4040

Probabilistic Fiber Tractography Using Bootstrap-based Estimation of the Diffusion Tensor

Hae-Jeong Park[1]

[1] Detp. Diagnostic Radiology, Yonsei University, College of Medicine

parkhj@yumc.yonsei.ac.kr

The streamline techniques that utilize the eigenvector field do not allow for uncertainty of fiber direction and they are susceptible to noises in the diffusion tensor images. In this study, we presented a bootstrap-based fiber tractography to render fiber tracking more robust to noise and to evaluate probabilistic connectivity between regions of brain. Tensor of each voxel was estimated by decomposing diffusion-weighted images (DWIs) randomly sampled from pool of whole acquired DWIs at the voxel. About 10000 iterations of bootstrapping, distribution of the eigenvectors associated with the largest eigenvalue at the voxel could be derived. Probabilistic fiber tractography was conducted based on this sampling of DWIs which allows the uncertainty at each voxel. From a given seed point, the streamline moves a step toward the major eigenvector reconstructed from randomly sampled DWIs. In each iterative step, a new direction is randomly determined by bootstrapping of DWIs. In a number of such random walks starting from a region, the frequency that some other region has reached was used as a relative measure of the anatomical connectivity between the two regions. The propagation was regulated with a priori criteria of smooth curvature and high fractional anisotropy. The bootstrap-based fiber tracking method was evaluated at several brain regions including the corpus callosum and the internal capsule. Compared with fast marching method, the proposed method utilizes uncertainties driven by the acquired data. Compared with MCMC-based probabilistic approach, the bootstrapping method gained low computational costs.

Keywords : DTI, Bootstrap, Tracktography