Title: END TO END BRAIN FIBER ORIENTATION ESTIMATION USING DEEP LEARNING

In this work, we explore the various Brain Neuron tracking techniques, which is one of the most significant applications of Diffusion Tensor Imaging. Tractography provides us with a non-invasive method to analyze underlying tissue microstructure. Understanding the structure and organization of the tissues facilitates us with a diagnosis method to identify any aberrations which can occur within tissues due to loss of cell functionalities, provide acute information on the occurrences of brain ischemia or stroke, the mutation of certain neurological diseases such as Alzheimer, multiple sclerosis and so on. Under all these circumstances, time if of essence and accurate localization of the aberrations can help save or change a diseased life. Following up with the limitations introduced by the current Tractography techniques such as computational complexity, reconstruction errors during tensor estimation and standardization, we aim to elucidate these limitations through our research findings. We introduce an end to end Deep Learning framework which can accurately estimate the most probable likelihood orientation at each voxel along a neuronal pathway. We use Probabilistic Tractography as our baseline model to obtain the training data and which also serve as a Tractography Gold Standard for our evaluations. Through experiments we show that our Deep Network can do a significant improvement over current Tractography implementations by reducing the run-time complexity to a significant new level. Our architecture also allows for variable sized input DWI signals eliminating the need to worry about memory issues as seen with the traditional techniques. The advantage of this architecture is that it is perfectly desirable to be processed on a cloud setup and utilize the existing multi GPU frameworks to perform whole brain Tractography in minutes rather than hours. We evaluate our network with Gold Standard and benchmark its performance across several parameters.

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The public is welcome to attend.