EPSC
European Planetary Science Congress

Remote Sensing of Martian Terrain Hazards via Visually Salient Feature Detection

Said Al-Milli, Affan Shaukat, Conrad Spiteri, Yang Gao

Abstract:

The main objective of the FASTER remote sensing system is the detection of rocks on planetary surfaces by employing models that can efficiently characterise rocks in terms of semantic descriptions. The proposed technique abates some of the algorithmic limitations of existing methods with no training requirements, lower computational complexity and greater robustness towards visual tracking applications over long-distance planetary terrains. Visual saliency models inspired from biological systems help to identify important regions (such as rocks) in the visual scene. Surface rocks are therefore completely described in terms of their local or global conspicuity pop-out characteristics. These local and global pop-out cues are (but not limited to); colour, depth, orientation, curvature, size, luminance intensity, shape, topology etc. The currently applied methods follow a purely bottom-up strategy of visual attention for selection of conspicuous regions in the visual scene without any top-down control. Furthermore the choice of models used (tested and evaluated) are relatively fast among the state-of-the-art and have very low computational load. Quantitative evaluation of these state-of-the-art models was carried out using benchmark datasets including the Surrey Space Centre Lab Test-bed, Pangu generated images, RAL Space SEEKER and CNES Mars Yard datasets. The analysis indicates that models based on visually salient information in the frequency domain (SRA, SDSR, PQFT) are the best performing ones for detecting rocks in an extra-terrestrial setting. In particular the SRA model seems to be the most optimum of the lot especially that it requires the least computational time while keeping errors competitively low. The salient objects extracted using these models can then be merged with the Digital Elevation Models (DEMs) generated from the same navigation cameras in order to be fused to the navigation map thus giving a clear indication of the rock locations.
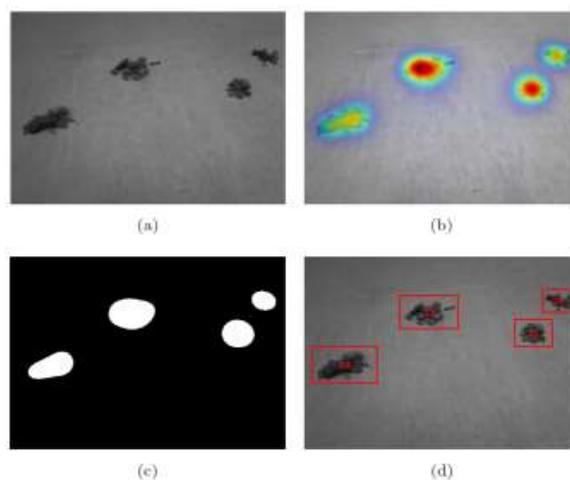
Figure: Example of saliency method used to detect rocks