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Automatic Detection of Changes on Mars Surface from High-Resolution Orbital Images

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Over the last 40 years Mars has been extensively mapped by several NASA and ESA orbital missions, generating a large image dataset comprised of approximately 500,000 high-resolution images (of <100m resolution). The overall area mapped from orbital imagery is approximately 6 times the overall surface of Mars [1]. The multi-temporal coverage of Martian surface allows a visual inspection of the surface to identify dynamic phenomena, i.e. surface features that change over time, such as slope streaks [2], recurring slope lineae [3], new impact craters [4], etc. However, visual inspection for change detection is a limited approach, since it requires extensive use of human resources, which is very difficult to achieve when dealing with a rapidly increasing volume of data. Although citizen science can be employed for training and verification it is unsuitable for planetwide systematic change detection.

In this work, we introduce a novel approach in planetary image change detection, which involves a batch-mode automatic change detection pipeline that identifies regions that have changed. This is tested in anger, on tens of thousands of high-resolution images over the MC11 quadrangle [5], acquired by CTX, HRSC, THEMIS-VIS and MOC-NA instruments [1]. We will present results which indicate a substantial level of activity in this region of Mars, including instances of dynamic natural phenomena that haven't been cataloged in the planetary science literature before. We will demonstrate the potential and usefulness of such an automatic approach in planetary science change detection.

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