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AUTONOMOUS BAND CO-REGISTRATION OF LAPAN-A3 MULTISPECTRAL IMAGER USING EDGE DETECTION AND FAST FOURIER TRANSFORM

Abstract

LAPAN-A3 satellite is third Indonesian microsatellite which was successfully launched in June 2016. As experimental remote sensing satellite, it brings three optical payloads, which are 4-bands multispectral pushbroom imager, digital matrix camera and analog video camera. Images produced by LAPAN-A3 multispectral imager suffer from both radiometric and geometric distortion caused by various sources. This paper discusses about systematic-geometric processing of LAPAN-A3 multispectral imager data, particularly analyzes geometric band co-registration error caused by position and orientation differences of the four band-detectors respect to the lens center. Conventionally, band co-registration error can be corrected either by using manual approach or by using rigorous geometric model of the imaging sensor. However, to save precious processing time and to avoid the need of accurate sensor model or satellite attitude data, this research develops autonomous band co-registration of LAPAN-A3 multispectral imager data. Many image co-registration algorithms exist in literature, but not many deals with multispectral pushbroom images. We propose simple method to calculate co-registration error between each image bands by using edge detection algorithm and Fast Fourier Transform (FFT). The relative position and orientation of each detector in image domain are then produced by fitting the calculated co-registration error using pre-determined polynomial model. Finally, band co-registration error can be corrected by resampling the image using the corresponding fitted-polynomial model. Based on more than 50 images processed, it can be concluded that the proposed method can produce a fairly good band-registered composite-image. After successfully band co-registered, the corrected image can be further processed to be referenced to proven reference images, slowly but continuously building up the coverage of a huge area of Indonesian archipelago.