

Brain 3D Anatomy

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Background and Motivation

When reviewing the MRI scan, the neurologist or neurosurgeon see only a 2-dimensional image on a screen taken from the 3-dimensional MRI scan, which might be detrimental in the analysis of the image. The doctor has to imagine the 3-dimensional organ in his mind's eye, based on his knowledge and studies of the body, and gather the information from a partial view of the image at any given time. This could lead to lower accuracy in detection by inexperienced doctors, or in the worst case, a wrong diagnosis.



Abstract

We attempted in this project to create a new visual tool that will enhance the tools that are already in wide use by doctors around the world today, and give a new understanding of the brain imaging to doctors, patients and students alike.

Our system consists of three main parts:

- We used Matlab in order to create 2-dimensional images from 3-dimensional matrix represents the MRI scan of the brain.
- The second part is to load the images into Unity and create a 3-dimensional object from them.
- The last part was to implement the ability to present the object in virtual reality using HTC vive and allow features which will give the user the feeling of the 3-dimensional object.



System description



Input: 3D matrix represents the MRI brain scan as a mat file.

Output: 3D object represents the brain in VR.

The system includes the following features:

- ▶ Rotating – rotate the brain using the handheld controller.
- ▶ Cutting – Cut the brain along the three X, Y and Z axes.
- ▶ Zoom – zoom in and zoom out.
- ▶ Reset button – turn back to the initial model.
- ▶ Masking – emphasize different parts of the brain according to the user choice (color the chosen part or remove the others).



Design



The clients of our project are doctors and medical students. Therefore, we tried to make the interface as simple as possible, using only one button in the handheld controller while keeping all the features the system provides.

In order to achieve good performances, we pre processed the data and used synchronization mechanisms (we used co-routine and back-ground-worker to make the heavy calculations in the background while the user interface is still reactive).



Summary

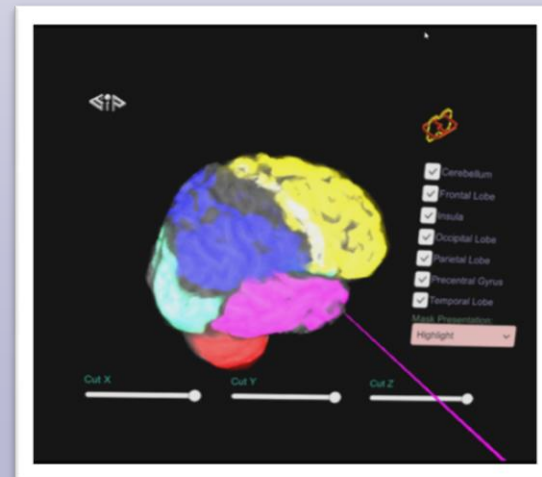
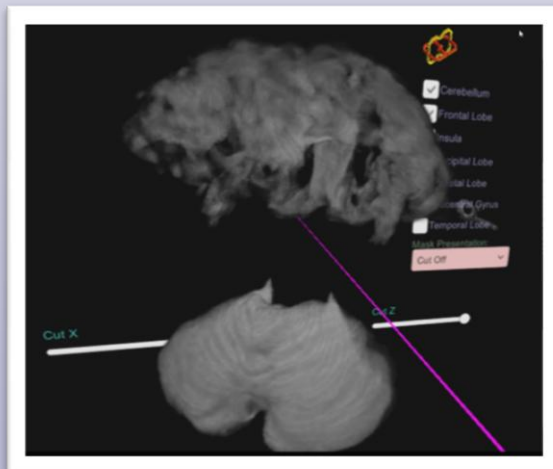
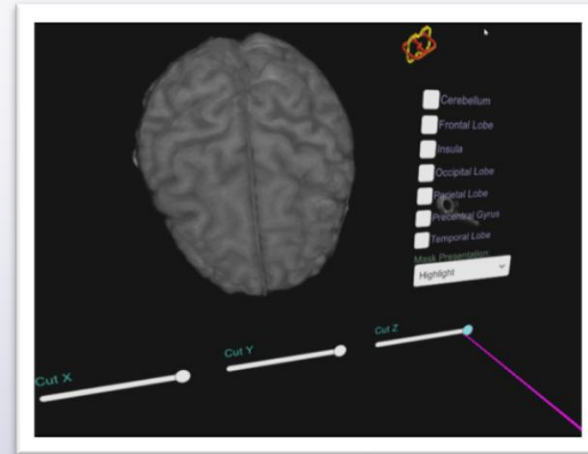
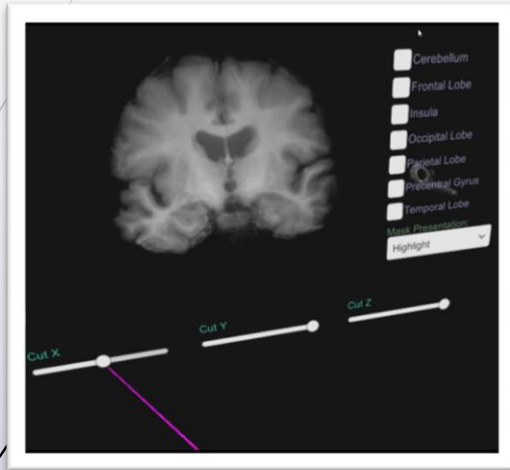


During the project we tried to build a system which will ease the doctors work in interpreting MRI scans of the brain.

We believe that this project provides a glance of a new technology which can lead new breakthrough in this branch of medical science. We are excited to take part in this beautiful new world.



Gallery

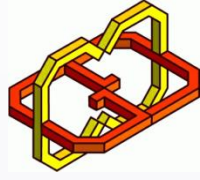




Works Cited



- ▶ An open source code from github:
<https://github.com/brianasu/unity-ray-marching/tree/volumetric-textures>
- ▶ MRI scan and data about the different parts of the brain: Hagai Tzafrir with corporation with Rambam Hospital.
- ▶ VRTK - VR toolkit, a collection of usage examples of the HTC vive and interaction with the controllers
<https://vrtoolkit.readme.io/>



Future Work

Possible features to be added for the project:

- ▶ Provide the possibility to get the input as a nifty file in order to get the MRI scans directly from the user, without the need to convert them to a mat file via Matlab.
- ▶ Present the functionality of each part of the brain using a human demo.
- ▶ Provide more information about additional parts of the brain.
- ▶ Provide the possibility to cut the brain in any angle, not just in the X, Y and Z axes.