RECTIFICATION FOR LINEAR PUSHBROOM IMAGE OF UAV

Ling Zhu[1,2] Wuming Zhang[1] Ruoming Shi[2]

1State Key Laboratory of Remote Sensing Science, Beijing Normal University, 100875, Beijing, China

2 School of Geomatics, Beijing University of Civil Engineering and Architecture, 100044, Beijing, China

E-mail: zhuling@bnu.edu.cn

1. INTRODUCTION

In recent years, unmanned aerial vehicle (UAV) has become a strong supplement and an important complement for satellite and manned aerial remote sensing, because UAV has the ability to cover a large area, flight at higher altitude than before, and be not restricted to traveling on the dangerous place. This research presents a method of rectification for the image flow acquired by UAV.
With regard of our project, different types of sensors have been loaded on the UVA, one of them is the multi-channel push broom sensor. Each linear array of the sensor consists of 6000 pixel array of CCDs which include blue, green, red and IR bands. The linear array can cover a stripe with approximately 6 Km on the ground. The motions (roll, pitch, yaw, etc) of the UVA platform are influenced by the relatively low-altitude flying so that have the attitude changed which are terrible to produce severe distortion of image. Therefore, a three-step rectification method is developed by mean of the DEM and GCPs (ground control points) of study area, as well as data of the positioning instruments (GPS, INS) on the UVA platform.

2. METHODOLOGY

The work follow of the three-step rectification method is expressed as below:

2.1 Preliminary rectification

Firstly, The external orientation parameters (position, attitude, six for each image line) of each linear array are calculated with data provided by the positioning instruments (GPS, INS), and then, the collinearity equation for multi-lens sensors is adopted with combining with the DEM data, finally, the original image can be rectified to level one (L1) image, 6000X6000 pixels in size approximately, which meets the requirements for accepted visibility.

2.2 Integrated rectification

The positioning accuracy of the L1 image is not sufficient for more precision mapping since the pose and attitude of the vehicle is not stable and the parameters provided by the GPS and INS have additional systematic errors in the measurements, therefore further correction to the L1 image is required. In our approach, the sensor geometry is modeled with enhanced polynomials because this kind of functions is very flexible and can be adapted to different flight conditions. In this step, it is necessary that a reference image is used and several GCPs are selected in order to produce Level two (L2) image.

2.3 partial rectification

The original image generally has been rectified after two steps mentioned above, consequently, some errors caused by certain factors have been removed. However, the geometrical distortions of the pushbroom image are complicated and can not be simulated using a single function, which result in partial distortions in the L2 image. The third step of the rectification is an essential process using partial distortion model which geometrically stretch the local image.

Firstly, the dense GCPs are matched to L2 image, which display and calculate whether exist the partial distortions or not. Secondly, to segment the whole L2 image to neighboring partial images, Delaunay triangle transformation algorithm, a scheme of disassembling the entire image into multi-triangles to form a network, is introduced, and the GCPs are used as the vertexes of the triangle in the network. Thirdly, in each triangle, the partial image pixels are corrected using the geometrical stretch method and meanwhile, the adjacency of each triangle must keep the coherence. The L3 image can be obtained and is the final delivery after the third step of the rectification is completed.

3. CONCLUSION

Many experiments have been carried out in different conditions and areas using the method mentioned above. The results present the three step rectification is feasible and effective.

4. REFERENCES

[1] WANG Feng, SHI Wenzhong, CHENG Penggen, “Partial Distortion Correction of Rectification Error of Remote Sensing Images,” *Geomatics and Information Science of Wuhan Universityl*, Vol.26 No.5, pp. 425-428, 2001