A Novel Object Detection-Based Method To Detect Craters and Rilles on the Lunar Surface

Younes, Fadil (School: Al Khobar Secondary School)

Because we have used fossil fuels as our primary fuel source, CO2 levels in the atmosphere are rising and pose serious environmental challenges. Helium-3 may serve as a clean energy resource and is available on the moon in significant quantities. This research focused on the initial phase of building a system that detects helium-3 concentrations. Several object detection models were developed, such as YOLOv5 and YOLOX. At first, the original dataset, 300 images of craters and rilles, was expanded using several image augmentation techniques, such as mosaic to help in detecting small objects and flipping images horizontally and vertically. The final version contains 900 images, with 2693 rille objects and 2047 crater objects. Multiple object detection models were trained on the dataset. Parameters like batch size and weights were changed to optimize the models' performance. Then, mean average precision (mAP), a popular metric used to evaluate object detection models, was calculated by the model. mAP for the models was compared and the most accurate model was YOLOX. It achieved higher than 89% mAP. The final model would help in detecting areas with a high concentration of helium-3 with its exact location. Helium-3 could be used in nuclear fusion, security, science, and medical applications, such as magnetic resonance imaging, after it is extracted and transported to Earth.

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