Denoising Autoencoder and Anomaly Detection-Based Method to Automatically Looking for Changes on Martian Image Pairs

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The Martian surface is not as static as was previously believed with more frequent repeat observations of the surface from higher and higher resolution revealing dynamic phenomena on its surface at different scales due to different reasons such as new impact craters[1], Spiders[2], and Recurring Slope Lineae[3]. With the increasing amount of repeat imagery available of Martian surface, semi-automatic or automatic methods are potentially more and more useful to detect changes over larger areas, utilising multi-instrument images available over 40 years of Mars observation.

In this research, we present a method to detect changes in pairs of Martian image strips based on a denoising autoencoder and anomaly detector to look for change candidates. Pairs are automatically coregistered and orthorectified using the in-house (ACRO)[4] system to the same base image, depending on whether HRSC[5][6] and CTX[7] are available, to reduce false positives based on imperfect coregistration. To assess the performance of the method, annotations have been produced on 5 areas of Mars with different surface changes such as dark slope streaks and dust devils as well as Martian polar changes using multi-instrument image pairs in similar and different imaging conditions. Anomaly detectors are assessed to obtain suitable precision and recall percentages to narrow down change candidates on unseen image pairs.

References:
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