



DEVELOPMENT OF A SYSTEM FOR PHOTOGRAMMETRIC RECTIFICATION OF TILTED IMAGES

Ranu Bhardwaj¹, Dr. Kamal Jain²

¹ Remote Sensing, Banasthali Vidyapith, (India)

² Geomatics Department, IIT Roorkee, (India)

ABSTRACT

All engineering projects require updating topographic maps. In the modern world cities are expanding, new settlements are appearing, new roads are constructing, forests are cutting and new developing areas are constructing over there, land use structure is changing slowly. Therefore, topographic maps are always subject to update. Presently Photogrammetry is widely accepted as main method for preparing maps in developed countries. Photogrammetry in last two three decades has been shifted from conventional film, optical/mechanical plotters to digital plotters.

For the Rectification of stereo tilted images we used transformation (Rotation, Translation, and Scaling) of tilted images. After the procedure of Transformation, condition of Epipolar geometry is achieve. For the 3D vision, anaglyphic image generation method is used. Anaglyphic images are generated by overlapping stereo pair into different channels.

Keywords: *MATLAB R2015A, Stereo pair*

I. INTRODUCTION

Distortion in the imagery occurs because of variations in platform attitude (roll, pitch and yaw), altitude, earth rotation, earth curvature, panoramic distortion and detector delay etc. Mostly distortion can be removed mathematically before buying an image. A change in attitude is a distortion inducing process for correcting the distortion, procedure is followed which is called image rectification. Rectification is a process which corrects image geometrically after which corrected image can be presented on a planar surface. This process makes image geometry planimetric. For the Rectification of stereo tilted images we used transformation (Rotation, Translation, and Scaling) of tilted images. After the procedure of Transformation, condition of Epipolar geometry is achieved. Stereo algorithm requires rectified images, i.e., in the stereo images where epipolar lines are Parallel and horizontal and corresponding points have the same vertical coordinates. For the 3D vision, anaglyphic image generation is the method which produces 3D images. Anaglyphic images are generated by overlapping stereo pair into different channels.

method which produces 3D images. Anaglyphic images are generated by overlapping stereo pair into different channels.

II. PREVIOUS WORK

As previously explained that, perspective projection of 3D scene on a 2D surface generates perspective distortion. To correct distorted image without having loss in image information is a challenging task in the field computer vision. Corners are detected on the basis of image orientation. There is a method which is based on plane homography and transformation is used for perspective correction. This algorithm gives image information directly without any knowledge of camera parameters [1].

Previously explained that Projective geometry is a tool for solving the problem of rectification without calibration of camera. If the matrices used for projective rectification are not implemented properly, then geometric distortion can occur in rectification process. Here, an improved algorithm has been generated for minimizing the distortion by adding a new developed projective transform with shearing transform [2]. A technique for the calibration and rectification of image pairs in a very simple way for binocular or trinocular vision system has been explained earlier. After the process of image rectification, epipolar lines are parallel to the image axes ; hence, matches of all images satisfies simple relation and final result has been obtained with binocular as well as trinocular vision [3]. Here is an algorithm for the rectification of Heterogeneous Image pairs which has been made based on the focal ratio of two cameras. Transformation rectification of stereo pair has done by finding corresponding points on both images. Experiments are performed for the evaluation of method. For the improvement over the rectification error analysis is proposed. This method is helpful obtaining stereoscopic vision [4].

III. METHOD

Normally for the image rectification we require interior orientation parameters (Principle point, Focal length, fiducial point and lens distortion. Here we do not require Interior orientation parameters. Here we can directly rectify images by removing Y parallax from the stereo pair.

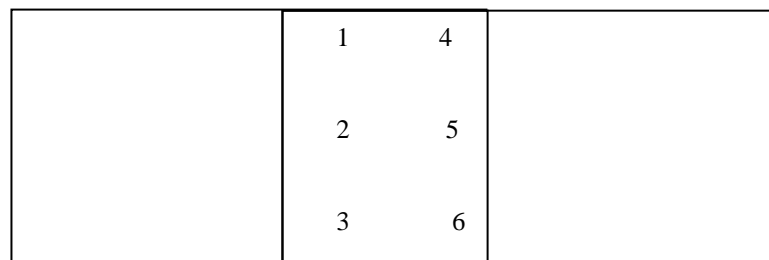


Fig.1 von Grubber's Points on stereo pair

For the method we have used as shown in Fig.2. We require stereo pair for the rectification purpose. Von Grubber's points need to be placed on the images as shown in Fig.1. To rectify stereo pair we have to remove Y Parallax from both images simultaneously. Y Parallax may remove by applying transformation (Rotation, Translation and Scaling). To obtain relative orientation we have to apply angular orientation on point 1, point 2, point 3, point 4, point 5/ point 6. These 6 points are known as von Grubber's Points as shown in Fig.1. Which element is responsible for Y parallax is the one can reduce Y parallax. Apply ω (Rotation in Z direction), ω (Rotation in Y direction) and κ (Rotation in X direction) on left and right images.

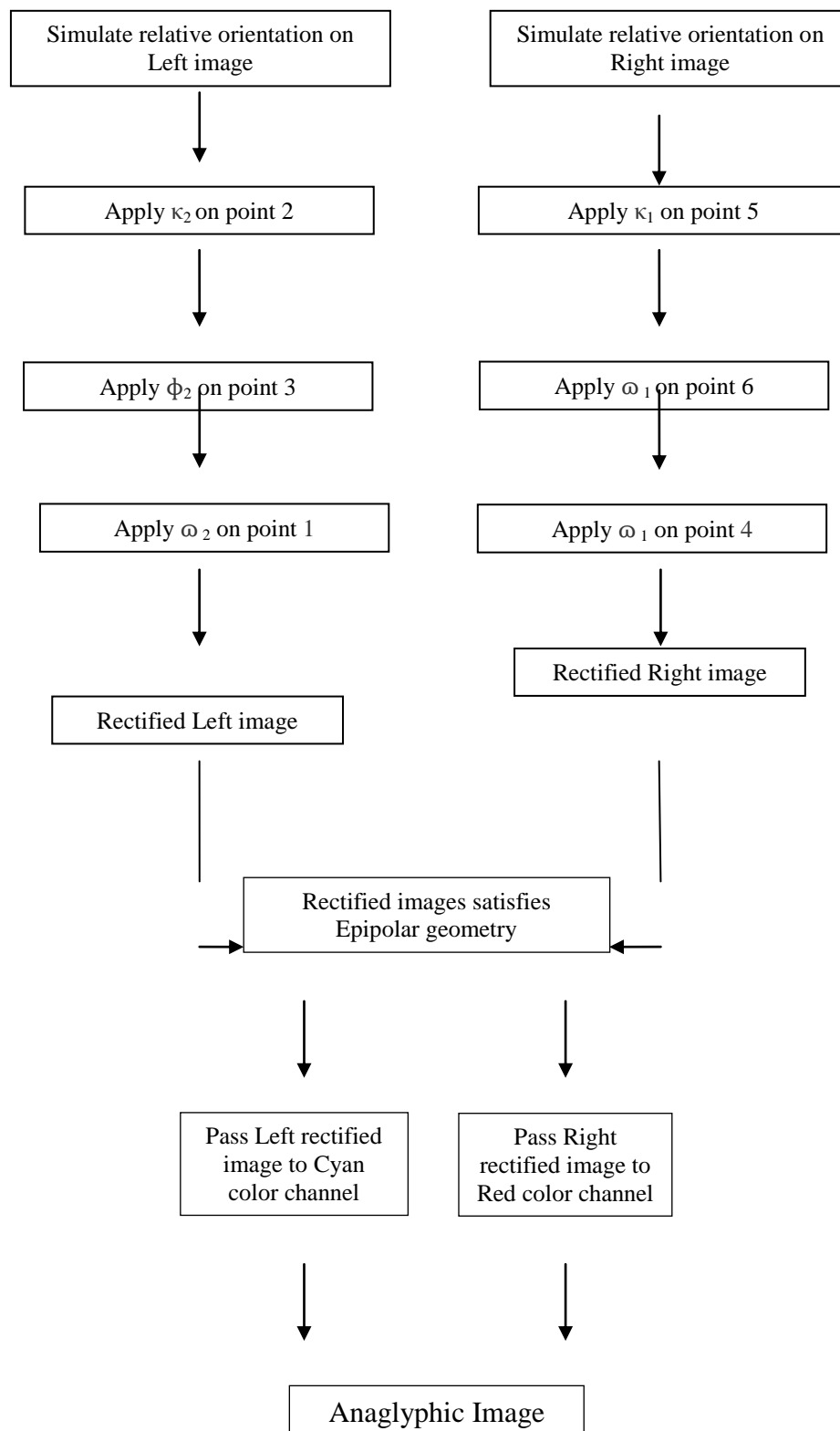


Fig.2 Process of tilted image rectification

For the purpose of rectification of images we require stereo pair. Aim is to remove Y parallax from von Grubber's Points on stereo pair as shown in Fig.1. We plotted point 2 on the left image and 5 on the right

image as shown in Fig.1. To remove Y parallax from these two points plotted on the same feature as shown in Fig.3. To remove Y parallax from these points we applied κ_2 on point 2 and κ_1 on point 5 as shown in Fig.3. Similarly we plotted point 3 in the down direction of point 2 and point 6 in the down direction of point 5 as shown in Fig.4. To remove Y parallax from point 3 and point 6 we applied ϕ_2 on point 3 and ϕ_1 on point 6. Now remove Y parallax from point 1 or 4 by applying $\omega_{2/1}$ as shown in Fig.5. Removal of Y parallax from stereo images, satisfy epipolar line condition, and similar features of both images appears in same line. Rectified images satisfy co planarity condition as well. Now stereo pair may use for further purpose. Using stereoscope, 3D vision may be seen. Using anaglyphic glasses, 3D view may be seen by overlapping stereo pair.

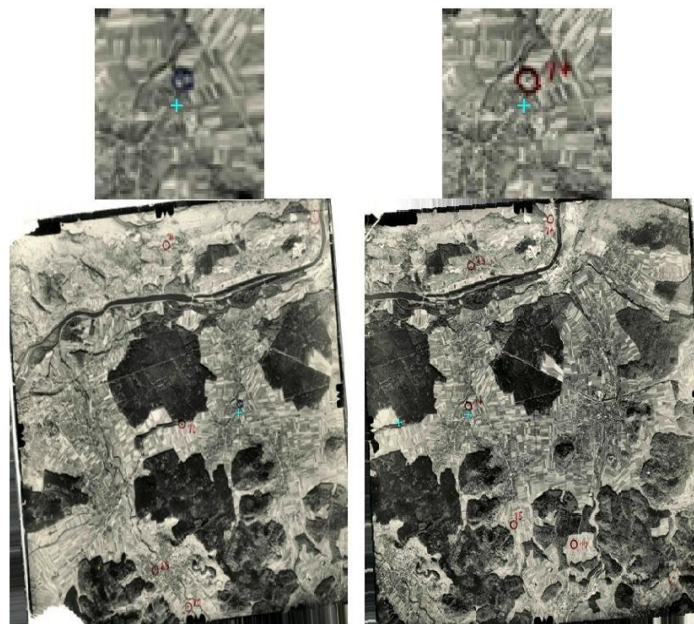


Fig3 Kappa rotation on images

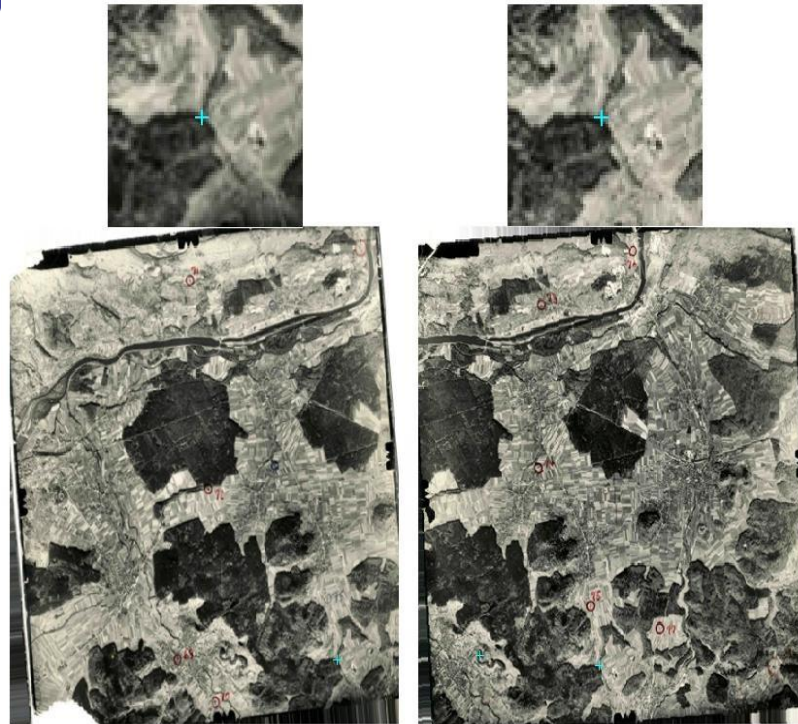


Fig4. Phi rotation on image

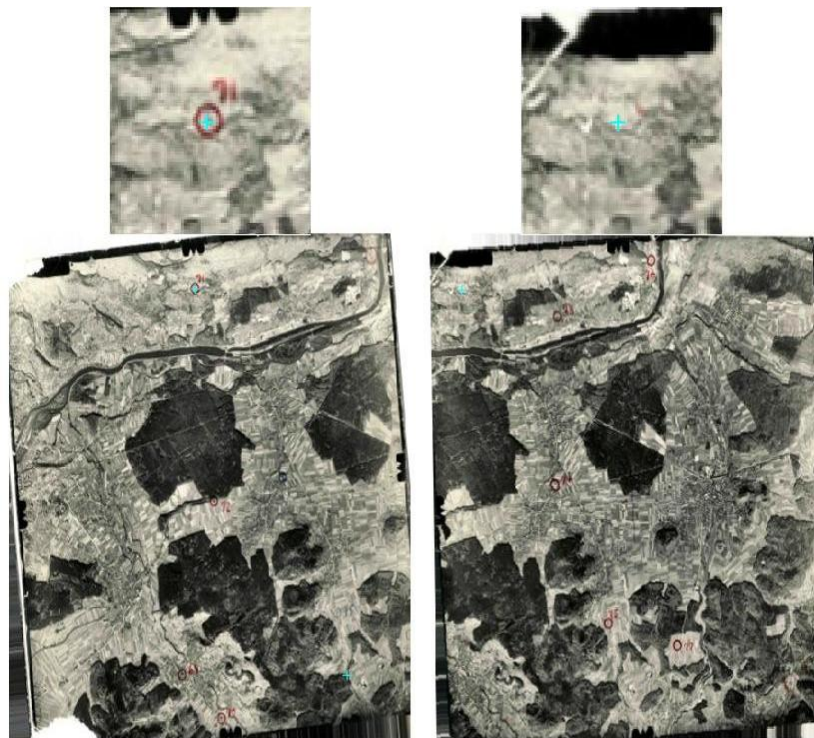


Fig5. Omega rotation on images

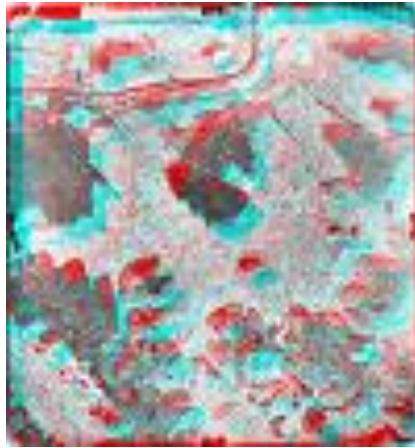


Fig.6 Anaglyphic image

IV. RESULTS



Fig.6 Original Stereo pair



Fig.7 Rectified images



Fig.8 Anaglyphic image

V. CONCLUSION

We have used MATLAB software for the development of a system for photogrammetric rectification of Tilted images. For the rectification purpose we can use aerial images, or stereo pair obtained from simple camera. Rectified images satisfy epipolar geometry and co-planarity condition as well. 3D vision using anaglyph glasses and stereoscope has been done successfully.



REFERENCES

- [1] Ghilani, "Coordinate Transformations", Adjustment Computations 2006.
- [2] Jan Sandr "Epipolar Rectification for Stereovision", January, 2009.
- [3] Geetha Kiran and Murali "Automatic Rectification of perspective distortion from a single image using plane Homography", International Journal on Computational Sciences & Applications (IJCSA) Vol.3, No.5, October 2013.
- [4] T. Kim, "A study on the epipolarity of linear pushbroom images," Photogrammetric Engineering & Remote Sensing, Vol. 66, No. 8, pp. 961-966, 2000.