



Generating Virtual Objects

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Abstract

Our goal is to develop an application that generates virtual objects from real world input in the form of images and allows these objects to be shared and manipulated in real time.

To process the images to generate a virtual object, we are using Neuralangelo, which is an artificial intelligence model developed by Nvidia.

We are connecting two or more Oculi via a Photon Unity Networking (PUN) server, so one device can act as an instructor and scan objects to import into the virtual world as well as manipulate those objects. The other Oculi will act as spectators and only be able to watch.

Introduction

Virtual reality technology has many applications in the field of education. One such application is sharing objects between instructors and students. Currently, this would be difficult for instructors to implement, as manual creation of virtual objects with tools like ProBuilder is challenging, error prone, and time-consuming. The research presented here examines how to implement Neuralangelo to automate the process of generating virtual objects which can then be imported into a shared virtual environment, updated by a PUN server .

Methods and Materials

Materials

- Unity 2022.3.10f1
- PUN2 (FREE)
- Docker
- Neuralangelo
- COLMAP

Once set up, Neuralangelo will take an input of 2D videos or a group of images and return a 3D-rendered object or scene.

To set up a shared scene that multiple users can simultaneously exist in, a PUN server was set up. Then PUN2 (FREE) was downloaded from the Unity Asset Store and imported into the Unity project. A loading scene was then created with the purpose of being the first scene a user is loaded into. Within this scene is a C# script that connects the user to the PUN server. A lobby scene was added to serve as an intermediate scene with a C# script which allows users to create or join a room on the server. Once the room is created or joined, the user will be taken to the SharedSpace scene, where users can interact with one another and objects.

Contact

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```

using System.Collections;
using System.Collections.Generic;
using UnityEngine;
using Photon.Pun;
using UnityEngine.SceneManagement;

public class ConnectToServer : MonoBehaviourPunCallbacks
{
    // Start is called before the first frame update
    void Start()
    {
        // connect to server before first frame update
        PhotonNetwork.ConnectUsingSettings();
    }

    // once connected to server, join the lobby
    public override void OnConnectedToMaster()
    {
        PhotonNetwork.JoinLobby();
    }

    // taking user to lobby scene
    public override void OnJoinedLobby()
    {
        SceneManager.LoadScene("Lobby");
    }
}

```

Figure 1. ConnectToServer Script

```

using System.Collections;
using System.Collections.Generic;
using UnityEngine;
using UnityEngine.UI;
using Photon.Pun;

public class CreateAndJoinRooms : MonoBehaviourPunCallbacks
{
    // input field corresponding to the name of the
    // room the user is creating or joining
    public InputField roomNameInput;

    // create a room
    public void CreateRoom()
    {
        PhotonNetwork.CreateRoom(roomNameInput.text);
    }

    // called when user joins a room
    public void JoinRoom()
    {
        PhotonNetwork.JoinRoom(roomNameInput.text);
    }

    // makes the photon network open SharedSpace scene
    public override void OnJoinedRoom()
    {
        PhotonNetwork.LoadLevel("SharedSpace");
    }
}

```

Figure 3. CreateAndJoinRooms Script

Expected Results

We plan to use the Neuralangelo AI to create a virtual reality application that scans an object and returns a 3D-rendered object that can be manipulated by the user. In order to scan an object, we will have the user record a video that takes a 360° view of the object. The video will be passed to Neuralangelo and a 3D render will be sent back to the user and then to the server. This 3D render will be able to be manipulated by the users on the server in real time.



Figure 2. Meeting Room Rendered by Nvidia's Neuralangelo AI

Conclusions

We look forward to developing this application and continuing our research into the subject. Our next steps (something like that) include but are not limited to the following:

- Get Neuralangelo running in a Linux environment through Docker.
- Get XR Interaction toolkit up and running in SharedSpace scene.

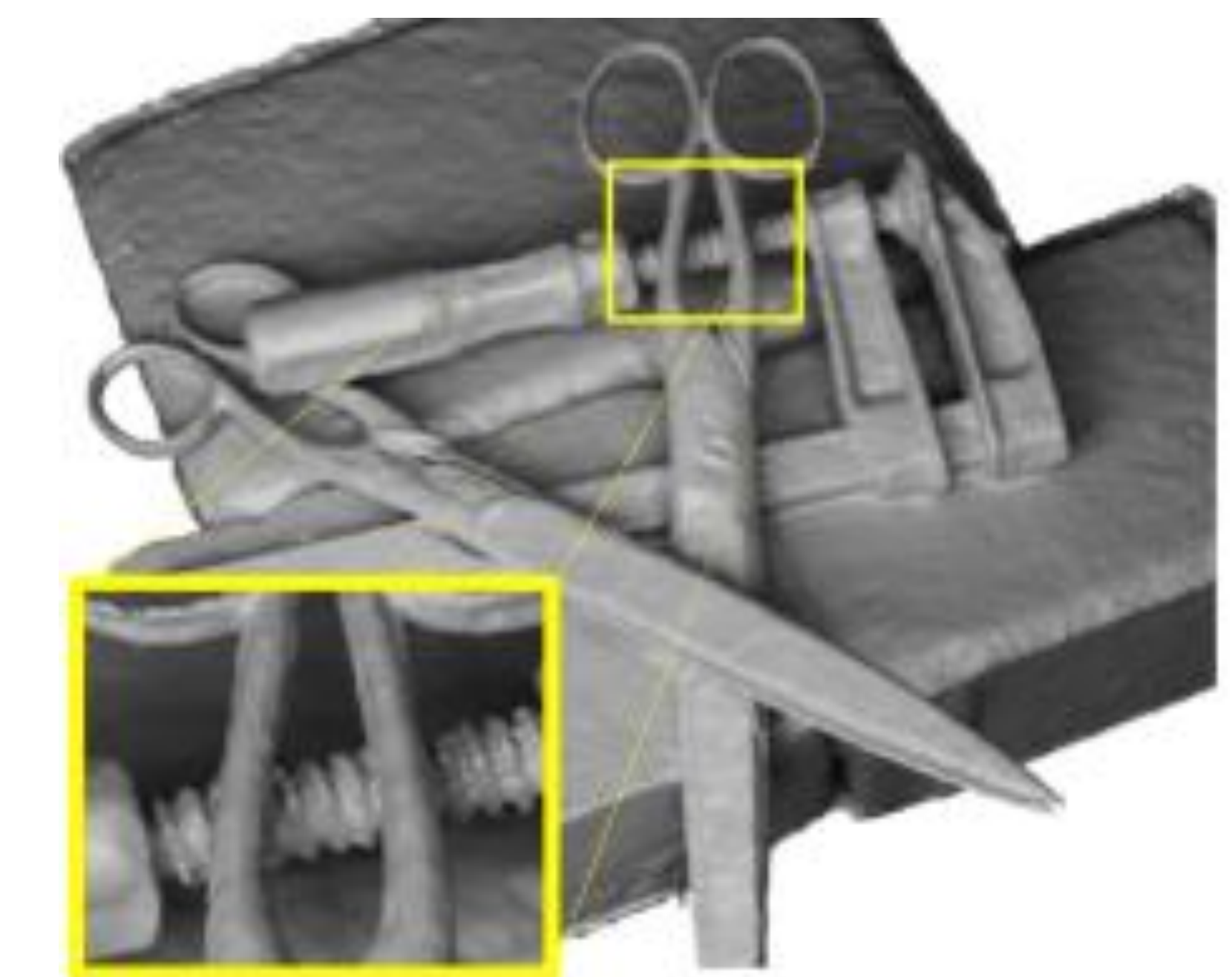


Figure 4. Tools Rendered by Nvidia's Neuralangelo AI

References

1. <https://youtu.be/93SkbMpWCGo?si=he3mVHEgCM3HS3QD>
2. <https://research.nvidia.com/labs/dir/neuralangel>
3. <https://doc-api.photonengine.com/en/pun/current/annotated.html>