Paper ID: 97809
oral
student

IAF SPACE EXPLORATION SYMPOSIUM (A3)
Interactive Presentations - IAF SPACE EXPLORATION SYMPOSIUM (IP)

Author: Mr. Siyang Meng
Northwestern Polytechnical UniversityNPU, China

SYLUNAR: A SYNTHETIC STEREO VISUAL SLAM DATASET WITH ROBOTS IN UNREAL CHALLENGING LUNAR ENVIRONMENT

Abstract

To deal with challenges in autonomous visual navigation of lunar robots, we make a synthesized dataset named Synthetic Stereo Lunar, SyLunar). We focus on the difficulties brought by the lunar environment, such as large open fields, weak texture, unstructured, deep shadows, and variations in ground texture. Using the existing lunar photogrammetric elevation map with 29m resolution, which is too coarse, we added detailed terrain surfaces with landscape creation tools, then referred to photography materials of Apollo and Yutu. So at a large scale, we try to maintain consistency in aspects of illumination angle, geographical topography, craters. At the detail scale, we make sure its gravel distribution and texture granularity are similar to real moon.

Based on the Unreal environment, six-wheel lunar rovers with physical simulation are driven in scenarios, to record the truth value of stereo camera sensors, visual perception and pose. The designed scenarios consist of 8 sequences, each with a core area of 800m*800m and, elevation map resolution of 0.1m. We design tasks for one robot or for multiple robots collaborating on one scenario. Tracks left by wheels of every robot are recorded as they move across the terrain, which may be used for relocalization. Ground truth of pose, including stereo image, depth maps, normal maps, DEM, and slope maps are recorded in our dataset, totaling 200k frames in length.

To test its feasibility, several tests were conducted using existing visual perception and SLAM methods, including multi-view 3D reconstruction, stereo depth estimation, and visual odometry. In certain challenging scenarios, the off-the-shelf method failed to track or recognize places revisited. The provided dataset can be used for training deep learning algorithms in environment perception, visual navigation, and other tasks, and is expected to generalize to real-world image sequences. The dataset will be publicly available soon.