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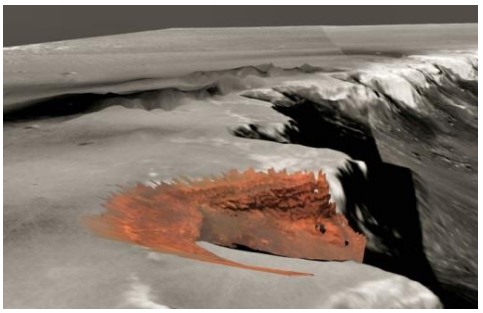
Special Lecture on Planetary Science

Leading scientists in the field of planetary science will give special lectures on their research work. They will explain how imagery from orbiters and rovers are processed and used for scientific analysis.

When:	Wednesday, July 15th 2015, 13:30-15:00
Where:	Tech Gate Vienna, Business Stage 4.2, Donau-City-Strasse 1, 4th Floor, 1220 Wien

The EU FP7 Project PRoViDE: 3D processing from planetary rovers' images

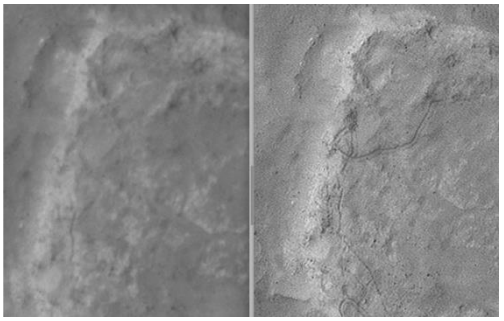
Gerhard Paar, JOANNEUM RESEARCH, Graz



The international planetary science community has launched, landed and operated dozens of human and robotic missions to the planets and the Moon. They have collected thousands of surface images that have only been partially utilized for further scientific purposes. The FP7 project PRoViDE (Planetary Robotics Vision Data Exploitation) is assembling a major portion of the imaging data gathered so far from planetary surface missions into a unique database, bringing them into a spatial context and providing access to a complete set of 3D vision products. The processing chain is shown which is exploited by a multi-resolution visualization engine that combines various levels of detail for a seamless and immersive real-time access to dynamically rendered 3D scenes. Latest results of 3D fusion between HiRISE and MER/MSL 3D stereo vision products will be shown, as well as combined 3D vision processing results from multiple rover stations.

Automated rover positioning on the Martian surface and 5cm imagery from super-resolution restoration of HiRISE 25cm images.

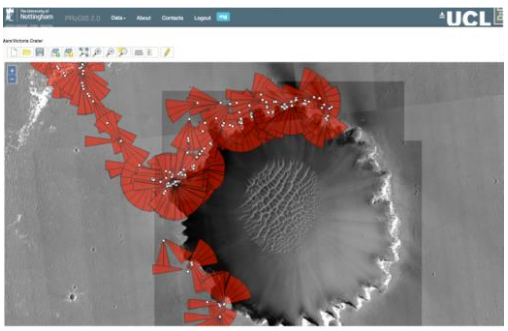
Jan-Peter Muller & Yu Tao
Mullard Space Science Laboratory, University College London



Since 2007, the availability of very high resolution imagery (25cm) of the surface of Mars from orbit from the NASA HiRISE instrument allows scientists to determine to high accuracy the location of surface rovers to tens of cm precision within a HiRISE image. This is achieved through the co-registration of common homologous features visible in onboard rover cameras, which can be matched to those visible in orbital images. However, the poor locational accuracy of the HiRISE images meant that the absolute location of any specific point could be hundreds of metres in error. Through the automated co-registration of HiRISE-to-CTX-to-HRSC orthorectified images, the locational accuracy is now within a few metres of the true position. Examples of such optical navigation will be shown for the MER-A (Spirit) and MSL including a comparison with the best accuracy achievable using incremental bundle adjustment (IBA). Recently, a fully automated method has been developed to generate a rover traverse through successive ground space co-registration which can employ the rover tracks for verification.
During the course of working on this automated navigation, a novel super-resolution restoration (SRR) technique has been developed which allows up to 5cm imagery to be generated from multiple overlapping orbital HiRISE images taken over a large number of years. Examples will be shown of the co-registration of the rover imagery with such SRR images as well as examples of its potential application to the future exploration of planetary surfaces including the selection of future science targets for the MSL Curiosity rover on its journey towards the summit of Mt Sharp.

Contextualising and Analysing Planetary Rover Image Products through the Web-Based PRoGIS

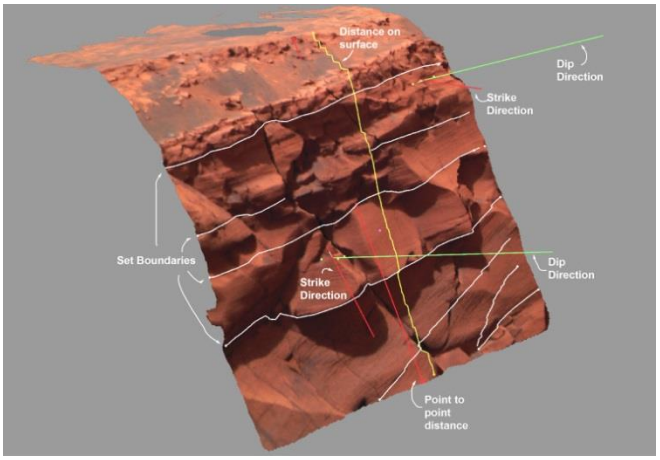
Michele Giordano, Nottingham Geospatial Institute, University of Nottingham, Nottingham, UK



The big amount of raw and derived data available from various planetary surface missions (Mars and Moon in this case) needs an integrated GIS to use it for scientific use: we aim not to replicate a desktop GIS with all its complexity but to create a web interface, PRoGIS, with minimal controls focusing on the usability and visibility of data, to allow planetary geologists to share annotated surface observations. Our aim is to use only Open Source components that integrate Open Web Services for planetary data to make available a universal platform with a WebGIS interface, a 3D viewer for derived data and the capability to make and share annotations. We use Python and Django for the server-side framework and Open Layers 3 for the WebGIS client. For good performance previewing 3D data (point clouds, pictures on the surface and panoramas) we employ ThreeJS, a WebGL Javascript library. Additionally, user and group controls allow scientists to store and share their observations. PRoGIS not only displays data but also launches sophisticated 3D vision reprocessing (PRoVIP) and an immersive 3D analysis environment (PRo3D).

PRo3D: A Virtual Environment for the Accurate Geologic Analysis of Martian Terrain

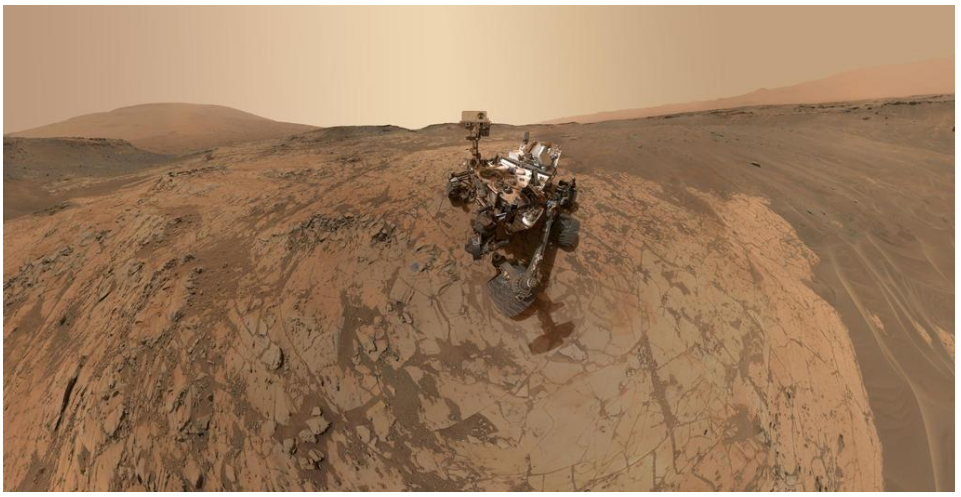
Christoph Traxler, VRVis Forschungs GmbH, Vienna, Austria



Remote geology on planetary surfaces requires immersive presentation of the environment to be investigated. Three-dimensional (3D) processing of images from rovers and satellites enables to reconstruct terrain in virtual space on Earth for scientific analysis. In this talk we present a virtual environment that allows planetary scientists to interactively explore 3D-reconstructed Martian terrain and perform accurate measurements on the surface. Geologists do not only require line-of-sight measurements between two points but much more the projected line-of-sight on the surface between two such points. It is also possible to create paths consisting of several points. This tool can also be used to delineate sedimentary facies and other characteristics. Comments and annotations can be provided in this way, which is especially important when collaborating with colleagues. All measurements and annotations can be used as landmarks, i.e. it is possible to interactively fly to the corresponding locations. This set of interactive tools enables planetary scientists to map geological surfaces and rock layers over large areas in a quantitative framework. Overall, they are able to construct digital models of rock outcrops that assist in identification of ancient sedimentary environments that may have been habitable.

The further adventures of Curiosity in Gale Crater, Mars

Sanjeev Gupta, Imperial College London, UK



The Mars Science Laboratory rover, Curiosity, has now been on the surface of Mars for over almost 3 years. Since its landing in Gale crater, this car-sized rover has been crossing the plains between the crater rim and Mount Sharp conducting an investigation of ancient rock formations and their potential to record ancient habitable environments.

In its journey from the Bradbury landing site to its current location at the foot of Mount Sharp, the rover has encountered an exciting array of sedimentary rocks that enable us to reconstruct a range of potential habitable environments. This talk will describe the rover's explorations and adventures, and discuss the latest findings.

The research leading to these results has received funding from the European Community's Seventh Framework Programme (FP7/2007-2013) under grant agreement n° 312377 PRoViDE