NOTICE OF THESIS PROPOSAL PRESENTATION

Geodesy and Geomatics Engineering

Doctor of Philosophy

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Head Hall – Room E-11 @ 2:00 pm

Supervisor:	Dr. Yun Zhang, Geodesy and Geomatics Eng.
Examining Committee:	Dr. David Coleman, Geodesy and Geomatics Eng.
	Dr. Julian Meng, Electrical and Computer Eng.
Chair:	Dr. Sue Nichols, Geodesy and Geomatics Eng.

Technical Development for Automatic Orthomosaic of High Resolution Satellite Imagery

ABSTRACT

High resolution satellite images are widely used in different fields. This is because the images contain large amount of information, especially geospatial information, such as position, elevation, and orientation. But the raw images usually contain many distortions. These distortions make the images unsuitable for geospatial analysis. Orthorectification can remove all the distortions with imagery, resulting in planimetrically correct images. Orthorectified imagery has become accepted as the ideal reference image backdrop necessary for the creation and maintenance of geographic information contained within a GIS database. On the other hand, because the satellite images are distributed scene by scene, sometimes even if the research area is very small, if this area is in the border of two images, image mosaic is inevitable. Image mosaic assembles adjacent images connected together into one image. Mosaic image covers a larger area than the original single image. This makes the mosaic image more useful than single image for many applications such as, area visualization, data updating, feature extraction and map production.

Orthomosaic image is normally produced by six independent steps: tie point selection; aerotriangulation; DEM generation; image orthorectification; radiometric adjustment and color balance; seamline selection and image mosaic. Up to date, for automatic orthomosaic, we still face some problems. First of all, although a lot of excellent feature detectors exist, such as Harris and SIFT, but they all have some critical drawbacks (Zhu et al 2007): (1) The SIFT detects mainly blob-like interest points, while the significant points, such as the corners of buildings and saddle points near the edge of roads, can not be successfully extracted. (2) The interest points SIFT detected may be not dense enough to fulfill the exterior orientation. (3) The Harris detector is sensitive to changes in scale, and also to rotations. Therefore, how to automatically extract enough tie points is still a challenge. Secondly, the physical camera parameters of high resolution satellites are not available to public users. A rational polynomial function is delivered in stead of physical sensor model. This makes a new challenge for sensor model refinement. The common method for the new sensor model (RPC) refinement is to add a polynomial correction (Di et al, 2003; Tao et al, 2002; Clive et al, 2003). This method is an approximation correction to the physical sensor model; as the increasing of the order of the polynomial, more and more GCPs are needed; it is not convenient to transfer the refined sensor model to other users. Color balance and seamline selection is the third problem for image mosaic (Martin, 2001; Elena, 1999). Rather than a mathematical problem, it is more a visual problem. But unfortunately, most of the researchers focus on the color similarity, seldom on texture similarity, because to precisely describe texture is another problem.

Based on the above analysis, following research proposals are proposed. First, rather than a polynomial correction to RPC, a rigorous RPC refinement algorithm will be developed. The camera parameters, image distortions as well as the atmospheric refraction will be considered in the new sensor model. Second, the Harris, SIFT, and other excellent scale and affine invariant detectors will be evaluated. The best format of SIFT descriptor for high resolution satellite image will be chosen. Furthermore, incorporated with Harris and SIFT, a new robust feature detector for satellite image will be developed. Third, a block radiometric adjustment algorithm and a distance weighted gray value interpolation algorithm in the overlapping area will be developed. Finally, an automatic seamline selection algorithm will be developed by paying attention to both color similarity and texture similarity.

Faculty Members and Graduate Students are invited to attend the 20 minute presentation