

DeLTA-BIT: a deep-learning based on Local TrActography for Brain Targeting in the treatment of movement disorders.

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Essential tremor (ET) is the most common adult movement disorder, markedly impairing quality of life. For medication-refractory tremor, surgical targeting of the thalamus ventral intermediate nucleus (VIM) is an effective treatment strategy. Transcranial MRI-guided focused ultrasound (tcMRgFUS) offers a non-invasive alternative, but accurate VIM localization remains challenging due to its small size and anatomical variability. Probabilistic tractography enables patient-specific targeting but is computationally demanding and impractical for real-time use. We developed DeLTA-BIT, an open-source framework for rapid VIM identification, based on a 3D UNet pre-trained on T1-w images and tractography-derived VIM labels from the Human Connectome Project, then fine-tuned on clinical tcMRgFUS datasets from ET patients. Performance was assessed on a clinical dataset (manually contoured) and compared with an atlas-based method (THOMAS). Fine-tuning on clinical data improved VIM localization accuracy over both the pre-trained model and THOMAS (DSC: 0.43 ± 0.17 , 0.23 ± 0.11 and 0.31 ± 0.07 , respectively). VIM predictions are generated in 1 min, making DeLTA-BIT a promising tool for real-time targeting.