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A REVIEW ON THE CRITERION FOR POINT CORRESPONDENCES FOR REAL TIME IMAGES

Aakanksha Gupta[1], Savita Malik[2]
Department of ECE, Bhagwan Mahaveer College of Engineering & Management, Sonipat, India

ABSTRACT: In this paper, we present a new criterion to evaluate point cor-respondences within a Real images. Many applications such as points matching and camera calibration require an evaluation criterion, indi- cating how well point correspondences fit to the epipolar ge- ometry. The common criterion here is the epipolar distance. Since the epipolar geometry is often derived from noisy and partially corrupted data, an uncertainty regarding the estima- tion of the epipolar distance arises. A real system must be able to determine the image parts that should not be matched.The basic idea behind our criterion is to determine the most probable epipolar geometry that explains the point correspon- dence in the two views.
Keywords: correspondence points ,epipolargeometry,inliers and outliers.

I. INTRODUCTION

For a given point in one image, a so-called epipolar line in a second image can be derived from the epipolar geometry, and a corresponding point should be located on that line. Some points in each image will have no corresponding points in the other image. (1) the cameras might have different fields of view. (2) due to occlusion. Due to noise and inaccuracies within a point correspondence analysis, only an approximation of the true epipolar geometry can be estimated, while the impact of the noise is not evenly distributed along an epipolar line. In [8], a different correspon- dence framework was introduced that covers the epipolar extremes and limits the search region for point correspondences. Many different distance measures, summa- rized in [3], evaluate how well a pair of points satisfies the epipolar geometry. All of these measures treat the epipolar distance equally throughout the image plane and none of these measures takes into account the uncertainty of the epipolargeometry[1]. Since, the covariance matrix of an epipolar line depends on the position of the according point correspondence, the reliability of the epipolar geometry. Recently, in [1] a method for calculating a probability density function for point correspondences was introduced, where for each pixel the summarized probability of all possible epipolar lines going through this pixel is computed. This implies that point correspondences, having a disparity similar to the mean disparity of the data set, become more likely than uncommon disparities. In this paper, we present a basic distance measure that takes into account the uncertainty of the epipolar geome- try in a sound way. We show that, using Lagrange multipliers, the constrained minimization problem can be reduced to solv- ing a set of three linear equations. We show the benefits of our criterion in an outlier removal task[4].

II. CONCEPT OF EPIPOLAR GEOMETRY

Practically, due to noise and outliers, only an approximation of the true epipolar geometry may be estimated. Common es- timation approaches like the normalized 8-point algorithm [3] and [9], as well as complex iterative estimation approaches like [5], which take into account the heteroscedasticity of the underlying problem, have been developed. A good overview on recent methods for computing the fundamental matrix is given in [6]. In the twocameras case, a point correspondence is defined as the pair of points from the two images that correspond to the same 3D point. The mapping from a point in one image to its corresponding point is potentially multimodal (e.g. occlusion, transparency) and spatially uncertain, since points are extracted using error-prone feature detectors.

Two-view geometry involve several new geometrical entities compared to single-view geometry.

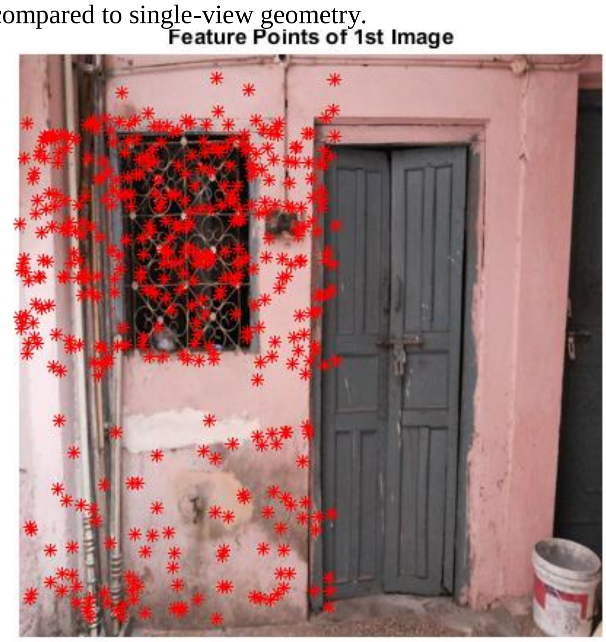

FIG:1

Uncertainty of the epipolar geometry: Point cor- respondences composing the data set, used to estimate the epipolar geometry and its uncertainty (Upper left corner). What does a line in the image correspond to in projective space? • A line is a plane of rays through origin – all rays (x,y,z) satisfying: ax + by + cz = 0 • A line is also represented as a homogeneous 3-vector[10].

From the covariance matrix �F of the fundamental matrix F, which may be directly estimated by a method described in [3], we can obtain the covariance matrix of the epipolar line by

$$\Sigma_l = J \Sigma_F J^T, \quad (1)$$

where J is the Jacobian of the mapping

$$l = (Fx)/\|Fx\|[6]. \quad (2)$$

Thus, we have an approximation, how well an arbitrary line u matches with the knowledge acquired so far about the epipolar geometry and its uncertainty[5]. For any given value of k2, we can compute an envelope of epipolar lines containing all possible epipolar lines having a value less or equal to k2. The envelope is described by a conic C defined in homogeneous coordinates[9].
With the assumption that the elements of 1 follow a normal distribution, k2 must follow a cumulative x§ distribution. In addition, the probability that the true epipolar line is located within this envelope can be associated to the k2-value, where = F2(k2) can be regarded as the probability to find thecorresponding point x' of x within C in the second image.

III. POINT CORRESPONDENCE BETWEEN TWO IMAGES

3.1. Basic idea

In this step Inliers and Epipolar lines determined. The inlier matching points are used to determine the fundamental matrix for epipolar geometry’s description. For photogrammetric applications, conjugated points are located at the particular features points or system distribution is used for locating points over image. Correlation algorithms are used with epipolar geometry for computing correlation techniques and fundamental matrix. Here for locating conjucate point in overlapped stereopairs, epipolar lines is used with one dimensional (line) search algorithm instead of search for whole image. The Inliers and Epipolar lines in first and second image are shown in Fig.2.

FIG:2

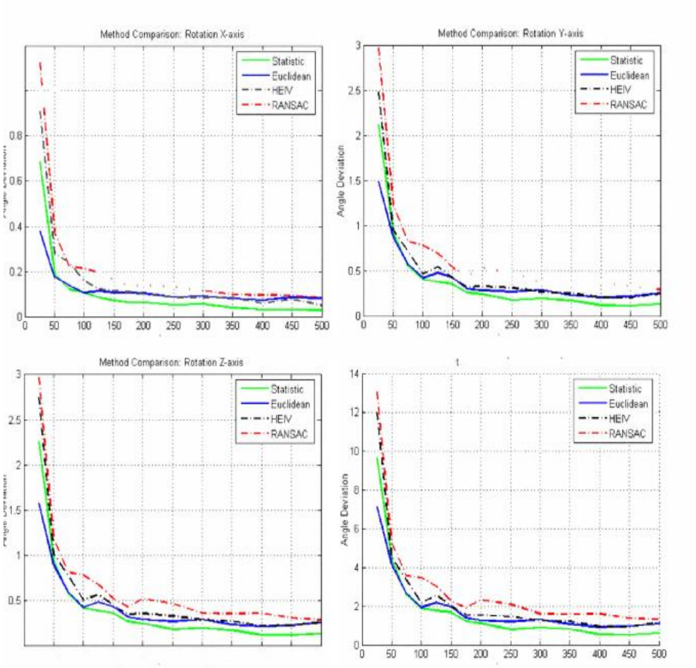

Fig. 3. Fundamental matrix decomposition: Angle deviation in degree from ground truth for the Rx, Ry, Rz rotation and translation components.

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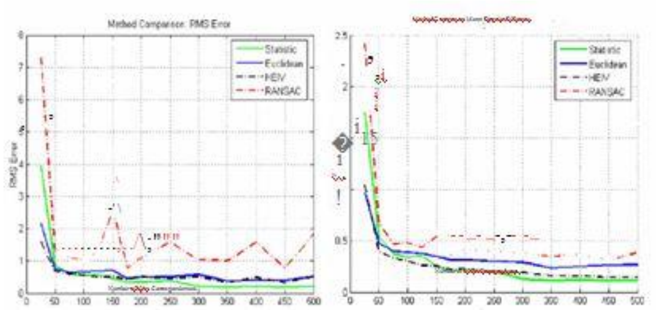

Fig. 4. RMS-error and mean epipolar distance computed for each method.

Fig.3 shows the angle deviation compared to the ground truth for all four methods regarding the rotation components and the translation. For two uncalibrated images under full perspective projection, atleast7 pointmatches are necessary to determine the epipolar geometry. When only 7 matches are available, there are possibly three solutions, which can be obtained by solving a cubic equation. If more data are available, then the solution is in general unique and several linear techniques have been developed. The reason for this is that the computation of the covariance matrix requires the es-timation of additional parameters, which is less accurate for a low number of point correspondences. In Fig. 4 the RMS- error as well as the mean epipolar distance of all methods is displayed. An important observation is that the RMS-error and the mean epipolar distance are not always consistent with the ground truth comparison, which was assumed above and is an addi- tionaljustification for a new criterion[3]. Also the relative distances between the other methods among each other behave differently.

IV. CONCLUSION

In this paperthere we conclude a criterion to evaluate point corre spondences in real time images. We described a new procedure7 for generating dense point matches over two images: we compute the fundamental matrix from given initial matches.Using an intensity preservation constraint, point matches are obtained and the epipolar geometry of two images is obtained from the match point sets. Contours are matched using the epipolar constraint as well as neighborhood intensity information. The use of epipolar geometry helps the algorithm overcome ambiguities in matching.

REFERENCES

[1] S. Brandt. On the probabilistic epipolar geometry. Im age and Vision Computing, 26(3):405-414, 2008.
[2] B. Boufama and R. Mohr, \Epipole and fundamental matrix estimation using the virtual parallax property," in Proc. 5th Inter. Conf. on Comput. Vis., (Boston, MA), pp. 1030{ 1036, June 1995.
[3] R. Tsai and T. Huang, \Uniqueness and estimation of three-dimensional motion parameters of rigid ob jects with curved srface," IEEE Trans. Patt. Anal. Mach. Intel l., vol. 6(1), pp. 13{26, Jan. 1984.
[4] Intel. Open source computer vIsion library. http://www. intel.com/techno logy /computing/opencv.
[5] K. Kanatani and Y. Sugaya. High accuracy fundamental matrix computation and its performance evaluation. In Proc. 17th British Machine Vision Conf (BMVC 2006), vo!.I, pages 217-226, 2006.
[6] S. M. Kay. Fundamentals of statistical signal process- ing: Estimation Theory. Prentice-Hall, Inc., Upper Saddle River, NJ, USA, 1993.
[7] Lee, C.-Y., Cooper, D. B., and Keren, D., “Computing Correspondence Based on Region and Invariants without Feature Extraction and Segmentation,” Proc. CVPR´93, New York, USA, 1993, pp. 655-656
[8] B. Triggs. Joint feature distributions for image corre- spondence. In Proceedings of the 8th International Conference on Computer Vision, pages 201-208, 2001.
[9] Z. Zhang. Determining the epipolar geometry and its uncertainty: A review. International Journal on Com- puter Vision, 27(2):161-195, 1998.
[10] H.C. Longuet-Higgins, “A computer algorithm for reconstructing a scene from two projections,” Nature, Vol. 293, 10 Sept. 1981.
[11] Russo, F., “Edge Detection in Noisy Images Using Fuzzy Reasoning,” IEEE Transactions on Instrumentation and Measurement, Vol. 47, No. 5, Oct. 1998, pp. 1102-1105.

