International Research Journal of Engineering and Management Studies (IRJEMS)
Volume: 03 Issue: 05 | May -2019 ISSN: 2395-0126

A SURVEY PAPER ON METHODS OF REAL TIME IMAGE MATCHING FOR COMPUTER VISION

A. M. Meshkar

[1] *Assistant Professor, Computer Science and Engineering,SIPNA COETAmravati, Maharashtra, India*

Abstract

Abstract - Image matching is a crucial step in many image analysis tasks, such as image registration, image fusion, object recognition environmental surveillance, etc. With the dramatic increase in data volumes and types of sensors ,,image matching became also important for content based retrieval of remote sensing data and image data from large data repositories.Among local features, scale-invariant feature transform (SIFT) has become one of the most impressive methods for image matching and object recognition. Owing to the scale invariance of the detector and the distinctiveness of the descriptor, SIFT-based methods have been successfully used in remote sensing image matching or registration as compared with template matching.Feature-based matching, such as sift, has higher precision but lower computational efficiency. Image matching is often one of the first tasks in many photogrammetry and remote sensing applications. Though previously suggested algorithms are found to be enhancing some parameters at the same time reducing others.It is possible to design an algorithm which is tolerant and flexible towards certain image deviations.A new search strategy which is a modified one can be developed for robust image matching.The strategy will help to give out only those matches having high matching support and low image ambiguity.

KeyWords: *Key Block matching, image match, regional similarity, real-time application.*

----------***----------

I. INTRODUCTION

The goal of image matching is to decide whether a given image has been registered in the database or not. The query image may be affected with the noise, logo, scale changes etc. This work will mainly focus on how to extract exact point pairs tending to be unaffected. There are various methods for matching and retrievals. All these methods have tried to achieve greater matching rate but facing computational complexity and other problems related to invariance of scale.

The method presented in this paper try to develop points pairs that are resistant to noise, invariant to deformations, change of scale, illumination, etc. Most of image matching methods consist of usual steps extracting the features and then finding out their similarity measure. The main difficulty lies in choice of control point pairs. Therefore , the main approach here is to extract some well-defined point pairs in both reference and referenced image, and then to compute nearest neighbors using well defined k-means. This paper will focus on the common region detection and matching to acquire appropriate point pairs.

2. ANALYSIS AND DISCUSSION

In paper [1] authors have proposed the method of “image matching using SIFT features and relaxation technique” . The author ,in this paper presented a probabilistic neural-network-based feature matching algorithm for a stereo image pair which will be useful as a constraint initializing method for dense matching technique. In this approach ,scale-invariant feature transform (SIFT) features are used to detect interest points in a stereo image pair. Using disparity range computed by visual inspection, the search area can be restricted for a given stereo image pair. Reduced search area improves the computation speed. Confidence measures considering the neighborhood, unicity, and symmetry are some validation techniques which are built into the technique presented for finding accurate matches. The algorithm is found to be effective in matching SIFT features detected in a stereo image pair with greater accuracy.The performance of the algorithm for the number of matches found and proportion of inliers after achieving epipola geometry of the stereo image pair is compared with previous methods SSD, VNC, and BBFA .The results show that the proportions of matches as well as that of inliers given by the proposed method are much better than the other methods.

In paper [2] authors have presented method” scalable visual matching and retrieval”. This paper shows how to improve the matching efficiency and accuracy of floating points descriptors and the matching accuracy of binary descriptors. To achieve this goal, embed the spatial clues among local descriptors to a novel local feature, i.e., multi-order visual phrase which contains two complementary clues: 1) the center visual clues extracted at each image keypoint and 2) the neighbor visual and spatial clues of multiple nearby keypoints . Multi-order visual phrase does not scarify the repeatability of classic visual word and is more robust to the quantization error than existing visual phrase features.Comparisons with recent retrieval approaches clearly demonstrate the competitive accuracy and significantly better efficiency of these approaches. . Multi-order visual phrase effectively captures rich spatial clues and conquers the issues in existing visual phrase features, i.e., low flexibility and low

repeatability. Extensive experiments validate that SMVP and OMVP perform accurately and efficiently in image matching task. And in that it allows more flexible matching and is more robust to quantization error.

In paper [3] authors have proposed "Patch match randomized algorithm". The key insight driving this algorithm is that the elements of search domain patches of image pixels are correlated, and thus the search strategy takes advantage of these statistics. This one simple algorithm forms the basis for a variety of applications including image retargeting, completion ,reshuffling, object detection, digital forgery detection, and video summarization. However, because these algorithms must search and manipulate millions of patches, performance in many cases had previously been far from interactive: operations such as image completion could previously take minutes.In this paper an algorithm is proposed that accelerates many patch-based methods by at least an order of magnitude. This makes it possible to apply many powerful techniques for image editing for the first time in an interactive interface.The core element of nonparametric patch sampling methods is a repeated search of all patches in one image region for the most similar patch in another image region.Patch-based sampling methods have become a popular tool for image and video synthesis and analysis. This method is not robust to JPEG artifacts, but uses our more general matching algorithm, so it could potentially be generalized to find different types of forgeries such as those produced by automatic hole filling.

In paper [4] author has proposed "A technical perspective". The author here presented a fast method to guess a matching patch, given the match to the spatial neighbor, but such an approach can get stuck in solutions that are only locally optimal. The author has fixed to that comes from their second insight, delightfully counterintuitive: looking for a matching patch at random positions in the database region eventually finds good matches. Their "patch match" algorithm combines these approaches—deterministic update of a previous solution while allowing improvements from random guesses—to give a fast, approximate nearest neighbor algorithm for image patches that avoids getting stuck in bad solutions.The breakthrough of the algorithm is its processing speed, which, for the first time, allows interactive use of some remarkable image editing algorithms that were previously restricted to slow, batch processing. The author has applied the algorithm to many image processing tasks, showing a broad range of applications.The paper opens up algorithmic and theoretical questions. The work done by author is having a large impact in the vision and graphics communities, both for the algorithm itself and as an example of a class of algorithms to explore.

In paper [5] authors have proposed "A novel robust descriptor for image matching" to perform reliable image matching under large variations in scale, viewpoints, illumination and rotation. Built the descriptor based on elliptical sampling which samples image pixels according to the elliptic equations.The main advantage of elliptical sampling is that two controllable parameters of elliptical sampling can generate descriptors with different viewpoints and rotations. Recently, Scale Invariant Feature Transform (SIFT) method has been proposed to address these challenges. This method achieves a great success in image matching and becomes a dominant approach in image matching.

In paper [6] authors have presented the method for "effective contrast-based dehazing for robust image matching". The author has presented a novel strategy to enhance images degraded by the atmospheric phenomenon of haze. Here single-based image technique does not require any geometrical information or user interaction enhancing such images by restoring the contrast of the degraded images. The degradation of the finest details and gradients is constrained to a minimum level. Using a simple formulation that is derived from the lightness predictor this contrast enhancement technique restores lost discontinuities only in regions that insufficiently represent original chromatic contrast of the scene. The parameters of simple formulation are optimized to preserve the original color spatial distribution and the local contrast. it is demonstrated that this dehazing technique is suitable for the challenging problem of image matching based on local feature points.

In paper [7] authors have presented method of "learning image similarities via probabilistic feature matching".The author presented a novel image similarity learning approach based on Probabilistic Feature Matching (PFM).Matching process is considered as the bipartite graph matching problem, and defined the image similarity as the inner product of the feature similarities and their corresponding matching probabilities, which are learned by optimizing a quadratic formulation. It is proved that the image similarity and the sparsity of the learned matching probability distribution decrease monotonically with the increase of parameter C in the quadratic formulation where $C \geq 0$ is a pre-defined data dependent constant to control the sparsity of the distribution of a feature matching probability. This approach is the generalization of a family of similarity learning approaches, including SK, MK, and OAK, such that the similarity measure can be decided adaptive to data.

In paper [8] authors have proposed method of "uniform robust scale-invariant feature matching for optical remote sensing images". It is an improved SIFT algorithm that is fully automated and applicable to various kinds of optical remote sensing images, even with those that are five times the difference in scale. The main key of the proposed approach is a selection strategy of SIFT features in the full distribution of location and scale where the feature qualities are quarantined based on the stability and distinctiveness constraints. Then, the extracted features are introduced to an initial cross-matching process followed by a consistency check in the projective transformation model. Comprehensive evaluation of efficiency, distribution quality, and positional accuracy of the extracted point pairs proves the capabilities of the proposed matching algorithm on a variety of optical remote sensing images.

In paper [9] author has proposed an automatic image match algorithm based on SIFT features with match-support measure is presented for multi-source remote sensing images.In order to adjust SIFT algorithm applied in the

matching processing for different-source remote sensing images, the author has introduced the match support measure for similarity measure. Firstly, it builds SIFT feature descriptor and selects the points which satisfied the minimum Euclidean distance for candidate match result between reference image and match image.It calculates the match-support measure among the candidates separately. Finally, it employs the relaxation method to discard the false matching pairs. It has shown the improvement in image matching processing with this algorithm. It has remarkably increased the success rate and precision rate when compared with the classic SIFT feature match in experiments with the help of its feature named "Match support Measurement".However the extra computing amount is unavoidable and still needs to improve the efficiency of this algorithm and because of the match support measurement algorithm need match candidates support for each other, the distribution of matching result doesn't perform well.

In paper [10] authors have presented "the remote sensing image matching algorithm based on the normalized cross-correlation and SIFT" and proposed a normalized cross correlation with SIFT combination of remote sensing image matching algorithm. The basic idea of the algorithm is performing the space geometry transformation of the input image with reference to the base image. Then the normalized cross-correlation captures the relevant part of the remote sensing images. By this way, it can reduce the matching range. So some unnecessary calculations are properly omitted. By utilizing the SIFT algorithm, the preprocessed remote sensing images are matched, and got the registration points. This can shorten the matching time and improve the matching accuracy. Its robustness is increased correspondingly. The experimental results show that the proposed Normalized cross-correlation plus SIFT algorithm is more rapid than the standard SIFT algorithm while the performance is favorably compared to the standard SIFT algorithm when matching among structured scene images. Compared to the standard representation, this algorithm is both more distinctive and more compact leading to significant improvements in matching accuracy for both controlled and real-world conditions.

In paper [11] authors have proposed method of "Adaptive region matching for region-based image retrieval by constructing region importance index".This deals with the problem of similarity matching in region-based image retrieval(RBIR). A novel visual similarity measurement called adaptive region matching (ARM) has been developed. For decreasing negative influence of interference regions and important information loss simultaneously, a region importance index is constructed and semantic meaningful region (SMR) is introduced. Moreover, ARM automatically performs SMR-to-image matching or image-to-image matching. The authors proposed ARM is more flexible and more efficient than the existing visual similarity measurements that were originally developed for RBIR. SMR is extracted automatically based on RII and similarity is measured based on SMR, which aims to relieve users from the burden of query decision, and reduce negative influence of image-to-image matching and provides a fast, robust and effective performance.ARM can be further improved by considering not only visual similarity, but also semantic similarity, and decrease computational complexity as far as possible.

In paper [12] authors have proposed method for "Image Matching Based on Two-Column Histogram Hashing and Improved RANSAC".To improve computational efficiency in synthetic aperture radar (SAR) image matching, a fast image matching method using a novel two-step searching strategy is proposed here. This method is based on two-column histogram (TCH) hashing and improved random sample consensus (RANSAC). First, coarse matching is conducted using a novel TCH hashing, which is notable for its robustness and speed.Compared with the discrete cosine transform used in perceptual hashing, TCH describes SAR images more accurately and rapidly.On the basis of prior information, a model of energy function has been constructed to improve sampling strategy.To improve the speed and probability of matching, authors used a rapid template matching based on TCH hashing in the coarse matching. Then, an improvedP-RANSAC algorithm is applied to remove the mismatchingpoints for better precision. The TCH hashing algorithm effectively suppresses the noise of the SAR image and describes the image more accurately and achieves a higher real-time Performance. However the matching time is longer.

In paper [13] the authors have proposed method of "Feature based image matching for Airborne platform". In computer vision, detection and tracking of targets is very complex problem and demands sophisticated solutions.This work mainly consists of image matching for reconnaissance and Surveillance,Digital Scene Matching Area Correlation (DSMAC), Image Registration by using various correlation techniques, Mean Shift Algorithm, Cam shift Algorithm, Otsu Thresholding and Principal Component Analysis (PCA) and using Point detectors like Scale Invariant Feature Transform (SIFT) , Speed Up Robust Feature (SURF) and Saliency Map.This technique is robust for scale changes like rotation and translation. Compared to all techniques SIFT and SURF technique is efficient for scale invariance required for matching by using key points.However the computation is complex.

In paper [14] the authors have presented the method of "High-Accuracy Image Matching Using Phase-Only Correlation".The demand for high-performance image matching achieving sub-pixel registration is rapidly growing in many applications.Authors have developed an efficient image matching technique using Phase-Only Correlation (POC), which uses the phase components in Discrete Fourier Transforms (DFTs) of given images.

In this paper,authors briefly presented fundamentals of image matching technique.The same technique has also been successfully applied to high speed image recognition systems for industrial machine vision applications. This algorithm can find pairs of corresponding points between the given two images with sub-pixel accuracy. It can be applied to a wide range of applications, such as image sensing, computer vision,

industrial image recognition, biometrics, and waveform analysis.But CPU implementation is less efficient than GPU.

In paper [15] the authors have proposed method of "Fast image matching algorithm based on affine invariants". Feature-based image matching algorithms play an indispensable role in automatic target recognition (ATR). In this work, a fast image matching algorithm (FIMA) is proposed which utilizes the geometry feature of extended centroid to build affine invariants. Based on affine invariants of the length ratio of two parallel line segments, FIMA overcomes the invalidation problem of the state-of-the-art algorithms based on affine geometry features, and increases the feature diversity of different targets, thus reducing misjudgment rate during recognizing targets. However, it is found that FIMA suffers from the parallelogram contour problem and the coincidence invalidation. An advanced FIMA is designed to cope with these problems. The proposed algorithms have better robustness for Gaussian noise, gray-scale change, contrast change, illumination and small three-dimensional rotation. Compared with the latest fast image matching algorithms based on geometry features, FIMA reaches the speedup of approximate 1.75 times. Thus, FIMA would be more suitable for actual ATR applications. FIMA and AD-FIMA increase the feature diversity of different targets and thus could be expected to reduce misjudgment rate during recognizing single target in optical images.

In paper [16] the authors have presented "Multi-temporal and multi-sensor image matching based on local frequency information" .The authors developed an efficient approach to automated multi-temporal and multi-sensor image matching based on local frequency information. Two new independent image representations, Local Average Phase (LAP) and Local Weighted Amplitude (LWA), are presented to emphasize the common scene information, while suppressing the non-common illumination and sensor dependent information. As these two representations are both derivative-free and threshold-free, they are robust to noise and can keep as much of the image details as possible. A new Compositional Similarity Measure (CSM) is also presented to combine the LAP and LWA with the same weight for measuring the similarity of multi-temporal and multi-sensor images. The template is usually selected without consideration of its matching robustness and accuracy. In order to overcome this problem, a local best matching point detection is presented to detect the best matching template.Presented approach is effective for matching image pairs with significant scene and illumination changes and that it has advantages over other state-of-the-art approaches. A local best matching point detection method based on self-similarity analysis is presented to choose the template with the most distinct feature in the region centered on the target point. The two image representations do not involve any thresholding and, therefore, preserve all the image details. This is in contrast to commonly used representations which eliminate most of the detailed variations within the local image regions.

3. CONCLUSION

Overall it can be found that owing to the scale invariance of the detector and the distinctiveness of the descriptor, sift-based methods have been successfully used in remote sensing image matching or registration as compared with template matching.Feature-based matching, such as sift, has higher precision but lower computational efficiency.Image matching is often one of the first tasks in many photogrammetry and remote sensing applications. Though previously suggested algorithms are found to be enhancing some parameters at the same time reducing others.It is possible to design an algorithm which is tolerant and flexible towards certain image deviations.A new search strategy which is a modified one can be developed for robust image matching. Much improved matching results can be obtained with this method resulting into the increased matching rate. However, method can be extended to different search domains such as 3D geometry, videos and for other new applications.

REFERENCES

[1]. Finkelstein "The Patch Match Randomized Matching Algorithm for Image Manipulation "Communications of ACM,vol. 54 ,no. 11,pp-103-110, November 2011.

[2]. William T. Freeman" Technical perspective :A Perfect 'Match' " Communications of the ACM, vol.54,issue no.11,pp-102, November 2011.

[3]. Yong Luo, Yangxi Li, Jinhui tu, Chao Xu" FIMA: real time content based sample image matching system" IEEE, pp-551-555, 2013.

[4]. Shiliang Zhang, Qi Tian,Qingming Huang,Yong Rui"Embedding Multi-Order Spatial Clues for Scalable Visual Matching and Retrieval" IEEE Journal On Emerging And Selected Topics In Circuits And Systems,vol.4,issue no.1,pp-130-141, March 2014.

[5] Jyoti Joglekar, Shirish S. Gedam, and B. Krishna Mohan"Image Matching Using SIFT Features and Relaxation Labeling Technique—A Constraint Initializing Method for Dense Stereo Matching" IEEE Transactions on Geoscience and Remote Sensing, vol.52, issue no.9, pp-5643-5652, September 2014.

[6]Xiaohui Yang, Lijun Cai"Adaptive region matching for region-based image retrieval by constructing region importance index" IET journal, vol.8,no-2,pp-141-151, August 2013.

[7]Mamoru Miura, Shuji Sakai, Shoichiro Aoyama, Jumpei Ishii, Koichi Ito and Takafumi Aoki "High-Accuracy Image Matching Using Phase-Only Correlation and Its Application" SICE Annual Conference 2012, pp-307-312.

[8]Hong-Chang Shin, Gwang-soon Lee, and Namho Hur "View interpolation using a simple block matching and Guided image filtering" IEEE 2014.

[9].Ran li"Muti-Source Remote Sensing Imageries matching based on SIFT Feature with Match-Support Measurement"IEEE,pp-1-4,August 2011.

[10]. Xingxing Shen & Wenxing Bao"The Remote Sensing Image Matching Algorithm Based on the Normalized Cross-

Correlation and SIFT" Springer, vol-42,issue no-2, pp:417-422, December 2013.
[11].Xiaohui Yang, Lijun Cai"Adaptive region matching for region-based image retrieval by constructing region importance index" IET journal, vol.8,no-2,pp-141-151, August 2013
[12].Bin Li, Delie Ming, Wenwen Yan, Xiao Sun, Tian Tian, and Jinwen Tian"Image Matching Based on Two-Column Histogram Hashing and Improved RANSAC"IEEE GEOSCIENCE AND REMOTE SENSING LETTERS,vol. 11, no. 8,pp-1433-1437,august 2014.
[13]. Humera Siddiqua, .H.Shanthakumara, Md. Shahid"Feature based image matching for Airborne platform" Proceeding of IRF conference,pp- 14-21,July 2014.
[14].Mamoru Miura, Shuji Sakai, Shoichiro Aoyama, Jumpei Ishii, Koichi Ito and Takafumi Aoki" High-Accuracy Image Matching Using Phase-Only Correlation and Its Application" SICE Annual Conference,pp- 307-312, August 2012
[15].ZHANG Yi, LU Kai, GAO Ying-hui"Fast image matching algorithm based on affine invariants"Springer,pp-1907-1918, August 2013.
[16]. Xiaochun Liu , Qifeng Yu , Xiaohu Zhang , Yang Shang , Xianwei Zhu , Zhihui Lei "Multi-temporal and multi-sensor image matching based on local frequency information" International Archives of ISPRS Congress, Australia,pp- 485-490, September 2012

BIOGRAPHIES

Ashwini M. Meshkar
Has completed M.E. Degree in Computer Science and Information Technology from PG Department of Computer Science and Information Technology, SGBAU Amravati University, Amravati, Maharashtra, India.She is currently working as an Assistant Professor in SIPNA COET, Amravati. Her current research interest is Image Processing Applications.
(E-mail: ashwinimeshkar@gmail.com)