JOANNEUM RESEARCH DIGITAL

Anmeldung / Registration

Bitte bis / please register
until November 28th 2015 for PRoViDE Plenary Exploitation Event

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Ich nehme / I will attend
❑ teil / yes ❑ nicht teil /no

Titel, Name .....

Firma .....

Adresse .....

Tel. / Fax .....

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Veranstaltungsort / Venue

VRVis Zentrum für Virtual Reality und Visualisierung Forschungs-GmbH

VRVis GmbH, Tech Gate Vienna
Donau-City Straße 1
1220 Vienna
Stage 3.2

THE INNOVATION COMPANY

prm ver401 015

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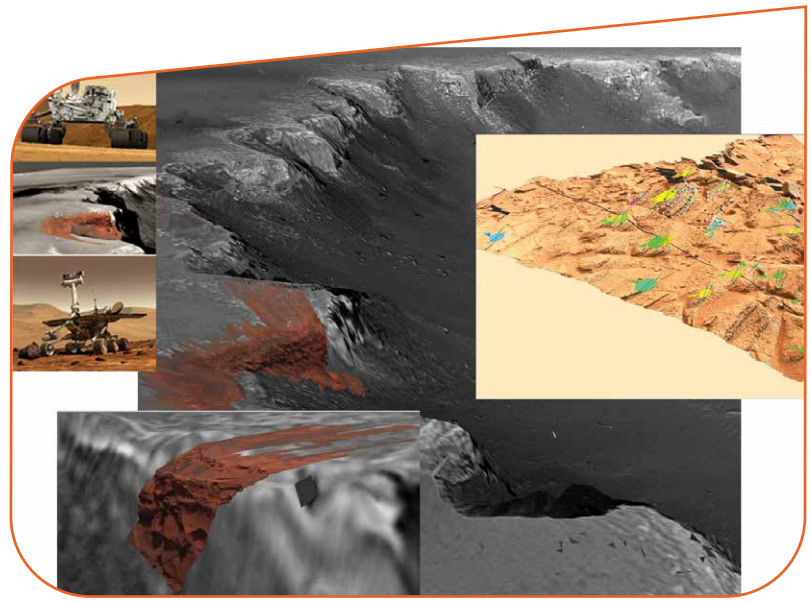
Invitation/ Einladung



Courtesy of PRoViDE consortium

PRoViDE Plenary Exploitation Event

PRoViDE – Planetary Robotics Vision Data Exploitation

Dec 2nd 2015, 13:30 to 16:30

VRVis GmbH, Tech Gate Vienna
Donau-City Straße 1
1220 Vienna
Stage 3.2

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

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Dec 2nd 2015

13:30 Public Lecture

13:30 **PRoViDE:**
3D vision processing & fusion from planetary rover's images
Gerhard Paar, JOANNEUM RESEARCH, AT

13:50 **Mosaics from Mars: Rover Panorama Production and Use**
Bob Deen, Multimission Image Processing Laboratory, Jet Propulsion Laboratory, California Institute of Technology, USA

14:30 **Filling the visual gap between rover cameras and orbital views using superresolution restoration**
Jan Peter Muller, Mullard Space Science Laboratory, University College London, UK

14:50 **MSL Curiosity rover geologic exploration on Mars**
Sanjeev Gupta, Imperial College London, UK

15:10 **3D Geologic Analysis of Planetary Surfaces Using PRo3D**
Rob Barnes, London, UK / ***Christoph Traxler,*** VRVis, AT

15:30 Demos

PRoGIS: Contextualising and Analysing Planetary Rover Image Products
Michele Giordano, University of Nottingham, UK

Lunar GIS Portal: Context on the Surface of Moon in 2D and 3D
Andrey Garov, MIIGAiK, RU

PRo3D: A Virtual Environment for the Accurate Geologic Analysis of Martian Terrain
Christoph Traxler, VRVis, AT

16:30 Discussion

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Programm / Programme

Public Lecture

PRoViDE: 3D vision processing & fusion from planetary rovers' images
Gerhard Paar, Head of Machine Vision Applications Group, JOANNEUM RESEARCH

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 and novel 3D fusion products between HiRISE orbiter and multiple-station MER/MSL rover 3D stereo vision products will be shown, being 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.

Keynote: Mosaics from Mars: Rover Panorama Production and Use
Bob Deen is a Principal Software Developer at the JPL Multimission Image Processing lab, where he has worked for the last 28 years. He is responsible for the ground-based image processing software (including mosaic software) used as part of the daily operations of the MER, Phœnix, MSL, InSight, and Mars 2020 missions. In addition, he is on the operations team for all of these missions.

From the Viking landers to the current Curiosity and Opportunity rovers and beyond, panoramic mosaics have been one of the primary ways for people to experience Mars. This talk will describe the mosaics produced by the Multimission Image Processing Lab at JPL for rover operations, science, and public outreach. Use cases and examples will be shown, along with an overview of production techniques. A look ahead at the mosaic challenges for the upcoming InSight lander will be included.

Filling the visual gap between rover cameras and orbital views using superresolution restoration
Jan-Peter Muller, Head of Imaging Group, Mullard Space Science Laboratory, University College, London, UK

Within PRoViDE, one of the key objectives is to be able to visualise (and measure) features on 3D surfaces from fusion of orbital 3D images, such as 25cm HiRISE with 3D images taken by rover cameras, such as Navcam of 2mm at 2m range. Unfortunately, there is a visual gap at a range of 5m or greater from the rover imagery and we do not match the projected resolution from Navcam until a range of 25m. To meet this gap, we have developed a super-resolution restoration (SRR) technique for generating up to 5x increases in resolution from stacks of 25cm HiRISE images. We will describe this technique and show examples of its use from MER-A,B & MSL for filling this visual gap as well as in its own right for making maps of rock-size distributions along the rover track.

MSL Curiosity rover geologic exploration on Mars

Sanjeev Gupta, Imperial College London

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.

3D Geologic Analysis of Planetary Surfaces Using PRo3D

Robert Barnes, Imperial College London / ***Christoph Traxler***, VRVis

Panoramic digital cameras (Pancam on MER and Mastcam on MSL) are used for characterising the geology of rock outcrops along rover traverses. A key focus is on sedimentary rocks that have the potential to contain evidence for ancient life on Mars. Clues to determine ancient sedimentary environments are preserved in layer geometries, sedimentary structures and grain size distribution. The panoramic camera systems take stereo images which are co-registered to create 3D Ordered Point Clouds (OPCs) of rock outcrops to be quantitatively analysed as geologists would analyse an outcrop on Earth.
Rendering of 3D OPCs in PRo3D enables the user to zoom, rotate and translate the 3D outcrop model. Interpretations can be digitised directly onto the 3D surface, and simple measurements can be taken of the dimensions of the outcrop and sedimentary features. Dip and strike is calculated within PRo3D from mapped bedding contacts and fracture traces.
These tools have been tested on three case studies; Victoria Crater, Yellowknife Bay and Shaler. Victoria Crater, in the Meridiani Planum region of Mars, was visited by the MER-B Opportunity Rover. Erosional widening of the crater produced <15 m high outcrops which expose ancient Martian eolian bedforms. Yellowknife Bay and Shaler were visited in the early stages of the MSL mission, and provide excellent opportunities to characterise Martian fluvio-lacustrine sedimentary features. Development of these tools is crucial to exploitation of vision data from future missions, such as the 2018 ExoMars Rover and the NASA Mars 2020 mission.

Demos

DEMO: PRoGIS: Contextualising Planetary Rover Image Products

Michele Giordano, University of Nottingham

The big amount of raw and derived data available from various planetary surface missions (Mars and Moon in this case) needs an integrated approach to use it for scientific exploitation. One of the main goals was to put all data in the same spatial context (IAU2000:49900) to give scientists a wide view on phenomena. Standard OGC web services are used to integrate data from different sources and missions. We aim not to replicate just a GIS desktop software with all its complexity

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but create a web interface, with minimal controls focusing on the usability and visibility of data, to allow planetary scientists to share knowledge and observations on planetary surfaces. In details geologists can explore raw data from Mars rover, HiRISE, SRR, point clouds and panoramas.
Only Open Source components that integrate Open Web Services for planetary data are used to make available a universal platform with a WebGIS interface, a simplified 3D viewer for derived data and the capability to make and share annotations. Mission and user/group controls allow scientists to store and share their observations with team people. PRoGIS not only displays data but also launches 3D vision batch processing (PRoVIP) and the immersive 3D analysis environment (PRo3D).

DEMO: Lunar GIS Portal: Context on the Surface of Moon in 2D and 3D

Andrey Garov, MIIGAiK

We developed a Lunar Geoportal as a web GIS for collection, storage, processing, analysis, interpretation, and access to Lunar vision data. Archive panoramas and metadata obtained by Lunokhods were assembled and uploaded into a database as well as a catalogue with morphologic assessment of the lunar surface based on panoramas. Based on the Planetary Geoportal (http://cartsrv.mexlab.ru/geoportal) we show a new version of 3D-web GIS using an innovative approach including: - a cross-platform solution with shared codebase; - a single compact messaging protocol between the modules within a single process and via the network without the use of middleware; - the modular approach with ability to easily transfer modules between the server and the client via just reconfiguration to achieve optimal performance; - WS/WSS and WebRTC (instead of HTTP, XHR); - OGC protocols (WFS, WMS) via special compatibility module; - scripting API for running external scripts and animation; - teleconference regime (including video/audio broadcasting) as remote scripting via WebRTC protocol providing context synchronization.

DEMO: PRo3D: A Virtual Environment for the Accurate Geologic Analysis of Martian Terrain (Optionally conducted in the CAVE[1])

Christoph Traxler, VRVis / London, UK

In this demo, we present the virtual environment PRo3D that allows planetary scientists to interactively explore 3D-reconstructed Martian terrain and perform accurate measurements on the surface. The demo focuses on geologic interpretation and analysis. It shows how the set of interactive tools are used to delineate sedimentary faces, calculate the dip & strike of beddings and map geological surfaces and rock layers over large areas in a quantitative framework. In this way, scientists create digital models of rock outcrops that assist in identification of ancient sedimentary environments that may have been habitable. In course of this demo, we present the latest results of 3D fusion between HiRISE and MER/MSL, as well as combined 3D vision processing results from multiple rover stations. The CAVE[1] demo focuses on the immersive exploration of planetary surface reconstruction in a 3-wall projection system.

[1]The CAVE is a 3 wall seamless projection system allowing immersive exploration of planetary surface reconstructions. A gamepad can be used to fly through high resolution data sets from Mars and the Moon. The panoramic view provided by the CAVE is especially suitable to study the larger geologic context from arbitrary perspectives. Besides that it is an exciting experience for the broader public and can be used to mediate planetary research results.