

Photogrammetric Techniques for Terrain Model Generation from LROC NAC images

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This paper presents the results of photogrammetric processing of the LROC (Lunar Reconnaissance Orbiter Camera) NAC (Narrow-angle Camera) stereo images using a software package, OSU OrbiterMapper, developed to model orbital sensors for high resolution stereo photogrammetric mapping. The system is successfully employed for processing Earth based satellite imagery and HiRISE Mars stereo images. It is modified to model the LROC NAC cameras and generate high resolution lunar topographic products. Various technical challenges are addressed, including accurate modeling of the non-traditional LROC NAC cameras (two partial overlapping cameras in one orbit), boresight calibration for identification of the spatial relationships between the two cameras, and bundle adjustment for elimination of the inconsistency between images from two or more orbits. A special method for eliminating or reducing the effect of seams in DEMs caused by two CCD overlapping areas is introduced. Specific techniques of using the least-squares image matching method are developed to solve the problem of step patterns in DEMs caused by pixel-locking in the dense-matching process. A depth-first matching strategy associated with the hierarchical structure of the pyramid images is used for error detection in the matching results to prevent the propagation of errors from upper levels to lower levels. The produced topographic products will be presented.