroimage 2020).

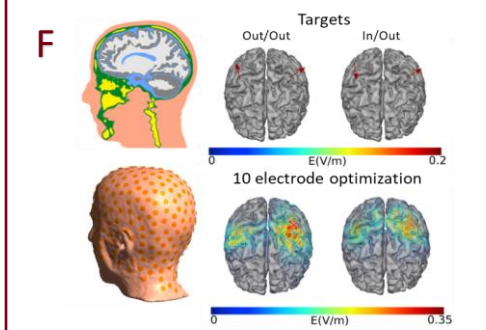
Adding functionality to integrate neuronavigation systems with SimNIBS.



Extending the visualization and graphical interfaces of SimNIBS.



Utilizing software containers to provide simple cross-platform and high-performance access to SimNIBS.



Optimization of TES electrode locations (Saturnino et al Neuroimage 2019; Saturnino et al J Neural Eng 2021).