AN AUTOMATED SEAMLESS MOSAICING SYSTEM OF MULTI-CHARGE COUPLED DEVICES OF PANCHROMATIC DATA

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ABSTRACT

Panchromatic data of pixel resolution 5.8 m obtained from IRS-1C and IRS-1D satellites proved to be very useful for mapping purposes. One of the popular data product is the 70 km swath mosaic which is covered by a combination of 3 CCD line sensors, each with 4096 pixels. Each CCD-line sensor with different imaging times causes geometric problems of mosaicing three strips data together. In this paper, we propose the details of the design elements of system that caters to the need for accurate and automatic multi strip image registration without any second resampling of the data. The systematic geometric correction grid mapping is improved to facilitate accurate mosaicing by automatic image registration task that makes use of the overlap data within image strips and image registration is achieved up to sub-pixel level.

Introduction

The Indian remote sensing satellites IRS-1C and IRS-1D that are having push broom imaging capability comprise of a panchromatic camera (PAN) with ground geometric resolution of 5.8 m at nadir. PAN camera has three CCDs housed in the same optics. Each CCD has 4096 detector elements and its swath coverage is about 23.9 km (Fig. 1). Three CCDs are displaced both in along and across track directions with respect to the satellite ground trace in such a way that by combining all the three coverage a data product of swath of 70 km can be achieved (Fig. 2). PAN camera also has the capability to image ground from different view angles within ±26° from the nadir direction (Joseph
et al., 1996). Geometrically corrected PAN data is used worldwide for preparing and updating city maps and in general mapping purposes (Srivastava et al., 1996; Armenakis and Savaopol, 1998; Jacobsen, 1999).

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Geometric Corrections

The geometric correction of monoscopic data accounts for distortions are due to variety of factors, including the rotation of earth during image acquisition, the curvature of the earth, panoramic effects related to the image geometry, variations in the platform altitude, attitude and velocity and Datum and map projections.

These are the essential corrections applied to the satellite acquired image data. These corrections are incorporated in the geometric model, which basically solves a look point equation to find out the geographic location on the earth surface actually imaged. The geometric correction models are discussed abundantly in literature.

The geometric correction has two steps (i) geometric transformation and (ii) resampling. The first step is actually about establishing a mapping between a system corrected space coordinates (final output image coordinates) to the radiometrically conditioned input image data coordinates. The second step is actual gray level interpolator to fill in the empty matrix created in spatial transformation achieved. This transformed input image location mapping will not overlay a pixel. Resampling is used to assign a DN value to the output matrix pixel – determined on the basis of the pixel values which surround its transformed position in the original input image matrix. Different kernels used for resampling are nearest neighbor and cubic convolution (Park and Schowengerdt, 1983).

Image to Image Registration

For mosaicing two images, first of all images have to geometrically conform to each other; this process of making two images conforming to each other is called as image to image registration. It means that the image features in both images have