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The Diffusion Orientation Transform (DOT) for MR Imaging
EVREN OZARSLAN, Dept Comp Info Sci & Eng, TIMOTHY SHEPHERD, Dept Neuroscience, BABA VEMURI, Dept Comp Info Sci & Eng, STEPHEN BLACKBAND, Dept Neuroscience, THOMAS MARECI, Dept Biochem & Mol Biol, U of Florida, Gainesville, FL — Diffusion-weighted signal attenuation in pulsed field gradient MRI experiments provides a powerful means to extract microstructural information, such as anisotropy, from porous media and biological tissues. However, in fibrous media, it remains challenging to find the preferred orientations of water diffusion when there are more than one fiber orientations inside a voxel. We describe a novel technique, the diffusion orientation transform that provides a direct link between the apparent diffusion coefficients and the water displacement probabilities along different directions. The transform can be applied to data collected on a single spherical shell with the assumption of monoexponential attenuation. Alternatively, data acquired on several spherical shells can be reconstructed to yield more accurate probability values on the sphere. Both simulations and real experiments demonstrate that the parameterized surfaces constructed from the probability values are able to resolve crossing fibers accurately. The developed methods will improve the reliability of schemes used to map the anatomical connectivities within nervous tissue.

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