

PHOTOMOD – a Software System for Planetary Image Analysis

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Introduction

PHOTOMOD [1] is a digital photogrammetric software initially developed for the Earth images processing and DTM, orthophotoimages and mosaics creation.

In 2011 the PHOTOMOD software has been upgraded for the possibilities of the planetary images processing ability and 3D models creating.

The upgraded software PHOTOMOD was tested at MIIGAiK Extraterrestrial Laboratory and can be used for tiepoint measurements, bundle block adjustments, mosaic and orthophotoimages preparing, and images analysis for planetary bodies of the Solar System.

We have plans to integrate the output of the PHOTOMOD software with PDS database (<http://pds.nasa.gov/>).

The list of some advantages of image processing by means PHOTOMOD software is presented here:

Batch loading of push-broom scanner images with automatically reading geo-reference data, interior and exterior orientation parameters.

By means of PHOTOMOD software the following processes can be performed automatically:

- reading of image metadata,
- overlapping areas of images computation as well as deviation angle from nadir,
- color depth estimation of images (8-16 bit/pixel),
- brightness adjustment for an individual image or a group of images.

Additional "pyramid" files are created for quick preview of images – it would take some time to open the file but further work with image will be faster.

Automatic triangulation (images auto-correlation) for blocks of pushbroom scanner images and bundle-block adjustments:

- automatic identification of tiepoints using preliminary exterior orientation and overlapping areas with subpixel accuracy,
- indication of a camera name and a deviation angle from nadir for each image to exclude mono

images from triangulation,

- loading of more than 100 images for mean residuals of points control,
- visualization of tie errors vectors in the measuring tie points window for misidentified measurements control.

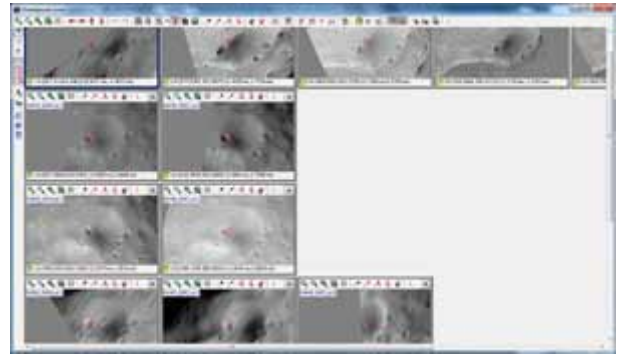


Fig. 1. Set of Phobos area images in the Measuring tie points window.

Mosaic creation in several seconds:

- able to construct any projection,
- automatic brightness balancing is performed with a single click,
- region of interest (ROI) automatic image creating,
- brightness balancing ignoring some areas (for example, shaded crater floors or shade from mountains),
- preliminary preview of a mosaic on all stages of mosaicking,
- transparent cutlines for excluding shaded areas to fill shaded areas by images with better illumination condition (Fig.2).

DTM (Digital Terrain Model), DEM (Digital Elevation Model) generation using automatic correlation at nodes of a regular grid as well as easy-to-use edit tools in the manual mode:

- parameters preset for automatic identification of surface points,
- loading of preliminary DEM allows to search identical points faster,
- manual generation of vector objects in stereo mode for the entire area of a stereo pair,
- compiling of stereo pairs based on only exterior orientation data,
- tools of filtration of misidentified points meas-

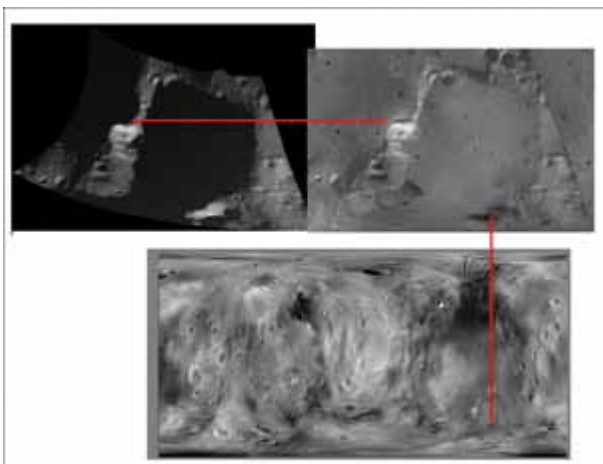


Fig. 2. Global mosaic of Phobos: an example of transparent cutlines applying.

ured by means of automatic correlation,

- export images, DEM, DTM to common used formats.

Results of small bodies study by means of PHOTOMOD software are the following:

- control point networks for Phobos, Io, Enceladus with improved accuracy [2,3,4],

- observation of the forced libration amplitude for Phobos [2],

- DEMs with breaklines for Phobos [2], for some regions of Enceladus and detailed DTMs of lunar surface from LROC NAC images (Fig. 3),

- orthomosaics of Io, Phobos, Enceladus and interesting Lunar regions (Lunokhod-1,2 areas) with global brightness adjustment.

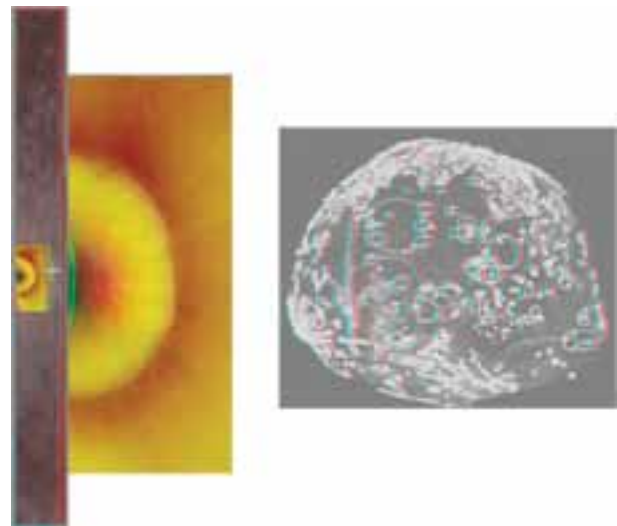


Fig. 3. Results of image processing by means of PHOTOMOD: Elevation matrix for lunar crater (on the left) and DEM with breaklines for Phobos.

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References:

[1] <http://www.racurs.ru/?lng=en&page=634>.

[2] I. Nadezhdina I. et al. (2012) EPSC 2012, Abstract #238

[3] Nadezhdina I. et al. (2012) 43 LPSC, Abstract #1039.

[4] Nadezhdina I. et al. (2012) EGU 2012, Abstract #11210.