Visual Display of Diffusion Tensor Fields

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Medical imaging modalities can measure an immense variety of characteristics of biological tissue. Diffusion tensor magnetic resonance imaging (DT-MRI) can measure microstructural properties, such as the coherent linear organization of white matter of the central nervous system, or the fibrous texture of muscle tissue. Interactive and quantitative tools for exploring and visualizing DT-MRI may help researchers understand the organization of the white matter tracts which connect different parts of the nervous system, or changes in white matter due to disease. I will describe a combination of visualization methods, including superquadric glyphs for inspecting individual tensor values, fiber tractography for estimating tract pathways, and direct volume rendering for portraying the over-all shape of large-scale structures. The different range of scales at which these methods operate require different visualization strategies for presenting their findings. While standard surface rendering techniques are well-suited for showing glyphs and fibrers, direct volume rendering may benefit from artistic methods of non-photo-realistic rendering to help portray numerous distinct tensor attributes and their inter-relationships. I will describe some preliminary work in this area, with the hope of generating discussion about the role and capabilities of GPU-based volume rendering of tensor fields.