

The identification and analysis of lunar craters and boulders play a vital role in understanding the geological history and evolution of the Moon's surface. Traditional methods of manually detecting these surface features are time-consuming and subject to human error, posing challenges for large-scale analysis and precise mapping. To address these challenges, this project proposes the development of an AI/ML-based model capable of automatically detecting craters and boulders in high-resolution OHRC (Orbiter High-Resolution Camera) images captured during lunar missions.

The solution begins by preprocessing OHRC images through techniques like normalization and seleno referencing, using auxiliary information to ensure data consistency and accuracy. A semi-automated annotation process will be implemented to label craters and boulders, thus generating a comprehensive dataset for training the machine learning model. The primary goal is to ensure the model can accurately detect surface features and improve the efficiency of lunar surface mapping, with evaluation metrics including precision, recall, and F1-score to assess the model's accuracy.

Once trained, the model will be used to predict and identify craters and boulders in new images. Detected features will be outlined and converted into polygonal shapefiles, which include their selenographic coordinates, enabling scientists to obtain detailed maps of the lunar surface. This approach not only provides a more reliable and faster alternative to manual detection but also supports scientific research by enhancing the quality of data available for analysis.

The project will also develop a user-friendly interface, allowing scientists to easily upload images, run detections, and download shapefiles. This ensures that the technology is accessible and can be seamlessly integrated into daily operations. The system's scalability and efficiency will contribute to mission planning and the broader scientific study of lunar geology, making it a valuable tool for space exploration.