ISPRS Workshop on
Geospatial Data Infrastructure: from data acquisition and updating to smarter services
October 20-21, 2011, Guilin, China

ABSTRACT SUBMISSION FORM

Abstracts should be submitted via e-mail to isprswg41@nsdi.gov.cn or jiangjie_263@263.net before April 30,2011.

Title of the Paper

Bundle Adjustment of Chang'E-1 Imagery and Laser Altimeter Data for Lunar Topographic Mapping

Author(s) [1]

Bo Wu and Jian Guo
Department of Land Surveying & Geo-Informatics
The Hong Kong Polytechnic University
Hung Hom, Kowloon, Hong Kong

Corresponding Author [2]

Bo Wu
Assistant Professor
Department of Land Surveying & Geo-Informatics
The Hong Kong Polytechnic University
Tel: +852 2766 4335
Fax: +852 2330 2994
Email: lsbowu@polyu.edu.hk

Technical Session [3]

Data acquisition and updating/ Database creation and maintenance

Keywords (5-8) [4]

Photogrammetry, Imagery, Laser scanning, Multisensor, Integration

ABSTRACT(more than 300 words) [5]

Lunar topographic information is of paramount importance for lunar exploration missions and lunar scientific investigations. Lunar orbital imagery and laser altimeter data are two major data sources for lunar topographic information derivation. Starting from the 1960s, a vast amount of lunar imagery and laser altimeter data have been collected and processed in the Apollo missions and the Clementine mission. More recently, China launched its first lunar probe Chang'E-1 in October 2007. On-board the Chang'E-1spacecraft there is a three-line array CCD camera system providing lunar surface imagery and a laser altimeter generating range measurements. The Chang'E-1 mission successfully returned 1098 orbiter images with a spatial resolution of 120 m and more than 3 million range measurements covering the whole lunar surface.

For lunar topographic mapping from orbiter imagery and laser altimeter data, most of the previous work has processed imagery and laser altimeter data separately. Usually though there are inconsistencies

between the topographic models derived from them due to the unavoidable errors (e.g., errors from sensor positions and orientations). This paper presents an endeavor to integrate the Chang'E-1 imagery and laser altimeter data for consistent and precision lunar topographic mapping. A bundle adjustment methodology for the Chang'E-1 imagery and laser altimeter data has been developed which could reduce the inconsistencies between them and subsequently produce better lunar topography from the Chang'E-1 data. In the bundle adjustment model, the participants are the laser altimeter points, image exterior orientation (EO) parameters, and tie points collected from the stereo images. They are used to build observation equations of bundle adjustment model. A special weighting scheme is designed for the participants and a local surface constraint is imposed to improve the performance of the model. The bundle adjustment is carried out based on a least squares approach, in which the weighted squared sum of the residuals of observations should be minimized. The output of the bundle adjustment is the refined image EO parameters and laser ground points. Experimental results using the Chang'E-1 data in the Apollo 15 landing site areas show that the proposed combined adjustment approach can reduce the mis-registrations between the imagery and the laser altimeter data by maximum 1- 18 pixels in image space. Results from the detailed DEM profile comparison show that the mis-registrations in object space can also be significantly reduced.

The developed bundle adjustment model enables cross-sensor data integration, which is very valuable for integrating data sets from different sources to produce consistent lunar topographic information. Future research will study the flexibility of adding data sets from other lunar missions (e.g., data from Clementine or NASA's LRO mission).

Please refer to overleaf for details.

[1] Should include the author(s) name(s), affiliation, mailing address, e-mail. For the authors affiliated with a Specific Session or Working Group of ISPRS, a separate title may be entered.

[2] Should indicate who the corresponding author is, and list the telephone and fax numbers.

[3] The workshop will organize the technical sessions according to the following topics: (1) Data acquisition and updating;(2) database creation and maintenance; (3) smarter geo-spatial services and applications; (4)standards and liaison. Authors must indicate clearly to which topic the paper is intended.

[4] Author(s) must select 5-8 keywords from the list provided at **http://www.isprs.org/documents/orangebook/ISPRS_Keywords.html**. Only keywords provided on the lists will appear in the “Keywords Index” found at the end of each Volume of the *Archives*.

[5] An abstract should be written in English comprising not less than 300 words. Each abstract must contain sufficient details for evaluation (including the approach, results, the concepts, the reasons why it should be considered an interesting message for the audience).