VR Brain Anatomy

Students:

Bashar Zahalka

bashar.za@campus.technion.ac.il

Mikhail Shihadeh

mikhail.sh@campus.technion.ac.il

Supervisors:

Boaz Sternfeld

Introduction

Magnetic Resonance Imaging (MRI) scans play a crucial role in the fields of medicine and neuroscience, offering non-invasive and detailed imaging of the human brain.

Creating 3D models out of MRI scans allows for enhanced visualization, which can help in research and analysis, education and training, and possibly surgical planning and simulation.

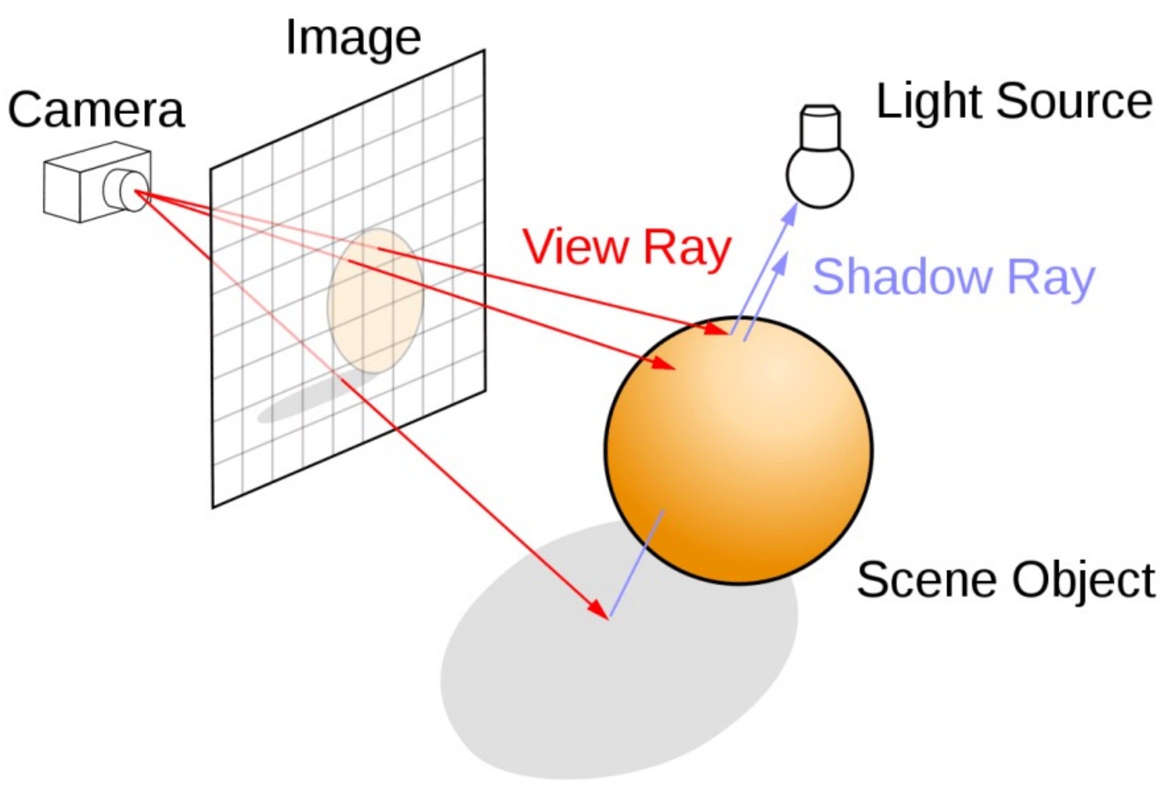
Taking this concept a step further with Virtual Reality and an interface for dissection can provide a more immersive analytical experience.

Overview

Unity is a versatile cross-platform game development engine used for creating 2D, 3D, AR, VR, and MR applications. It provides a user-friendly interface, a scripting API, and an extensive asset store for developers.

The **Oculus Quest 2** is a standalone VR headset by Meta Platforms. Released in 2020, it doesn't require a PC or console and offers improved specs, including a higher-resolution display. It's popular for its affordability, ease of use, and diverse VR experiences, ranging from gaming to social applications.

Ray marching is a rendering technique that iteratively advances along a ray, evaluating a mathematical function at each step. It's often used with signed distance fields or procedural functions, allowing for the creation of visually complex scenes and fractal-like structures in computer graphics.



Project Description

In this project we convert MRI scans into a 3D Hologram, and provide an interface for interaction (rotation, zooming, cutting) with the hologram.

Rendering Methodology:

- We utilize ray marching for rendering, a technique that evaluates a mathematical function along a ray. However, this method does not generate a 3D object directly usable in Unity.

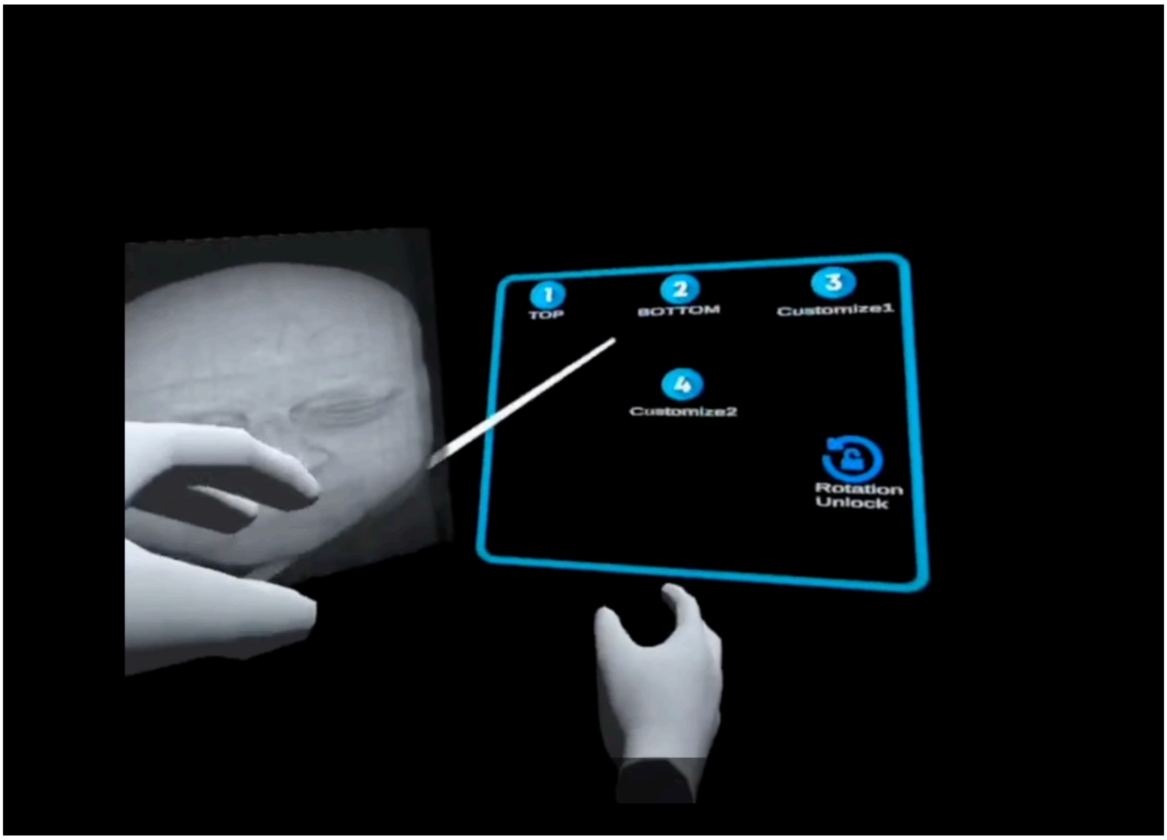
Key Features:

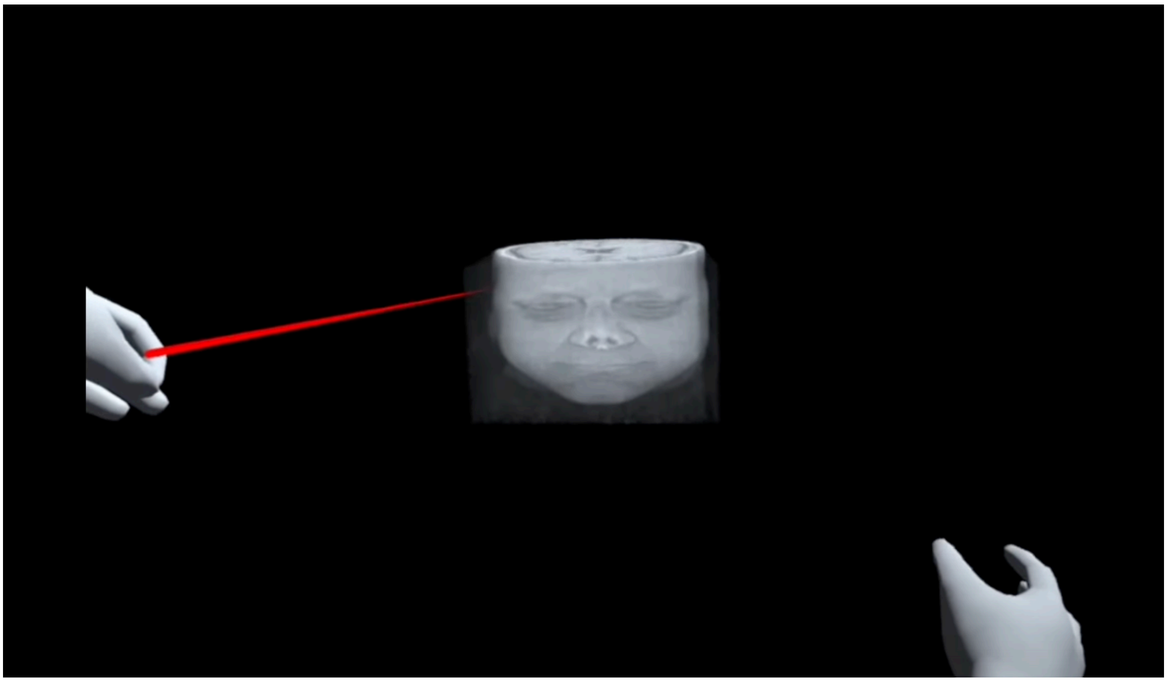
- **Cutting Functionality:** We implemented four cutting planes which selectively obstruct light, enabling the manipulation of the holographic representation. Two planes are vertically oriented, while the other two allow for customization with adjustable normals.
- **Rotation:** The design accommodates holographic rotation, offering dynamic changes in visual presentation.
- **Side Camera:** An additional side camera provides a top-down perspective, enhancing the overall visualization of the holographic content.

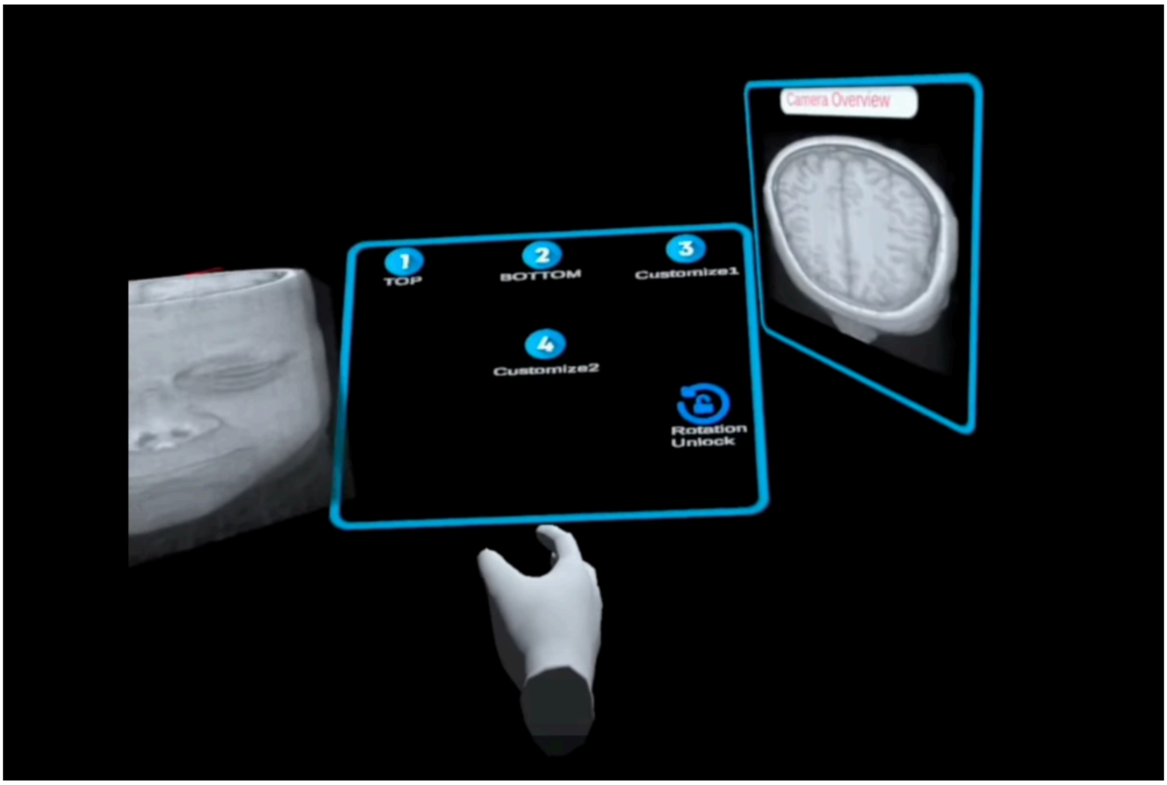
Interface:

- Inside the scene we have a control panel, which along with ray tracing allows the user to control the hologram by rotating, cutting from different angles and activating the side view camera.

Gallery







Summary

This project takes anatomy education and practice one step closer to viewing and dissecting brain using VR technology. The interface could be improved by working closely with the target audience and understanding what features would be desired.

Future Plans:

- Allow user input MRI scans and displaying them in runtime
- Divide hologram into parts and allow viewing each part individually
- Enhanced visuals
- Realistic and unrestricted dissection interface

Source code: https://github.com/Basharza/VR-Brain-Anatomy