CS530 Assignment 5

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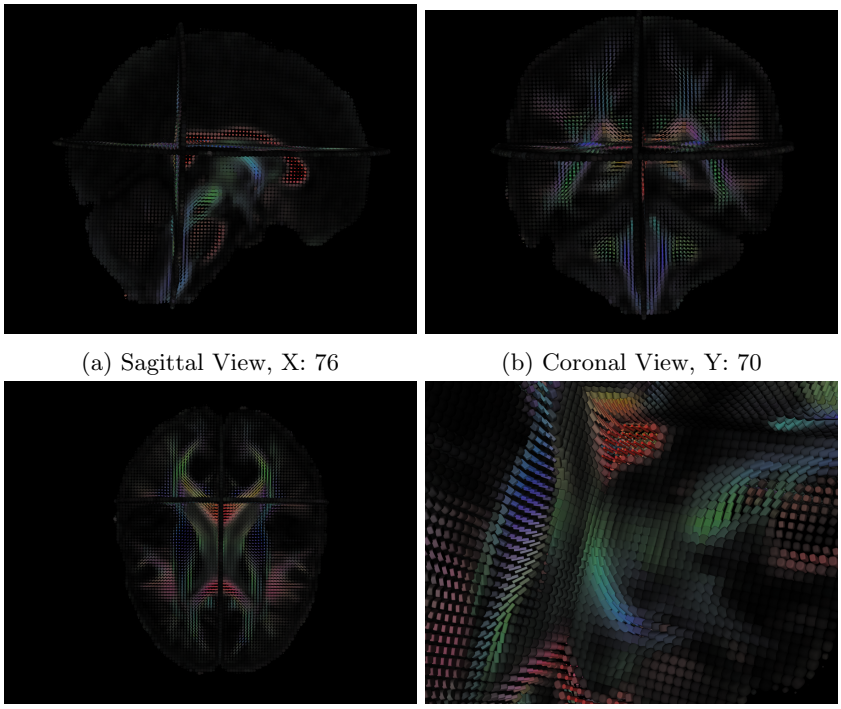
1 Task 1



(a) Sagittal View, X: 76

(b) Coronal View, Y: 70

(c) Transverse View, Z: 90

(d) Superquadric Glyphs

Figure 1: Superquadric Glyphs

The sagittal plane was chosen at X = 76 as it effectively captures the entire brain structure, including its characteristic folds and its extension toward the neck. Based on this, the coronal plane was positioned at Y = 70, further toward the back of the brain, to ensure the inclusion of key anatomical details from the posterior region. This decision also influenced the selection of the transverse plane at Z = 90, placing it in the upper part of the brain to encompass the majority of its matter.

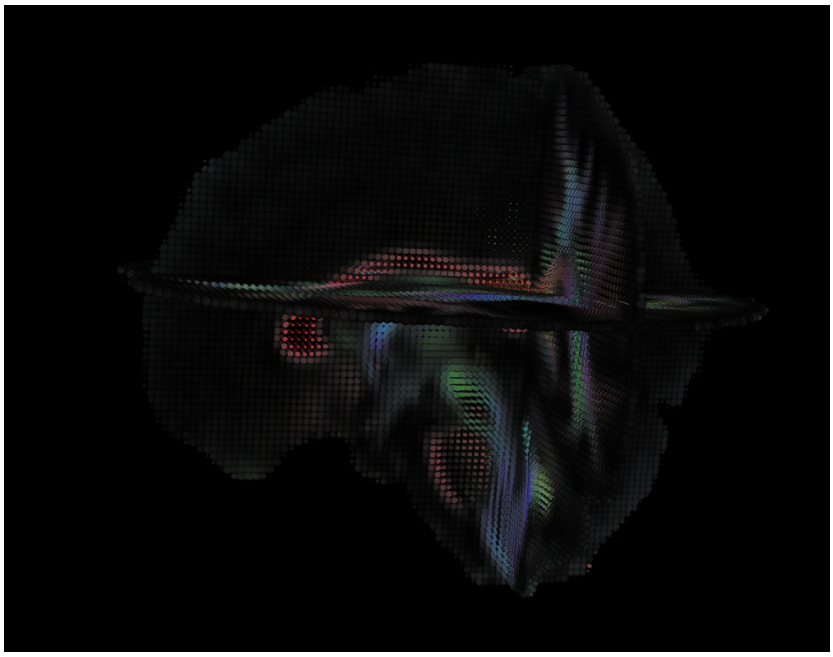
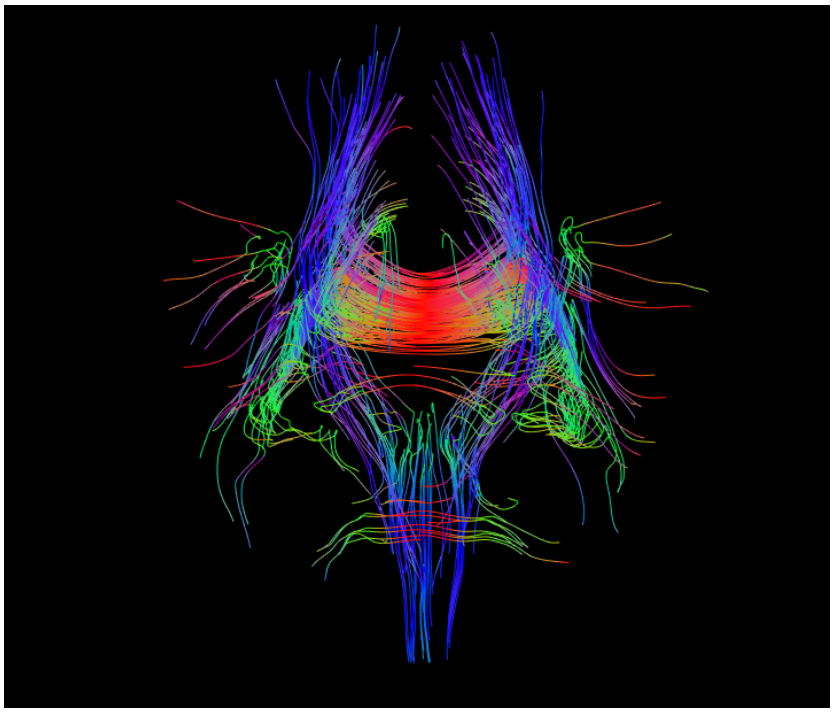
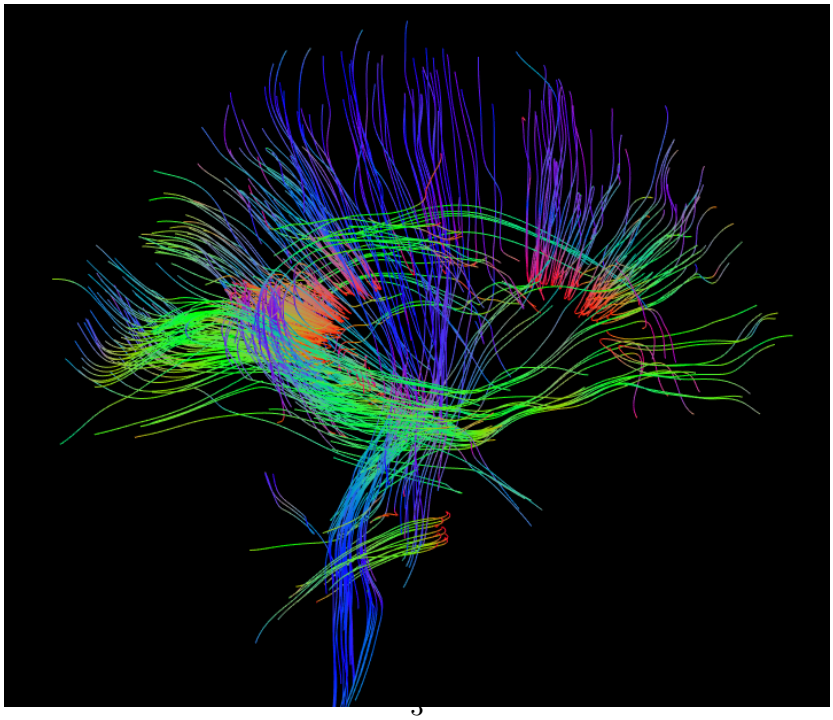


Figure 2: All views

2 Task 2



(a) Front View



(b) Side View

The clipping planes that were decided from task 1 were X = 76, Y = 70, Z = 90. Seeding locations were chosen by sampling points from these selected clipping planes. Each plane contributed a proportional number of points to ensure even distribution. This approach ensures a balanced and representative seed distribution across active planes.

3 Task 3

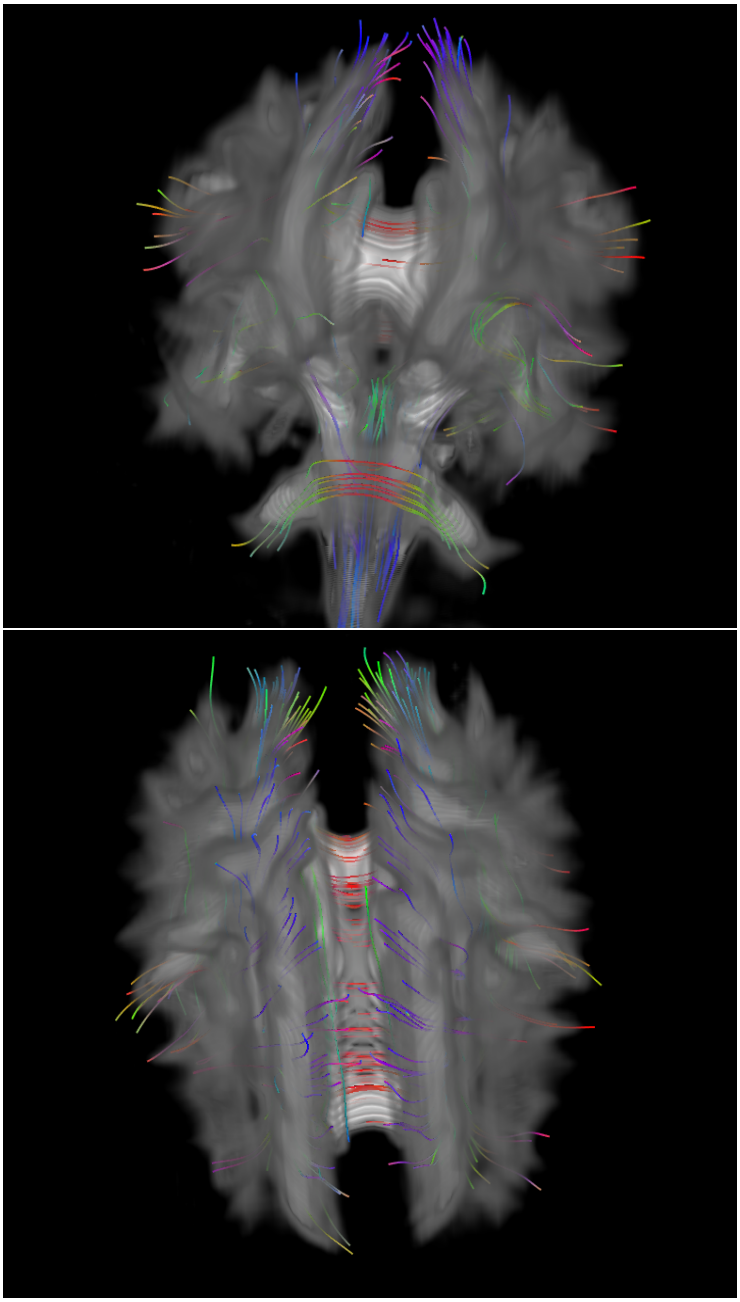


Figure 4: Volume

To effectively visualize the Fractional Anisotropy (FA) volume using volume rendering, the transfer function consists of two components:

1. **Color Transfer Function (CTF)**: This function maps scalar FA values to RGB colors. Since FA values range between 0 and 1, a linear grayscale mapping was chosen:

   - FAmin (minimum FA value) is mapped to black (0,0,0).
   - FAmax (maximum FA value) is mapped to white (1,1,1).

   This ensures that regions with higher FA values appear brighter, aiding in the identification of fiber tracts.

2. **Opacity Transfer Function (OTF)**: The opacity function was designed to highlight FA variations while suppressing noise and background artifacts. The points in the opacity function include: The opacity function

FA Value	Opacity
FAmin	0.0
0.2 * FAmax	0.0
0.4 * FAmax	0.2
0.5 * FAmax	0.0
0.6 * FAmax	0.5
0.75 * FAmax	0.0
0.9 * FAmax	0.7
FAmax	0.0

Table 1: Opacity Transfer Function Values

   allows high FA regions to be visible while suppressing noise from low FA areas.

The volume-rendered FA visualization was compared against tensor lines extracted using hyperstreamlines. The key observations are:

- **Tensor Lines**: Tensor lines provide a direct visualization of fiber pathways by tracing principal diffusion directions. This approach effectively represents individual fiber trajectories but does not provide an overview of FA intensity distribution.
- **Volume Rendering**: The FA volume rendering method offers a continuous representation of anisotropy distribution. This provides a global view of white matter integrity, revealing regions with high and low anisotropy values.

While tensor lines are useful for detailed fiber tracking, volume rendering provides context by showing the overall FA structure. Combining both techniques results in a more comprehensive visualization.