Title:

1) AFD-based structure informed tractography to choose pathway branches

2) Towards improving fiber tractography by detecting pre-mature termination voxels

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Abstract

Keywords

Figures

Introduction

Tractography is known to suffer from false positives. However, accumulative errors can cause pre-mature termination in fiber tracking pathways. Probabilistic tractography outperforms deterministic fiber tractography in the presence of outliers within crossing fiber regions. By applying proper methods to detect the outliers, the study aims to improve the tractography by modifying the outlier voxels where streamlines pass through.

Global tractography methods compared with resolving the local inverse problems has been explored in previous studies, as margin 2013, christiaens 2015. In the study of margin 2013, a spin-glass was introduced to represent the local fiber properties, and three types of energies (interaction energy, the first models fidelity to the diffusion data and the second models a low curvature prior. ) The so-called SGT was illustrated on a crossing and a curving phantom and the callosal fibres of a HARDI dataset. Christiaens 2015 in their study modifies the SH representations of the signals based on global energy minimization then performed probabilistic tractography. Both methods suggested the possibilities to achieve better tractography through a combination of local inverse problems and minimaizing the cost energy between voxels and their neighborhoods.

In this study we propose to modify the magnitudes (small peaks of th<0.1) and angles from the fods before tractography. Local minimums of magnitudes and local high peak curves were redefined by their neighborhood values therefore tractography won’t be disturbed by outlier voxels (potentially resulted from noises or partial volume effects).

Steps: 1: modify the magnitudes

Step 2: through dir\_ of the peaks, calculate the closest angles between neighbours

Step 3: FT before and after modification, find the proper angle thresh.

Methods

Data 1-3 was used to validate the outlier detection methods, data 4 was used to explore the effects of outlier detection in real data.

Data1. A simple phantom with crossings and an outlier point

(CeateFiberPhatom\_FG\_untitled2.m).

Data2. A phantom created in ExploreDTI, 71x71x5.

Data3. A brain phantom created based on the first eigen values of HCP dataset, with an infinite SNR and a SNR of 30.

Data4. HCP 100307.

Methods (Analysis)

Outlier detection 1: go further along the tracts.

Results

Discussions

Conclusions

Acknowledgements

References

Supplementary