DT-MRI Inspection and Visualization

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Interested in methods for “looking at” DT-MRI data and visually communicating its structure

Idea: two aspects of what’s called “visualization”

• Acquisition: get the data
• Inspection: “Show me the data”
  verify data integrity, coordinates, and layout
• Visualization: “Show me the structures”
  depict the form and character of features in the data
• Analysis: extract and quantify features
Fractional anisotropy (FA)  RGB(1st eigenvector $v_1$)

1 glyph = 1 mm$^3$
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Inspection saves the day

Sagittal slice: cingulum bundle, corpus callosum
Inspection saves the day

Scalar shape metrics (anisotropy)
  • Barycentric shape space

Glyphs
  • Boxes, spheres, cylinders, superquads
  • Culling based on anisotropy

Volume visualization
  • Isosurfaces of shape metrics
  • Transfer functions of shape
Space of tensor shape

\[ \lambda_1 + \lambda_2 + \lambda_3 = T \]

Scalar shape metrics

Westin, 1997
Scalar shape metrics

Basser + Pierpaoli, 1996

1 - VR
1 - volume ratio

FA
fractional anisotropy

RA
relative anisotropy

Glyph shapes
Volume Rendering

Simple algorithm

• Cast rays through volume
• Measure tensor, tensor properties
• Assign colors and opacities
• Composite

\[ DT \Rightarrow FA, c_l, c_p \]

\[ R, G, B, \alpha \]

Transfer function
Volume Rendering