



Notice of University Oral Examination

Geodesy and Geomatics Engineering
Doctor of Philosophy

Gang Hong

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Head Hall – ADI Room @ 10:00 am

Supervisor: Dr. Yun Zhang, Geodesy and Geomatics Eng.

Examining Board: Dr. David Coleman, Geodesy and Geomatics Eng.
Dr. Francois Anton, Geodesy and Geomatics Eng.
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Chair: Dr. Abdelhaq Hamza, School of Graduate Studies

Image Fusion, Image Registration, and Radiometric Normalization for High Resolution Image Processing

ABSTRACT

High resolution multi-temporal, multi-sensor remotely sensed data are often used in Earth observation applications. Image fusion is a widely used method to integrate those data, while image registration and radiometric normalization are two necessary procedures in transforming multi-temporal or multi-sensor data into identical geometric and radiometric bases respectively. This Ph.D research attempts to solve problems and develop improved techniques in these three aspects.

A new image fusion method based on the wavelet and IHS integration is proposed to reduce the color distortion in fusing high resolution images. This method was successfully evaluated using optical images (IKONOS and QuickBird) and microwave images (airborne SAR and Radarsat with commonly used multi-spectral images). This research also discusses the wavelet-based fusion problems, improvement approaches, and the factors that should be considered in fusion process.

Further using the multi-resolution property of wavelet, a new image registration method has been proposed. It uses the wavelet multi-resolution property to extract feature points; the normalized cross-correlation and relax-based probability matching techniques to find similarity between feature points in reference image and sensed image; and the triangle-based local transformation model to resample the sensed image. The method was evaluated using two sets of data. The evaluations show that the method can semi-automatically select enough control points and reduce the local distortions caused by terrain relief.

For image normalization, improved strategies are provided for normalizing the high resolution images through modifications to the existing image normalization methods, because existing image normalization methods designed for the Landsat TM/MSS image cannot be directly applied to high resolution images. It is shown the improved strategies to be very helpful in normalizing high resolution images.