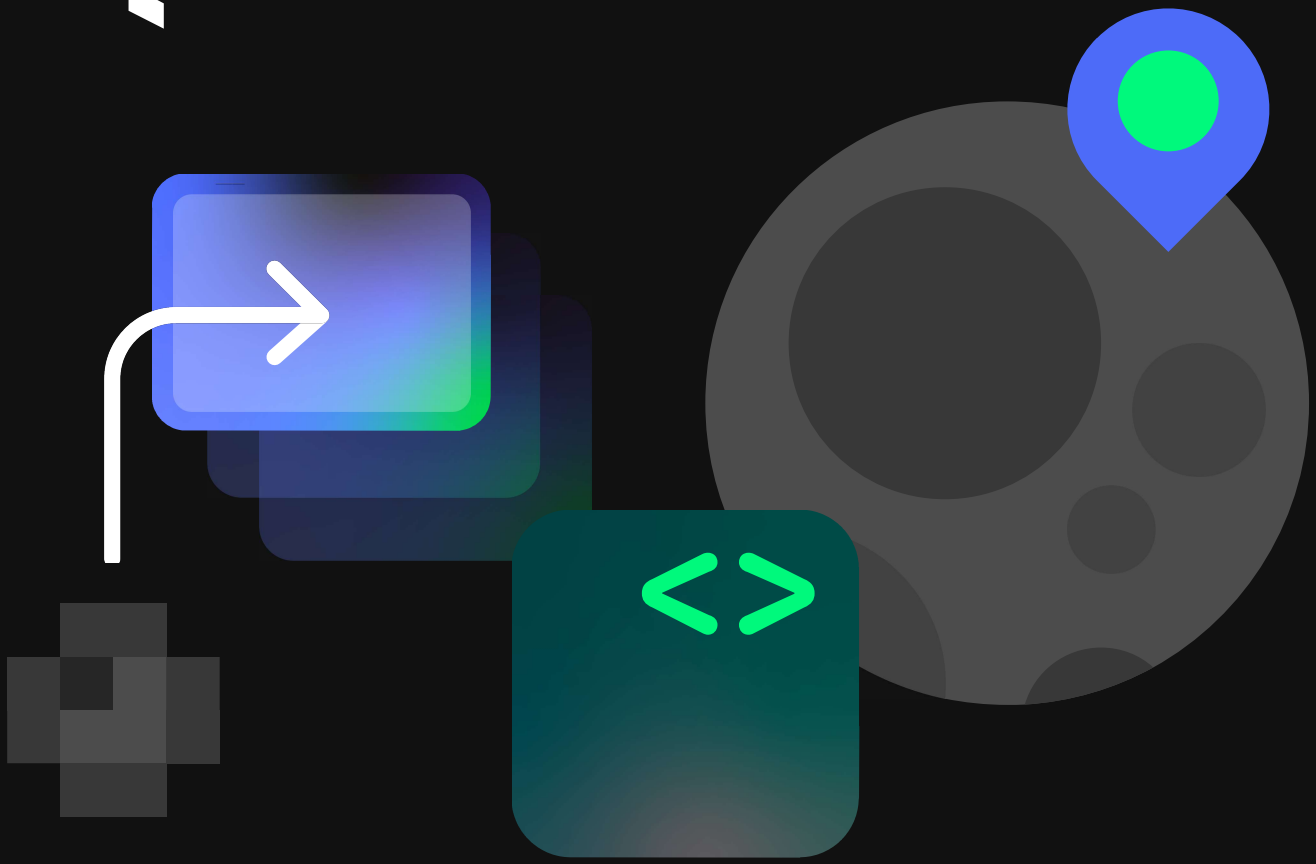
Inter IIT Tech Meet 11.0
IIT Kanpur



Mid Prep

THE CHANDRAYAAN MOON MAPPING CHALLENGE

Amongst the eight payloads that the Chandrayaan-2 Orbiter carries, it carries some imaging payloads too. Use them and the abilities of machine learning and artificial intelligence to create a high resolution map of the moon.

INTRODUCTION

The Chandrayaan-2 Mission of ISRO was launched on July 22, 2019 from the Indian Space Port, Sriharikota by GSLV Mk-III. It was a highly complex mission comprising many new technological developments. The mission is designed to expand the lunar scientific knowledge through detailed study of topography, mineral identification and distribution, surface chemical composition, as well as the lunar exosphere.

The Chandrayaan-2 Orbiter carry total eight scientific payloads. The Orbiter Higher Resolution Camera (OHRC) onboard Chadrayaan-2 Orbiter is an imaging payloads which provides high resolution (~ 30 cm) images of lunar surface. The Terrain Mapping Camera-2 (TMC-2) Chadrayaan-2 Orbiter maps the lunar surface in the panchromatic spectral band (0.5-0.8 microns) with a spatial resolution of 5 meter. The data collected by TMC-2 provides clues about the Moon's evolution and help prepare 3D maps of the lunar surface.

MOTIVATION

The OHRC and TMC-2 payloads are providing valuable imaging information of the moon surface. At present TMC-2 has covered more than half of the surface of moon. OHRC requires certain illumination conditions for optimal payload operations. Due to operational constraints, the coverage of OHRC is small and the payload operates in campaign mode for specific requirements. The data from both these payloads are of very good quality and available in public domain through Indian Space Science Data Centre (ISSDC) of ISRO.

There are common regions over which data from OHRC and TMC-2 both are available. Due to rapid advancement of AI/ML in various domain, it would be possible to train the AI/ML based software over the common coverage of OHRC and TMC-2. The trained software can then be validated on another set of common coverage data OHRC and TMC-2. The validated software can then be used to generate high resolution (> 30 cm) map of the moon from a comparatively low resolution TMC-2 data. As TMC-2 has covered a large area over the moon, a high resolution map of the moon can be generated through such software.

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PROBLEM STATEMENT

The problem statement is divided in two parts:

Part 1 Development of an AI/ML model to generate high (~30 cm) resolution lunar terrain image from medium/low (5 m / 10 m) resolution terrain image, and evaluate its accuracy; the model will be amenable to further training and improvement;
and,

Part 2 To generate a global lunar atlas (digital) with the help of the AI/ML model, based on the medium / low resolution data available.
The AI/ML model to be developed by using the publically available overlapping data of OHRC (~30 cm resolution) and TMC-2 (5 m /10 m resolution) payload data on board Chandrayaan-2 Orbiter.

Evaluation Criteria

Spectral Angle Mapper (SAM) will be used as the evaluation criteria. For more details on SAM, you can refer to this blog: **https://up42.com/blog/tech/image-similarity-measures**

DATA AVAILABILITY

Please see Chapter 3 of the document: Chandrayaan-2 Orbiter- Payloads and Data Products

https://www.isro.gov.in/Chandrayaan-2Science.html

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Such an AI/ML model, which may generate a very high spatial resolution image of the Moon is not available, to date. Once accomplished, this will be used to generate the first AI-generated digital atlas of the Moon in a global scale, which will be helpful for scientific analysis (like surface studies, chronology, etc.), as well as the planning of the exploratory missions, where lunar modules may be landed and made to rove on the lunar surface.