PRo3D – Interactive Geologic Assessment of Planetary 3D Vision Data Products

BARNES Robert[(1)], PAAR Gerhard[(2)], TRAXLER Christoph[(3)], MULLER Jan-Peter[(4)], TAO Yu[(4)], SANDER Kathrin[(2)], GUPTA Sanjeev[(1)], ORTNER Thomas[(3)], FRITZ Laura[(3)]

[(1)]Imperial College, Department of Earth Science and Engineering, South Kensington Campus, London, SW7 2AZ, UK; [(2)]JOANNEUM RESEARCH, Steyrergasse 17, 8010 Graz, Austria; [(3)]VRVis, Donau-City-Strasse 1, 1220 Wien, Austria, ; [(4)]MSSL, UCL, Holmbury St Mary, Surrey, RH5 6NT, UK;

The FP7-SPACE project *PRoViDE* (Planetary Robotics Vision Data Exploitation) has been conducted to exploit the wealth of orbital, probe and rover derived planetary surface imagery data taken from missions which have successfully travelled to other planetary bodies in the Solar System. A major element of the data transmitted from Mars in particular is stereo-imagery from the Pancam (NASA Mars Exploration Rovers MER-A and MER-B), Mastcam (NASA Mars Science Laboratory Curiosity Rover) and Navcam (MER and MSL) instruments. Stereo images can be processed to form 3D data sets including image texture that can be represented as *Ordered Point Clouds* (OPCs). Such OPCs allow viewers to visualize different levels of texture and geometry detail for immersive interactive presentation of large datasets. 3D real-time rendering of rock outcrops on the Martian surface can be achieved within the *PRo3D* tool, in which OPCs generated from the landers' instruments can be fused together with OPCs obtained from more regional stereo orbit-derived HiRISE digital elevation models (DEMs) and combined with Super-Resolution images for enhanced textural detail. PRo3D allows for geological analysis of such 3D models fused from multiple sources, namely to:

- Study 3D representations of rock outcrops by moving around efficiently and providing different perspectives.
- Visualize data from orbital imagery down to the magnifier-scale imagery (seamlessly investigate multi-resolution data sets) for global context and spatial referencing between differently located phenomena.
- Annotate and interpret the geological features of 3D OPCs.
- Measure geological structures to determine their dimensions and other geometric features.

We demonstrate the capabilities of PRo3D for geological analysis using terrestrial point cloud data from the *Ferron* sandstone in Utah, an exposed Cretaceous section which records changes in conditions from near-shore marine, shoreface and to meander-belt subaerial deposits from a fluvial and tide dominated delta. The interpretation and analysis techniques derived from this can then be applied to OPCs obtained from combined short baseline and serendipitous long baseline stereo Pancam rover imagery from the MER-B (Opportunity rover). Complete coverage was not possible with the available data, therefore fusion of OPCs from different locations of the sites-of-interest (along the rim of Victoria Crater) within the PRo3D viewer enables correlation of observations between well-imaged locations.

The PRo3D tool is currently being developed for exploiting the stereo capabilities of the PanCam instrument on board of the ExoMars Rover to be landed on Mars in 2019.

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