

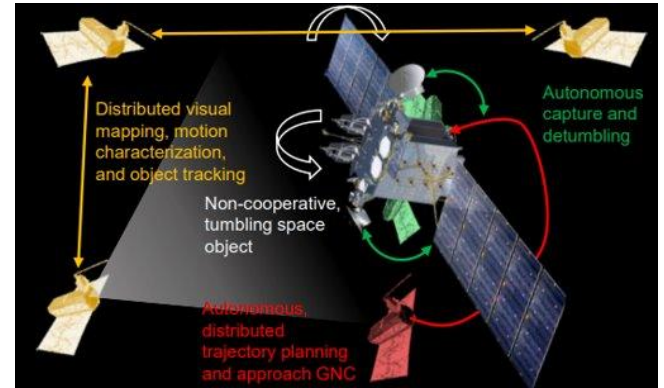
Synthetic Data Pipeline for Pose Estimation

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Goal and motivation

Generate videos of a satellite using 3D animation software with varying light and motion conditions for neural network pose estimation.

The current data gathering process requires users to hand animate the satellite traveling through space given specific parameters. Creating an automation pipeline will save a lot of time and push the research forward.



Approach

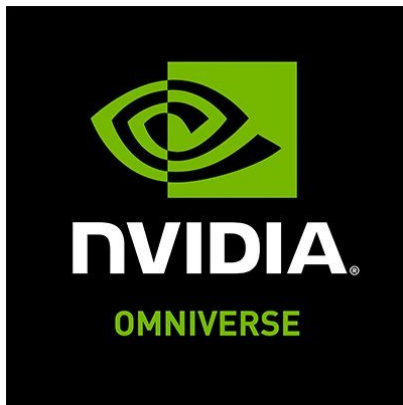
Create an API that will allow a user to enter in the flight path of the satellite, the model of the satellite, the amount of lighting, and the background. With the program will render a video of the satellite traveling.

Each scene will be used to train the neural network responsible for landing a smaller satellite on a larger satellite



Technical Challenges

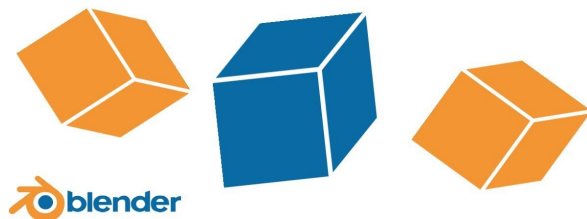
1. We need to learn to use tools new to us such as Blender and Nvidia Omniverse
2. We need to understand how 3D data works so that we can alter and render the data from an API
3. Lastly we have to take advantage of CPU or GPU to optimize the rendering time without compatibility errors



Milestone 1 Goals

- Source CAD models for a variety of satellites
- Understand the strengths and weaknesses of both Nvidia Omniverse and Blender
- Learn how to interface with rendering tools with python programs using API
- Combine these concepts to create a basic demonstrations of rendering satellites with python

Blender Python API



Milestone 2 Goals

- Incorporate motion to the 3D models given manually-created paths
- Simulate rotation and physics on the 3D models
- Implement lighting features to allow for adjusted brightness in different scenarios
- Test and create demos for each addition individually
- Extract pose information from each frame of animation



Milestone 3 Goals

- Create automated testing suite to make sure all features are working properly
- Make software compatible with different hardware such as GPU or CPU
- Add functionality to generate path of motion based on user inputted coordinates
- Discover how to customize the background using the API
- Allow user to easily adjust all setting and render using a configuration file

Task Matrix

Tasks	William	Nathan	Stephane	Hanibal
Read in CAD models	Omniverse	Omniverse	Blender	Blender
3D software API	Omniverse	Omniverse	Blender	Blender
Demos	Omniverse	Omniverse	Blender	Blender
Compare and select 3D software	Omniverse	Omniverse	Blender	Blender
Requirement Document	write 25%	write 25%	write 25%	write 25%
Design Document	write 25%	write 25%	write 25%	write 25%
Test Plan	write 25%	write 25%	write 25%	write 25%