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Software Implementation for 3D visualization of brain fiber tractography and high-resolution anatomical data

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Purpose : The purpose of paper is to implement a PC-based software for 3D visualization of brain fiber tractography and high-resolution anatomical data

Iintroduction : DTI (Diffusion tensor imaging) is a very useful noninvasive MRI technique for providing the direction and connectivity information of brain fiber tracts. Especially in patients with glioma, fiber tracts on the lesion side in the brain had varying degrees of displacement or disruption as a result of the tumor. Tract disruption resulted from direct tumor involvement, compression on the tract, and vasogenic edema surrounding the tumor. To combine information on fiber tracts surrounding tumor with a high-resolution anatomical 3D image may be clinically useful for surgical planning. Therefore we implemented a software for visualizing both brain fiber tractography and anatomical data.

Materials and Methods : DTI and T1 3D volume data were acquired on 3.0T GE scanner. We used 25 directional diffusion gradients scheme for DTI. All DTI images were linearly interpolated in order to obtain a isotropic volume. The DT was computed for each voxel by linear combination of the log-ratio images. Tractography was made using both streamline (i.e. fiber assignment by continuous tracking) and tensorline (i.e using both of streamline and diffusion tensor deflection) methods. We deskulled the 3D T1 volume data using both region-growing and threshold methods. All DTI images were registered a T2 image without diffusion gradient, and then were coregistered with 3D anatomical volume. Registration was done by rigid body transform using mutual information maximization. Fiber-tractography and an anatomical data were combined into one platform. Some patients with glioma were examined using our software

Results : We successfully visualized both fiber tractographical and anatomicalinformation on tumor and its surrounding lesion in gliomas. Our implementation showed fast and interactive visualization.

Conclusion : Ourstudy showed our software might be a promising tool to provide useful information on white matter tracts in relation to cerebral neoplasmsin a surgical planning.