AI Impact & Autonomy on Space Exploration (14)
AI Impact & Autonomy on Space Exploration - IP Session (IP)

Author: Mrs. Sai Venkata Lakshmi A
Indian Space Research Organization (ISRO), India

AI BASED CRATER DETECTION ON MOON AND PLANETARY SURFACES

Abstract

Crater detection and its analysis is an important and crucial task in planetary science. Crater and boulder detection is useful for autonomous rover navigation and identifying suitable landing sites. Accumulated number of craters and size-frequency distribution provide information on chronology of planetary surfaces and geological processes. Detecting and segmenting crater-like objects manually is laborious and time consuming. Deep learning(DL) models based on Convolutional Neural Networks(CNNs) have performed well for various computer vison tasks like classification, detection and segmentation. However these models are trained with specific types of data like images or Digital Elevation Model(DEM) and for specific objects. In this paper, we present a method for detecting crater-like objects from image and DEM based on Segment Anything Model (SAM), a foundation model for computer vision. This was applied on few areas of Lunar Reconnaissance Orbiter(LROC) Wide Angle Camera(WAC). For high resolution data of lunar surface, Chandrayaan-2 Optical High Resolution Camera(OHRC) images with the best available resolution of 0.25m for lunar surface and Terrain Mapping Camera(TMC)-2 DEM are used. Context Camera(CTX) data on Mars Reconnaissance Orbiter is taken for Mars surface. Model has successfully detected most crater-like objects on images and DEMS of these sensors. Detecting small craters and boulders is crucial for autonomous rover navigation. Significant contributions include: i) Small crater-like objects of meter size could be detected from Chandrayaan-2 OHRC data ii) Algorithm has been modified for improving accuracy of boundary detection and number of craters. iii) Using the outputs, preliminary analysis and comparison of different areas is done for number of craters and size-frequency distribution. Scope of this study includes differentiation of boulders and craters for effective autonomous navigation.