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A Survey: Image Matching

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Abstract –**Many methods claim as the best method to match the image but in reality, the proficiency of an algorithm is bounded in the region of experimental setup and assumptions considered by the researchers. Current comparative studies asses the performance of the algorithms based on the results obtained in different criteria such as speed, sensitivity, occlusion, and others. These studies are an important resource to understand the behaviour of the algorithms and their influence on the results obtained. Moreover, these methods cannot be used to predict the efficiency or level of accuracy that could be reached by using one algorithm or the other depending on of the type of images. This ability to predict performance becomes handy in situations where time is a limiting factor in a project because it allows one to quickly predict which algorithm will save the most time and resources. This study addresses the limitations of the existing comparative tools and delivers a generalized criterion to determine beforehand the level of efficiency expected from a matching algorithm given the type of images evaluated. Two texture based algorithms (SIFT and SURF) studied in this paper.**

Keywords –**Scale Invariant Feature Transform (SIFT), Speeded Up Robust Feature (SURF), Power Spectral Analysis.**

I. INTRODUCTION

Image matching is one of the centre territories of exploration in computer vision. A considerable measure of work is been demonstrated in this field since it has ended up being exceptionally valuable for various applications whether face recognition [1], fingerprint or iris recognition, enlarged reality and Robotic controls, military, medicinal finding, vehicle checking, observation and last yet not the slightest for security reasons [2].

Image matching compares the features extracted from an image with the test image stored in database. The image with highest percentage of match success is retrieved as output result. To prevent false images from recognized, a lower bound query is established (for example: 80% or maximum should match) into test algorithm [3].

Essential image matching frameworks [4] include extraction of features and after that coordinating of these features with the features computed and put away in the database. Features are essentially the 'key-points' which can extraordinarily characterize the entire object i.e. the features ought to have the capacity to give a large portion of the data about the object/information. Features can be fixes, edges, corners. At the point when all images are comparable in nature (same orientation, scale and so on) simple corner indicators [5] can work. Anyway, when there are images of diverse scales and rotations, then there is a requirement to utilize some extremely advanced procedures which can help in matching the objects with database under every one of these imperatives of distinctive orientations, scaling, occlusion and illuminations.

In this way, this paper gives a description of two extremely viable procedures which are explained as follows.

II. SCALE INVARIANT FEATURE TRANSFORM

Abhishek Nagar in 2013 [3] gave this Scale Invariant Feature Transform (SIFT) wherein he executed this method for image matching in large scale mobile visual search applications of online search. SIFT has now been effectively actualized in number of different recognition applications [7] also, for example, fingerprint recognition [8], face detection [9] [10], ear recognition [11], continuous hand motion detection [12], iris recognition [13]. SIFT gives us features which are strong to scaling, illumination changes, occlusion, orientation etc.

SIFT [6] is truly an included technique and along these lines it can be separated into following phases:

- Scale Space Extrema Detection
- Key point Localization
- Assigning an orientation to the keypoints
- Generate SIFT features

Therefore, SIFT is a strategy for separating particular invariant features from images that can be utilized to perform dependable coordinating between distinctive images of the same object. The principal stage is to recognize area and sizes of key

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points utilizing scale space extrema as a part of the DoG (Difference-of-Gaussian) capacities with distinctive estimations of σ, the DoG capacity is convolved of image in scale space divided by a constant factor k as the accompanying mathematical statement:

$$D(x,y,\sigma) = (G(x,y,k\sigma) - G(x,y,\sigma) \times I(x,y) \quad (1)$$

Where, G is the Gaussian function and I is the image.

Presently the Gaussian images are subtracted to deliver a DoG, after that the Gaussian image subsample by element 2 and produce DoG for inspected image. A pixel contrasted of 3×3 area will recognize the neighbourhood maxima and minima of D(x, y, σ).

In the key point localization step, key point candidates are limited and refined by disposing of the key points where they dismisses the low differentiation points. In the orientation task step, the orientation of key point is acquired in view of neighbourhood image angle. In depiction generation stage is to figure the neighbourhood image descriptor for every key point taking into account image gradient magnitude and orientation at every image test point in a region pointed at key point [14]; these examples fabricating 3D histogram of slope area and orientation; with 4×4 location grid and 8 orientation bins in every specimen. That is 128-component measurement of key point descriptor.

III. Speed Up Robust Features

SURF [14] is additionally prominently known as inexact SIFT. It utilizes necessary images and proficient scale space development for the effective generation of keypoints and descriptors. SURF fundamentally includes two stages:

- Recognition of Keypoint.
- Description of Keypoint.

In the first stage, as opposed to utilizing Difference of Gaussian like as a part of SIFT, integral images are utilized which permit the fast computation of rough Laplacian of Gaussian (LoG) images utilizing a box filter. The computational expense of applying the box filter is free of the span of the filter due to the integral image representation. Determinants of the Hessian matrix are then used to identify the keypoints. So as to be invariant to rotation, it figures the Haar-wavelet responses in x and y direction.

In image I, x = (x, y) is the given point, the Hessian matrix H(x, σ) in x at scale σ, it can be characterize as:

$$H(x,\sigma) = \begin{bmatrix} L_{xx}(x,\sigma) & L_{xy}(x,\sigma) \\ L_{yx}(x,\sigma) & L_{yy}(x,\sigma) \end{bmatrix} \quad (2)$$

Where Lxx (x, σ) is the convolution result of the second order derivative of Gaussian filter $\frac{\partial^2}{\partial x^2} g(\sigma)$ with the image I in point x, and similarly for $L_{xy}(x,\sigma)$ and L_{yy} (x, σ).

IV. Literature Review

Swapnil H. Kudke [15] in 2013 used SIFT based method for forgery detection in images. The method extracts robust features that detect that if a part of image is copy-moved. Since he copied part and original part possess same features, key points extracted at both ends will resemble each other.

Abhishek [3] incorporated color transformation using a new technique that is used before SIFT extraction technique. In experiment over 33K images substantial improvement was shown compared to baseline. Author used 5 main stages for feature recognition i.e.: i) SIFT extraction, ii) keypoint selection, iii) keypoint dimensionality reduction, iv) Global Descriptor Extraction, and v) keypoint location coordinates compression.

Jacob Toft Pedersen [16] studied group SURF for feature detection and description. Hessian matrix interest points are expressed in form of blob detector for response extent and local change around area. A descriptor provides unique and robust description of feature based on area that surrounds interest point. It can be efficiently calculated and based on HAAR wavelet with integral images.

Park et al. [8] propose a representation and matching scheme for fingerprint using Scale Invariant Feature Transformation (SIFT). They extract characteristic SIFT feature points in scale space and perform matching based on the texture information around the feature points using the SIFT operator. A systematic strategy of applying SIFT to fingerprint images is proposed. Using a public domain fingerprint database (FVC 2002), this paper demonstrates that the proposed approach complements the minutiae based fingerprint representation. Further, the combination of SIFT and conventional minutiae based system achieves significantly better performance than either of the individual schemes.

Mohamed Aly [9] proposes using SIFT features for the recognition process by matching the test object with database. The new technique is compared with well-established face recognition algorithms, namely Eigenfaces and Fisher faces. The results show the superiority of the new method over these two methods, specially using smaller

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training sets. In addition, the SIFT features approach continues to provide superior performance for up to 50% reduction in resolution.

Geng et al. [10] propose two new approaches: Keypoints-Preserving-SIFT (KPSIFT) which keeps all the initial keypoints as features and Partial-Descriptor-SIFT (PDSIFT) where keypoints detected at large scale and near face boundaries are described by a partial descriptor. Furthermore, this paper compares the performances of holistic approaches: Fisher face (FLDA), the null space approach (NLDA) and Eigen feature Regularization and Extraction (ERE) with feature based approaches: SIFT, KPSIFT and PDSIFT. Experimental results on ORL and AR databases show that these approaches, KPSIFT and PDSIFT can achieve better performance than the original SIFT. Moreover, the performance of PDSIFT is significantly better than FLDA and NLDA. And PDSIFT can achieve the same or better performance than the most successful holistic approach ERE.

Kisku et al. [11] presented a robust and efficient ear recognition system, which uses Scale Invariant Feature Transform (SIFT) as feature descriptor for structural representation of ear images. In order to make it more robust to user authentication, only the regions having color probabilities in a certain ranges are considered for invariant SIFT feature extraction, where the K-L divergence is used for keeping color consistency. Ear skin color model is formed by Gaussian mixture model and clustering the ear color pattern using vector quantization. Finally, K-L divergence is applied to the GMM framework for recording the color similarity in the specified ranges by comparing color similarity between a pair of reference model and probe ear images. After segmentation of ear images in some color slice regions, SIFT key points are extracted and an augmented vector of extracted SIFT features are created for matching, which is accomplished between a pair of reference model and probe ear images.

Vidyadharan et al. [13] presented an algorithm for the registration of digital images. Some multi–sensed or temporal images contain large number of speckles and noise, or image can have some distortion by some means. For these reasons, one needs to remove the noises, speckle and to recover from distortion. This paper registers two to find the similarity between the images. This paper discusses techniques for image registration based on SIFT. This paper uses NCC metrics for optimizing the matching work. Best bin first search using kd tree is used for feature matching and RANSAC is used for outlier elimination.

Image matching is an important task to be performed for the correspondence problem. The distinction between different matching primitives is probably the most prominent difference between the various matching algorithms. The primitives fall into two broad categories: either windows composed of grey values or features extracted in each image a priori are used in the actual matching step. The resulting algorithm usually called: Area Based Matching (ABM), and Feature Based Matching (FBM) respectively. **Babbar et al.** [14] presented a paper in which the comparative study of these two algorithms has been done which results with one best optimal method i.e. Feature Based Matching. FBM procedures widely used in pattern recognition and computer vision &fine increasing interest also in photogrammetric.

V. CONCLUSION

Carrying out literature review is very significant in any research project as it clearly establishes the need of the work and the background development. It generates related queries regarding improvements in the study already done and allows unsolved problems to emerge and thus clearly define all boundaries regarding the development of the research project. Plenty of literature has been reviewed in this paper in connection with image matching techniques.

REFERENCE

[1] Rajeshwar Dass, Ritu Rani, Dharmender Kumar, "Face Recognition Techniques: A Review", International Journal of Engineering Research and Development Volume 4, Issue 7 (November 2012), PP. 70-78.

[2] Ritu Rani, Surender Kumar Grewal, "A Comprehensive Survey of Object Recognition Techniques", in National Conference on Contemporary Techniques and Technologies in Electronics Engineering at D.C.R.U.S.T Murthal, on March 14th, 2013.

[3] Nagar, A., Saxena, A., Bucak, S., Fernandes, F., & Bhat, K. P. (2013, November). Low complexity image matching using color based SIFT. In *Visual Communications and Image Processing (VCIP), 2013* (pp. 1-6). IEEE.

[4] S. Dickinson,in: E. Lepore and Z. Pylyshyn , "What is Cognitive Science?", Basil Blackwell publishers, 1999, PP 172—207.

[5] Harris, C. and Stephens, "A combined cornerand edge detector", In Fourth Alvey Vision Conference, Manchester, UK, PP. 148-151, 1988.

[6] Lowe, David G. (1999), "Object recognition from local scale-invariant features". Proceedings of the International Conference on Computer Vision. PP. 1150–1157, 1999.

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[7] Ritu Rani, Surender Kumar Grewal, Indiwar, "Implementation of SIFT in various applications", International Journal of Engineering Research and Development, Volume 7, Issue 4,PP. 59-64, 2013.

[8] Unsang Park, Sharath Pankanti, A. K. Jain, "Fingerprint Verification Using SIFT Features", SPIE Defense and Security Symposium, Orlando, Florida, 2008.

[9] Mohamed Aly, "Face Recognition using SIFT Features", Technical report, Caltech, California Institute of Technology USA, 2006.

[10] Geng C., Jiang X., "SIFT Features for Face Recognition", IEEE Conference CSIT, PP 598–602, 2009.

[11] Hunny Mehrotra, Phalguni Gupta, and Jamuna Kanta Singh, Dakshina Ranjan Kisku, "SIFT-based Ear Recognition by Fusion of Detected Keypoints from Color Similarity Slice Regions", 2009.

[12] Nasser Dardas, "Real-time Hand Gesture Detection and Recognition for Human Computer Interaction", Technical Report, University of Ottawa, 2012.

[13] ViniVidyadharan, and SubuSurendran, "Automatic Image Registration using SIFT-NCC", Special Issue of International Journal of Computer Applications (0975 – 8887), pp.29-32, June 2012.

[14] Babbar, G., Punam Bajaj, Anu Chawla, and Monika Gogna. 2010. A comparative study of image matching algorithms. International Journal of Information, Technology and Knowledge Management. July-December. 2(2): 337-339.

[15] Kudke, S. H., & Gawande, A. D. Copy-Move Attack Forgery Detection by Using SIFT.

[16] Pedersen, J. T. (2011). Study group SURF: Feature detection and description. *Department of Computer Science, Aarhus University*.