Abstract: Tract Orientation Mapping for Bundle-Specific Tractography

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While the major white matter tracts are of great interest to numerous studies in neuroscience and medicine, their manual dissection in larger cohorts from diffusion MRI tractograms is time-consuming, requires expert knowledge and is hard to reproduce. Tract orientation mapping (TOM) is a novel concept that facilitates bundle-specific tractography based on a learned mapping from the original fiber orientation distribution function (fODF) peaks to a list of tract orientation maps (also abbr. TOM). Each TOM represents one of the known tracts with each voxel containing no more than one orientation vector. TOMs can act as a prior or even as direct input for tractography. We use an encoder-decoder fully-convolutional neural network architecture to learn the required mapping. In comparison to previous concepts for the reconstruction of specific bundles, the presented one avoids various cumbersome processing steps like whole brain tractography, atlas registration or clustering. We compare it to four state of the art bundle recognition methods on 20 different bundles in a total of 105 subjects from the Human Connectome Project. Results are anatomically convincing even for difficult tracts, while reaching low angular errors, unprecedented runtimes and top accuracy values (Dice). Our code and our data are openly available at https://github.com/MIC-DKFZ/TractSeg and https://zenodo.org/record/1285152, respectively. This work has previously been published at MICCAI 2018 [1].

References

1. Wasserthal J, Neher PF, Maier-Hein KH; Springer. Tract orientation mapping for bundle-specific tractography. Proc MICCAI. 2018; p. 36–44.