iFIBER, AN EFFICIENT ANDROID APPLICATION FOR THE VISUALIZATION OF BRAIN STRUCTURAL DATA[1]

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Introduction

With the advances of Magnetic Resonance Imaging (MRI), diffusion MRI (dMRI) has taken more relevance for the study of brain anatomy, along with the well-known T1 MRI images. dMRI tractography datasets are composed of 3D polylines or "fibers", representing the main brain axonal pathways[1]. It is possible to segment different tissues and create 3D meshes of their surfaces using T1 images [2]. Brain imaging tools usually allow users to display fibers with 3D meshes, 2D slices, and volume rendered visualizations [3]. Several software tools have been developed for desktop computers and typically require some hardware resources to provide quality visualizations. Tractography datasets, which can contain several hundreds of thousands of fibers, are usually represented as cylinders, with a high computational cost. The plain line drawing without shading is more efficient, but lacks the sense of depth.

Mobile device usage has a high growth rate, not only for communication and entertainment, but also for professional information sharing and manipulation. We believe, it would be very useful to have a brain imaging visualization tool able to run properly on smartphones and tablets.

We developed an efficient Android application able to display brain imaging data on mobile devices, using a lighting algorithm for fibers applied directly to lines[4]. The application integrates optimized and interactive features implemented in [5-7]. Along with fibers, it can display 3D meshes as transparent objects, and render T1 images using orthogonal planes placed on the 3D space, as well as volume rendered visualizations[8].

To the best of our knowledge this is the only mobile application with the described features.

Hypothesis

It is possible to use Android devices for the interactive visualization and manipulation of real brain MRI data, in order to facilitate the collaboration and analysis of results from brain studies

Objectives

- To develop an Android application for the visualization of brain fibers, T1 MRI (volume and slice rendering) and 3D meshes
- To design and implement solutions with efficient use of memory and computing resources, with scalable architecture
- To develop optimized algorithms for processing complex and large tractography datasets

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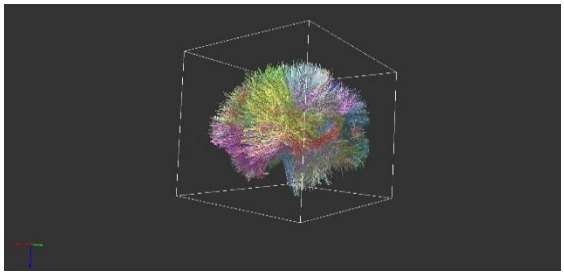
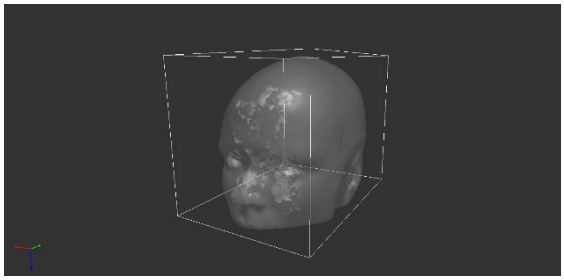
Results – proposed methods and perspectives

All the tests were performed in a Samsung S9 Plus smartphone, running with a 720p resolution display setup. The application can easily load tractography and T1 image objects with good performance. It can display up to 100,000 fibers (based in available memory) with no problem, with no object number limitation.

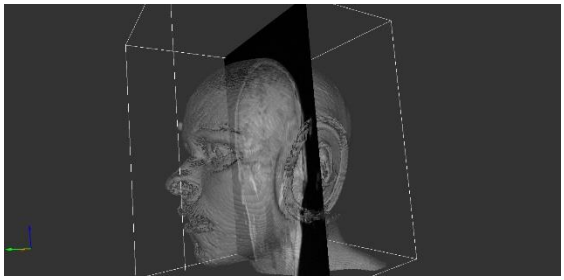
It can be used by researchers, physicians and students, for an easy analysis and sharing of brain MRI data, as well as for education and science divulgation.



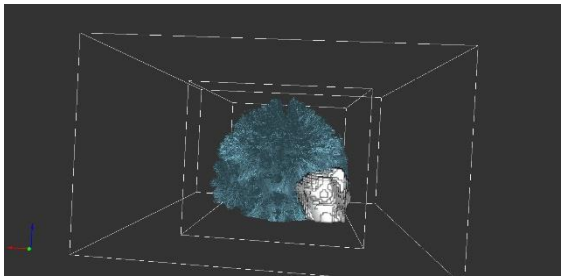
Visualization of a fiber bundle atlas



Rendering of a mesh file



An MRI visualization through volume rendering (VR) and x-axis slice.



Rendering of patient data: fibers and VR tumor mask

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