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EU-FP7-iMARS: analysis of Mars multi-resolution images using auto-coregistration, data mining and crowd source techniques: A Final Report on the very variable surface of Mars

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There has been a revolution in 3D surface imaging of Mars over the last 12 years with systematic stereoscopy from HRSC. Digital Terrain Models (DTMs) and OrthoRectified Images (ORIs) have been produced for almost 50% of the Martian surface. DLR, together with the HRSC science team, produced 3D HRSC mosaic products for large regions comprising around 100 individual strips per region (MC-11E/W). UCL processed full coverage of DTMs over the South Polar Residual Cap (SPRC) and started work on the North Polar Layered Deposits (NPLD). The iMars project has been exploiting this unique set of 3D products as a basemap to co-register NASA imagery going back to the 1970s.

UCL have developed an automated processing chain for CTX and HiRISE 3D processing to densify the global HRSC dataset with DTMs down to 18m and 75cm respectively using a modification of the open source NASA Ames Stereo Pipeline [1]. 1542 CTX DTMs + ORIs were processed using the Microsoft Azure® cloud and an in-house linux cluster. It is planned to process around 10% of the total HiRISE stereo-DTMs before the end of the project.

A fully Automated Co-Registration and Orthorectification (ACRO) system has been developed at UCL and applied to the production of around some 15,000 NASA images. These were co-registered co-registered to a HRSC pixel (typically 12.5m/pixel) and orthorectified to HRSC DTMs of 50-150m spacing [2] over MC-11E/W.

All of these new products images are viewable through an OGC-compliant webGIS developed at FUB,. This includes tools for viewing temporal sequences of co-registered ORIs over the same area [3]. Corresponding MARSIS and SHARAD data can be viewed through a QGIS plugin made publicly available [4]. An automated data mining system has been developed at UCL [5] for change detection to search and classify features in images going back to Viking Orbiter of IFoV $\leq$100m. In parallel, a citizen science project at Nottingham University [6] has defined training samples for classification of change features and eventually for verification of change [7]. Scientific applications include change mapping over MC11E/W, the SPRC [8], mass movements near the North Pole [9]; dark streaks [10] CRISM mapping of mineralogy of dust in the SPRC “Swiss cheese” layers [11] and mapping of dune movement [12]. Examples of some of these will be shown.

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