International Journal of scientific research and management (IJSRM)
||Volume||3||Issue||7||Pages|| 3312-3315||2015||
Website: www.ijsrm.in ISSN (e): 2321-3418

Detection of Conjugate Points on Pair of Overlapping Image using Epipolar Correlation

Kanika Khetarpal, Kamal Saluja
Department of Computer Science Engineering
Ganga Technical Campus, Soldha, Bahadurgarh

Abstract
Automation of the entire image mapping system is the ultimate goal of current research efforts in imagemetrology. In this paper, author presents the design and implementation of a MATLAB program thatautomates the processes involved in locating conjugate points on a pair of overlapping photograph usingepipolar correlation. In order to achieve this, sets of overlapping photographic stereopairs from differentsources were collected and used as input. The program was designed to perform the following processes;load the photographic stereopair, carryout an automated feature extraction to extract interest points in bothphotos, match these points putatively and remove false matches (outliers). The resulting inlier points wereused to compute the fundamental matrix describing the epipolar geometry between the photographicstereopair.

Key Words
Epipolar Lines, GUI (Graphical User Interface), LSM (Least Square Matching).

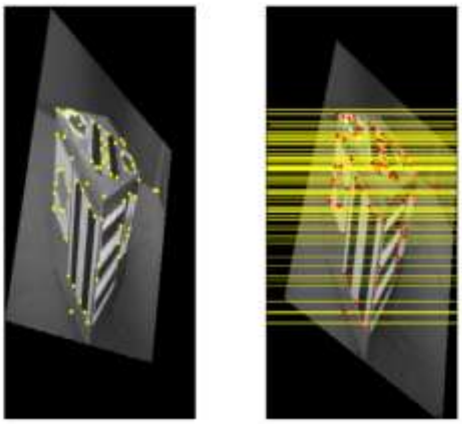
1. Introduction

The process of photogrammetric modeling for the various applications such as creation of topographic and other thematic maps, 3D perspective views of scenes, Terrestrial mobile Mapping, medical application, DEM creation, stereo positioning, personal identification or face recognition and other photogrammetric applications, are achieved by stereo modeling (3D modeling) approach which require conjugate points. Conjugate points are same object point which appears on a pair of overlapping photographs which may be used to establish a relative relationship between two camera stations and for the creation of stereo models for various photogrammetric applications. For the purpose of this work, we shall first use the feature based matching approach to establish initial correspondences and compute the fundamental matrix describing the epipolar geometry. Then, the area based matching is carried out for matching user specified points, using the epipolar geometry described by the fundamental matrix. The initial feature based matching will be used to ensure robustness of the application as well as reducing the human input, so as to minimize the possible occurrences of human error. All these processes would occur using a Graphical User interface (GUI) which would also be crated to enhance ease of usage of the program.
The remainder of the paper is organized as follows:

In section II, Epipolar Geometry is discussed. While algorithm is describes in section III, comparative simulation results are presented in section IV. Finally conclusions are given in section V.

II. Epipolar (Stereo) Geometry

The epipole is the point of intersection of the line joining the camera centres (the baseline) with the image plane. Equivalently, the epipole is the image in one view of the camera centre of the other view. It is also the vanishing point of the baseline (translation) direction.



Stereo image pair with horizontal epipolar lines

An epipolar plane is a plane containing the baseline. There is a one-parameter family (a pencil) of epipolar planes. An epipolar line is the intersection of an epipolar plane with the image plane. All epipolar lines intersect at the epipole. An epipolar plane intersects the left and right image planes in epipolar lines, and defines the correspondence between the lines.

III. ALGORITHM

The block performs a comparison and repeats it K number of times between successive transformation matrices. If you select the Find and exclude outlier option, the RANSAC and Least Median Squares (LMS) algorithms become available. These algorithms calculate and compare a distance metric. The transformation matrix that produces the smaller distance metric becomes the new transformation matrix that the next comparison uses. A final transformation matrix is resolved when either.
K number of random samplings is performed .The RANSAC algorithm, when enough number of inlier point pairs can be mapped, (dynamically updating K)

The Estimate Geometric Transformation algorithm follows these steps:

1. A transformation ***H*** matrix is initialized to zeros

2. Set count = 0 (Randomly sampling).

3. While count < K , where K is total number of random samplings to perform, perform the following;

a. Increment the count; count = count + 1.

b. Randomly select pair of points from images a and b, (2 pairs for Nonreflective similarity, 3 pairs for affine, or 4 pairs for projective).

c. Calculate a transformation matrix ***H***, from the selected points.

d. If ***H*** has a distance metric less than that of ***H***, then replace ***H*** with ***H***.

(Optional for RANSAC algorithm only)
i. Update K dynamically.

ii. Exit out of sampling loop if enough number of point pairs can be mapped by ***H***.

4. Use all point pairs in images a and b that can be mapped by ***H*** to calculate a refined transformation matrix ***H.***

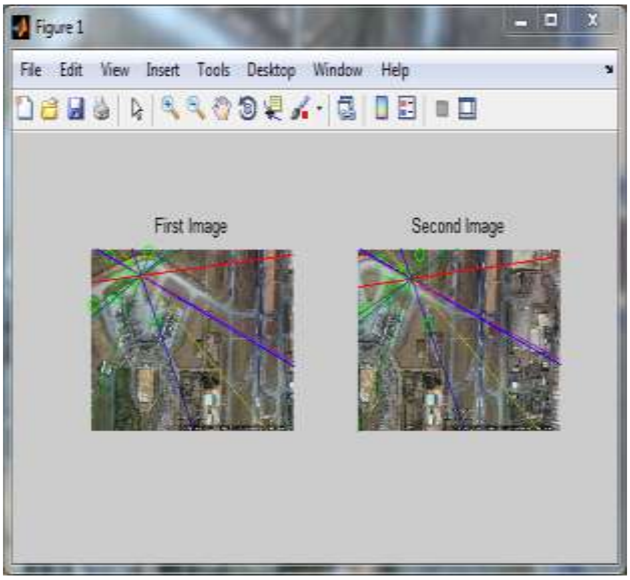
5. Iterative Refinement, (Optional for RANSAC and LMS algorithms)

a. Denote all point pairs that can be mapped by ***H*** as inliers.

b. Use inlier point pairs to calculate a transformation matrix ***H.***

c. If ***H*** has a distance metric less than that of ***H***, then replace ***H*** with ***H***, otherwise exit the loop.

IV Result



Sr. No.	Feature	Value
1	Percentage Overlap	55
2	No of features detected on left photo	183
3	No of features detected on right photo	178
4	No of putatively Matching index pairs	63
5	No of inlier matching points	32
6	No of outlier points	31
7	R.M.S error in epipolar constraints	0.00
8	R.M.S error delta X	0.03
9	R.M.S error delta Y	0.06

V. Conclusion

In this paper, we have detect matching points of two images. The Program has capability to automatically extract point features, match these points, remove outliers and establish epipolar geometry described by the fundamental matrix using a set of photographic stereopair as the only input for a wide range of applications.

References : -

[1] Hannah, M. J. "Digital Stereo Image Matching Techniques." *USA: Artificial Intelligence Center, SRI International333 Ravenswood Avenue, Menlo Park, CA 94025, 1987*

[2] Harris C. and Stephens M. . "A combined corner and edge detector" , *Proceedings of the 4th Alvey Vision Conference. pp. 147–151,1988*

[3] Helava, U. V " Digital correlation in photogrammetric instruments, Photogrammetria" , *Vol. 34, No. 1, pp. 19-41,1978*

[4] Zhang Z.,Deriche, R., Faugeras, O. and Luong, Q. T . " A Robust Technique for Matching Two Uncalibrated Images Through the Recovery of the Unknown Epipolar Geometry" . *Institute National de Recherche en Informatiqueet en Automatique , 1994*

[5] Helava, U. V " Object-space least-squares correlation, Photogrammetric Engineering and Remote Sensing" *Vol. 54, No. 6, pp. 711-714 ,1978*

[6] Hernandi, et al "Determining Conjugate Points of An Aerial PhotographStereopairs Using Separate Channel Mean ValueTechnique" *Faculty of Earth Sciences and Technology, ITB J. Eng. Sci. Vol. 41, No. 2, 2009, 141-147 , 2009.*

[6] Balleti, F. Guerra "Image matching for historical maps comparison*", e-perimetron, Vol. 4, No. 3, pp 180-186 ,2006.*

[7] Castillo, C D and Jacobs, D W "Using Stereo Matching with General Epipolar Geometry for 2D Face Recognition across Pose*" IEEE Transactions on Pattern Analysis and Machine Intelligence, VOL. 32, 2010*

[8] Domke J and Aloimonos, Y. "A Probabilistic Framework for Correspondence and Egomotion," *Proc. Workshop Dynamical Vision, R. Vidal, A. Heyden, and Y. Ma, eds., pp. 232-242 , 2006.*

[9] Domke, J and Aloimonos, Y. "A Probabilistic Notion of Correspondence and the Epipolar Constraint," *Proc. Third Int'l Symp. 3D Data Processing, Visualization, and Transmission, pp. 41 48, 2006*

[10] Morgan M. et al " *Epipolar Resampling of Space-borne Linear Array Scanner Scenes Using Parallel Projection*." Photogrammetric Engineering & Remote Sensing Vol. 72, No. 11, pp. 1255–1263 November 2006

[11] Olaleye, J. B " *Mapping From Images by Vector Photogrammetry."* Svy 517, Series in Geo informatics, Lecture Note 10-1, Dept. of Surveying and Geo informatics, University of Lagos, 2010.

[12] Pollefeys, M. " *Tutorial on 3D Modelling from Images*" , Tutorial organised in conjunction with ECCV 2000, Dublin, Ireland , 2000