ISSN(Online): 2320-9801
ISSN (Print): 2320-9798

International Journal of Innovative Research in Computer and Communication Engineering

(An ISO 3297: 2007 Certified Organization)

Vol. 3, Issue 12, December 2015

Stereoscopic Image Rectification

Vidya T[1], Ajay Menon M[2], Sunil K R[3], Varun Kumar S[4]

Dept of Electronics and Communication, Vidya Vardhaka College of Engineering, Mysore, India[1,2,3,4]

ABSTRACT: Image stereo-rectification is the process by which two images of the same solid scene undergo homographic transforms, so that their corresponding epipolar lines coincide and become parallel to the x-axis of image. A pair of stereo-rectified images is helpful for dense stereo matching algorithms. It restricts the search domain for each match to a line parallel to the x-axis. Due to the redundant degrees of freedom, the solution to stereo rectification is not unique and actually can lead to undesirable distortions or be stuck in a local minimum of the distortion function. The key technique used here is a image rectification algorithm that warps the input image pairs to meet the stereoscopic geometric constraint while avoiding noticeable visual distortion and disparity. Since each energy term is quadratic, this eventually formulates the warping problem as a quadratic energy minimization which is solved efficiently using a sparse linear solver. It also allows both local and global adjustments of the disparities, an important property for adapting resulting stereoscopic images to different viewing conditions.

KEYWORDS: ***Stereo rectification;epipolar lines;warping;***

I. INTRODUCTION

STEREOSCOPIC photography records a pair of images of a scene as it is seen by the two eyes of a viewer. Compared to a single image, a stereoscopic image pair has the advantage of enhanced depth perception due to the help of an additional depth cue, stereopsis, which is present only between two images. Since stereoscopic photography re-creates the illusion of depth, it provides a lifelike viewing experience.

The stereo rectification of an image pair is an important component in many computer vision applications. The precise 3D reconstruction task requires an accurate dense disparity map, which is obtained by image rectification algorithms. By estimating the epipolar geometry between two images and performing stereo-rectification, the search domain for registration algorithms is reduced and the comparison simplified, because horizontal lines with the same y component in both images are in one to one correspondence. Stereo-rectification methods simulate rotations of the cameras to generate two coplanar image planes that are in addition parallel to the baseline.

A good stereoscopic image pair has to satisfy a particular geometric constraint in order for the human visual system to fuse the images to create depth perception: the corresponding parts in the two images must have the same vertical coordinates. This constraint rises from the fact that the two coordinate systems of the two human eyes are mostly parallel

From the algebraic viewpoint, the rectification is achieved by applying 2D projective transformations (or homographies) on both images. This pair of homographies is not unique, because a pair of stereo-rectified images remains stereo-rectified under a common rotation of both cameras around the baseline. This remaining degree of freedom can introduce an undesirable distortion to the rectified images. Several methods have been proposed to reduce this distortion. The distortion is reduced by imposing that one homography is approximately rigid around one point and by minimizing the x-disparity between both rectified images.

ISSN(Online): 2320-9801
ISSN (Print): 2320-9798

International Journal of Innovative Research in Computer and Communication Engineering

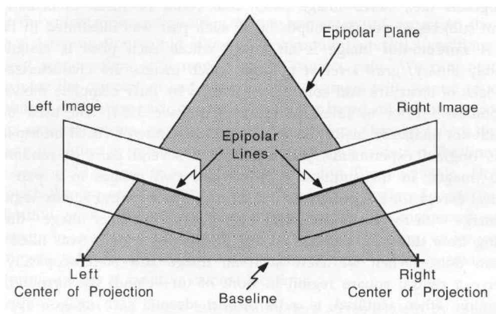
(An ISO 3297: 2007 Certified Organization)

Vol. 3, Issue 12, December 2015

A projective transformation is sought, as affine as possible to reduce projective distortion, but the affine distortion is not treated. A new parametrization of the fundamental matrix based on two rectification homographies is used to fit the feature correspondences.

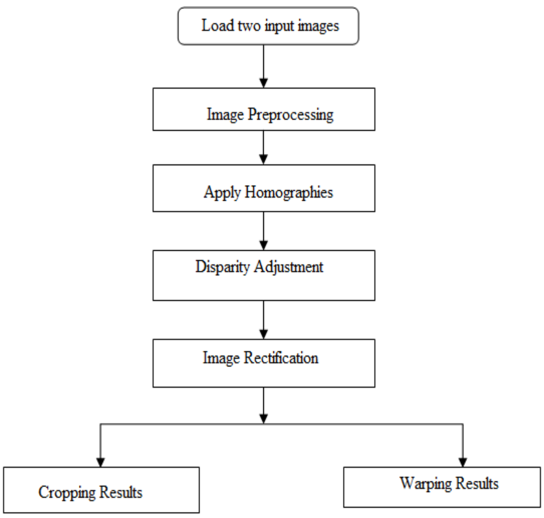
II. MATERIALS

A stereoscopic image pair can be captured in many ways, for instance, using a custom-built rig of two cameras to simulate two human eyes. These two cameras have the same intrinsic camera parameters and the same orientation. Their optical axes are parallel to each other and perpendicular to the baseline. These two cameras are typically separated from each other by 2.5 inches, which are roughly the distance between two human eyes. Occasionally, these two cameras are carefully toed in slightly for better depth composition.



III. METHODOLOGY

This method takes two images as inputs and outputs two images that make a good stereoscopic photo by meeting the stereo constraint with minimal visual distortion.



First, two images of an identical object is the obtained from a source. The source is usually hardware source like a monocular camera or mobile phone. MATLAB provides image acquisition toolbox which helps reading and preparing image for preprocessing.

ISSN(Online): 2320-9801
ISSN (Print): 2320-9798

International Journal of Innovative Research in Computer and Communication Engineering

(An ISO 3297: 2007 Certified Organization)

Vol. 3, Issue 12, December 2015

Image preprocessing is the process in which the acquired images are prepared for image enhancement. Image resizing is the major process carried out .The resized image is then subjected to digital image processing. It enabled the MATLAB application to display the full image instead of reduced size of the image as witnessed before resizing. Resizing the image was shown at 67% instead of normal 100% Image enhancement is the process which involves removing low frequency background noise that arise during image acquisition process, normalizing the intensity of the various parts of image. The orientation of the camera can be adjusted by applying a homography on the image, which has the form:

$$H = KRK^{-1}$$

Several disparity adjustment operators for a user to manipulate the disparity distribution are provided. A user can shift one image horizontally to uniformly change the disparity distribution. The global linear and nonlinear operators are also implemented.

Rectification algorithm allows manual adjustments of disparities using the operators described. It also is used toward creating visually pleasant stereoscopic images shows two input images. This method first computed an affine rectification approximation without the line constraints using the method. We can see that without the line constraints the window frames are not parallel between the left and right images.

A. NOTATIONS

H (Homographies) , K(simple calibration matrix), R(relative rotation before and after rectification)

IV. EXPERIMENT AND RESULTS

The algorithm is tested on several pairs of real images. The camera distance causes the initial epipolar lines to be far from the horizontal direction.

The performance is evaluated on two aspects: the rectification error and the introduced distortion. The rectification error is measured as the average and standard deviation of the y-disparity of rectified correspondences. The same statistics are computed for the original epipolar geometry with the distance from points to the corresponding epipolar lines as metric.

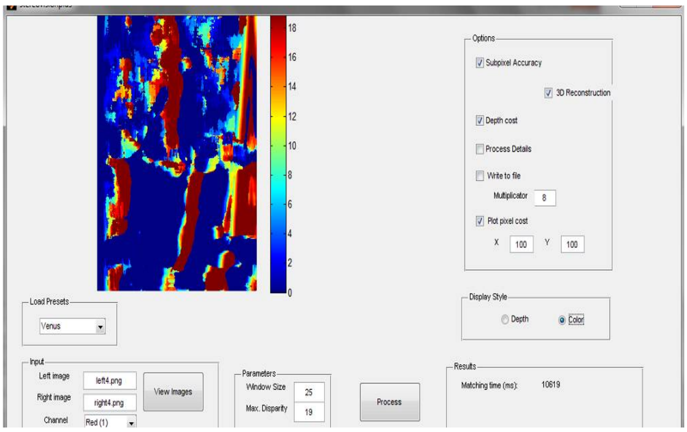


Fig. 1. 3D reconstruction of a colored depth map by obtaining RGB values

ISSN(Online): 2320-9801
ISSN (Print): 2320-9798

International Journal of Innovative Research in Computer and Communication Engineering

(An ISO 3297: 2007 Certified Organization)

Vol. 3, Issue 12, December 2015

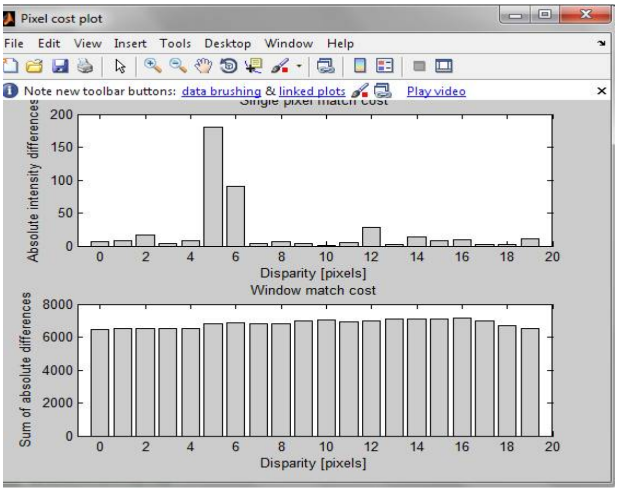


Fig.2.Pixel cost plot

Fig.2 shows the pixel cost plot. One can see that the affine rectification gives the largest vertical disparities on average, which is expected since affine transformations are a weaker model than homographies. Our warping method achieves the least vertical disparities. Rectified images often need to be cropped to obtain a stereoscopic image for regular displays. Cropping leads to loss of content. We performed cropping by computing a maximal rectangle inside the overlapping area of the two rectified images. We then projected this rectangle back to the original image and computed the coverage rate as the percentage of original pixels preserved in the cropping result

A. Conclusion

We presented a method for stereoscopic image rectification from two images taken by a monocular camera. This method rectifies these two images into a stereo image pair to deliver a pleasant viewing experience. A major advantage of using such warps is that we are able to both enforce minimal vertical disparity, which is crucial to minimize visual distortion and content loss. This method is able to support disparity adjustment and user specified line constraints.

ACKNOWLEDGMENT

The preferred spelling of the word "acknowledgment" in America is without an "e" after the "g." Avoid the stilted expression "one of us (R. B. G.) thanks ...". Instead, try "R. B. G. thanks...". Put sponsor acknowledgments in the unnumbered footnote on the first page.

REFERENCES

[1] K. Moustakas, D. Tzovaras, and M. Strintzis, "***Stereoscopic video generation based on efficient layered structure and motion estimation from a monoscopic image sequence***," IEEE Trans. Circuits Syst. Video Technol., vol. 15, no. 8, pp. 1065–1073, 2008.
[2] M. Lang, A. Hornung, O. Wang, S. Poulakos, A. Smolic, and M.Gross, "***Nonlinear disparity mapping for stereoscopic 3d,***" ACM Trans. Graph., vol. 29, no. 4, pp. 75:1–75:10, 2010.
[3] Y. Niu, F. Liu, W. Feng, and H. Jin, "***Aesthetics-based stereoscopic photo cropping for heterogeneous displays,***" IEEE Trans. Multimedia, vol. 14, no. 3, pp. 783–796, 2012
[4] C.-H. Chang, C.-K. Liang, and Y.-Y. Chuang," Content-aware display adaptation and interactive editing for stereoscopic images",2010.
[5] Bal´azs Ter´eki, Pirkko Oittinen, and L´aszl´o Szirmay-Kalos, "***Informational Aesthetic Measure for 3D Stereoscopic Imaging***" 2010.
[6] Sebastian Knorr and Thomas Sikora," "An Image-Based Rendering Approach For Realistic Stereo View Synthesis Of Tv Broadcast Based On Structure From Motion",2009.
.