Multi -Atlas Guided Automatic Tract Reconstruction

of White Matter Fibers

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Tractography based on diffusion MRI (Magnetic Resonance Imaging) produces massive sets of streamlines that contain a wealth of information about brain connections. In general, the way in which we identify fibers involves subjective judgment. In the tract-editing process streamlines are extracted by manual delineation of regions of interest. However, extracting fibers manually is time consuming and requires related knowledge about brain anatomy. Therefore, the demand for a larger dataset creates a need for automated clustering methods. Additionally, I applied a multi-atlas segmentation (MAS) method on 58 atlases, and tried to find a fully automated method to reconstruct 31 white matter tracts defined by TractEM protocols (https://my.vanderbilt.edu/tractem/). In this study I follow TractEM protocols a fast whole-brain protocol that defines 35 white matter tracts. This MAS approach I propose in this thesis includes five steps 1) registration, 2) label propagation, 3) label fusion, 4) voting, and 5) fiber tracking based on DSI-Studio. By testing my plan I created a new dataset based on 38 subjects with 22411 automatically identified tracts. In this report I will present in detail the methods used and the results achieved with my approach.

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