Interim Report

Name: Suraj Kothari

Project Title: Using Neural Radiance Fields (NeRFs) on Dark Cave Scenes

Internal Supervisor's Name: Simon Julier

External Supervisor's Name: N/A

Progress Made to Date

Objectives Completed

These are the objectives I set in my Project Plan which have been completed so far

1. Read and understood the original NeRF paper and found existing code that implements it on a toy dataset
2. Taken a look at the Onboard Illumination Visual-Inertial Odometry (OIVIO) dataset which consists of dark environments such as mines, tunnels, caves and downloaded some sample data to work with

Other Tasks Completed

This is work that has been completed so far which includes prototyping and testing. This work builds the foundation to achieve the rest of the objectives for the project.

1. Downloaded the COLMAP GUI and learnt how to use the software to perform pose extraction from a set of images
2. Downloaded a set of images of a building to use with COLMAP to perform the 3D reconstruction and get the pose information
3. Written a script to downsample a set of images to a lower resolution in order for them to be used later to train a NeRF model
4. Written a script to extract the data from text files generated by COLMAP. I needed to extract the images (stored as NumPy arrays), the intrinsic focal length parameter, and the extrinsic (4x4) pose matrices for each viewing direction. All of this data was then collated into a single dataset stored as a NumPy zip
5. Used an implementation of the original NeRF on a Jupyter notebook to train a model on a popular toy dataset, a Lego tractor, whose pose data was already given.
6. Used the same notebook to train another model on the custom building dataset (whose pose data was extracted via COLMAP)
7. Downloaded a GitHub repo that trains a NeRF using a python script instead of a notebook. This allows me to train larger models. Applied the script to the building dataset to generate a $360°$ reconstruction video containing novel views of the scene
8. Applied COLMAP to the OIVIO dataset for two sections of the cave, the initial starting scene and a tunnel

Remaining Work to be Done

- Train a larger NeRF model, using higher computing resources, on the OIVIO dataset
- Use the model to generate novel views of the underground cave network