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LUNAR HIGHRES-NET: SUPER RESOLUTION FOR LUNAR SURFACE IMAGERY

Abstract

In lunar robotic missions, Moon landing sites and initial mission plans have to be carefully chosen based not only on the mission's objective, but also the capabilities of the robot. Nowadays, this decision is taken using pre-landing information mostly obtained through remote sensing missions like NASA's Lunar Reconnaissance Orbiter (LRO). However, the resolution of NASA's LRO images ranges from 0.5 to 5 meters per pixel, having only the 40% of the database this level of resolution. This lack of resolution can potentially arise issues while performing the mission, even leading up to its failure.

This work aims to increase the resolution of these images by applying an adapted Multi-frame Super Resolution (MFSR) method for lunar imagery surface called *Lunar HighRes-net*. This is a deep learning architecture that performs lunar surface image enhancement using a Multi-frame Super Resolution approach. This convolutional neural network can provide images with greater detail, increasing up to three times the resolution of the base input images. By fusing several low-resolution captures of the same scene, a super resolution image is generated by the network with enhanced high-level details. This will provide more information that can lead to better and more accurate planning of the robotic mission that would be carried out on the lunar surface. Well defined craters in satellite images, for example, can avoid putting the robotic system in danger while allowing the optimization of the trajectory or task that the rover will perform and optimize the selection of the landing site. The results obtained with *Lunar HighRes-net* achieves the state of the art performance and shows promising results in which the perceptual quality significantly increases.

This new application of artificial intelligent can change disruptively the way in which we improve our knowledge of celestial bodies, decreasing time and costs necessary to get this information in a significant way.