A Discriminative Image Registration Model with Hybrid Feature Detector

Syed Abdul Hanan Ahmed Shah[*1], Shahnawaz Talpur[2], Bushra Naz[3]

[1, 2, 3]Department of Computer System Engineering, Mehran University of Engineering and technology Jamshoro Sindh, Pakistan

ARTICLEINFO

ABSTRACT

Image registration is a manner of aligning two or more images of the same scene which achieves maximum accuracy. Analysis of geometric distortion, caused by the difference in viewing angle, sensor resolution and distance. The critical step in image registration is the collection of feature points and evaluate a spatial transformation mainly when outliers are present. In our proposed framework we have used the hybrid feature-based and area-based methods together. Before applying those methods, the Bilateral Filter is applied for the preprocessing of both the images, the reference image and the image that needs to be registered in order to make the images noise free. For feature detection, the ORB (Oriented FAST and Rotated BRIEF) is used which is basically a fusion of FAST key point detector and BRIEF descriptor with many modifications to enhance the performance. KNN (K-Nearest Neighbors) is used for matching similar points and for reducing the miss matches the efficient algorithm is used which is Random Sample Consensus (RANSAC). The template matching method is applied for the area-based matching.

Keywords : Bilateral filter, ORB, KNN, RANSAC, template matching, Image registration.

I. INTRODUCTION

The image registration technique is a crucial one in image processing. Similar points in one image line up with those in another. [11].We can also say that image registration is the plotting of similarity between two images and those images can be from different sensors, different scenes or taken at different times. It is used in military, medical imaging, the disaster that causes damage that damaged is calculated, and it detects the changes. Image registration is also said to be as image fusion.

Image registration is divided in two groups.
1) Feature based methods
2) Area based methods.

If there are many features and they are easy to see, then feature-based methods are used, and if there are no more features, then area-based methods are used. Harris corner, edge property are common properties [10]. ORB based registration method is proposed in

this research. In ORB, the features are mostly concentrated in objects at the centre of the image while in SURF, SIFT and FAST key point detectors are distributed over the image. ORB is faster than SURF. For matching of similar points KNN is applied because it is fast method for matching of similar points and RANSAC is used it is robust transformation estimation algorithm or used for reducing the miss matches. For the area based matching template matching method is used that uses the normalized cross correlation technique.

II. RELATED WORKS

The proposed method by author for Image Registration by using Deep Residual Network features for multisource high-resolution remote sensing Image [1]. The SURF algorithm used for features detection author proposed its fast algorithm for the feature detection in image processing. It is the robust algorithm for local [2]. The SIFT algorithm is used for the detection of features that is invariant to the scale and noise. For matching similar points [3]. the SAR and RANSAC are used to improve the accuracy for the registration of multi modal infrared images [4]. The SIFT (MS-SIFT) approach is a new one that specifies rotation and scale alterations for the feature points. Better outcomes can be obtained by removing outliers [5]. The feature based LLT (locally linear transforming algorithm) has used for feature matching of remote sensing images [6]. After SIFT registrations, the author of this article improved the spatial distribution by using normalized cross correlation to gain tie points [7]. For multi viewpoint picture registration, techniques including SIFT, Euclidean distance, and RANSAC are utilized, and the author also used KNN to increase accuracy [8]. On the strategies for area-based matching, a survey is offered. The article provides a number of studies using a variety of methodologies [9]. The author used the SURF algorithm to add matching points and register the correct image. The nearest neighbor algorithm is used to match the key points [10]. A new image registration technique is proposed for remote sensing

images, which is a combination of both area-based and feature-based matching. The wavelet method and normalized cross-correlation fit are used for feature extraction [11]

III. PROPOSED FRAMEWORK

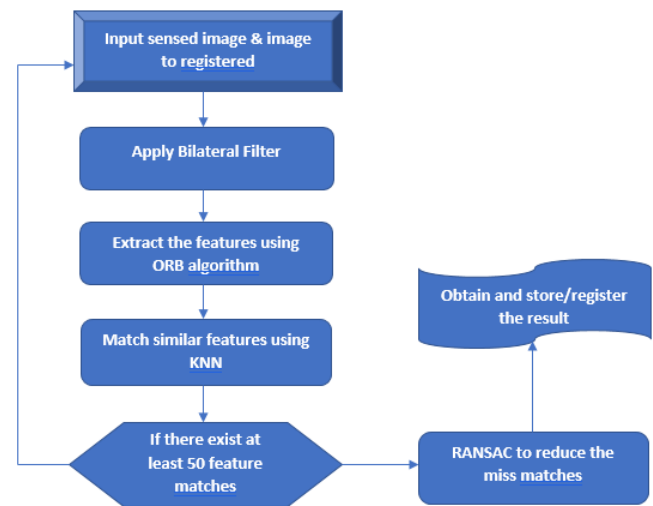The steps that are involved in our proposed framework are shown below in figure.

Fig. 1: Proposed Methodology

Brief description

In image registration, two or more images are align and registered. In our proposed framework the aerial images are used. The first step is to apply the Bilateral filter for the removing of noise because this filter removes the noise while preserve the edges. After that the feature based algorithm ORB (Oriented FAST and Rotated BRIEF) is applied for the feature detection. For the area based matching the template matching method is used so to match the template. KNN is used in our proposed framework for the matching of the similar points because that is more accurate and for reducing the miss matches the very effective algorithm is applied that is RANSAC (random sample consensus). The features that are extracted then evaluate if the features that are matched are equal or above to the minimum threshold that is 0.75%. The image is prepared for the registration when the required matching situation is accomplished which is however 50 matches otherwise rejected for the registration.

IV. EXPERIMENTAL RESULTS

The proposed techniques /methods are tested and applied on the aerial images and have gathered the results with good accuracy. The experiments were conducted on the 20 high resolution images.

1. Image Set

Figure 2 is the original image and figure 3 is the image that needs to be registered.
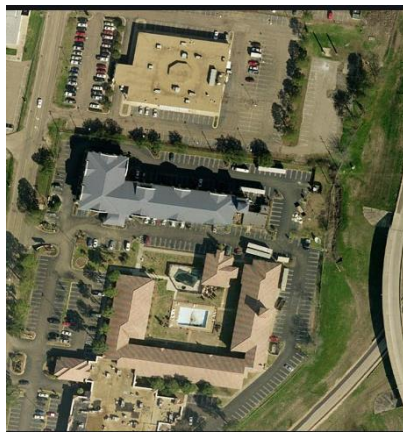

Fig. 2: Original input image

Fig. 3: Image to be registered.

2. Feature Extraction

After getting the preprocessed images now features are extracted using the ORB, **Oriented FAST and rotated BRIEF** (ORB) is a fast robust local feature detector.
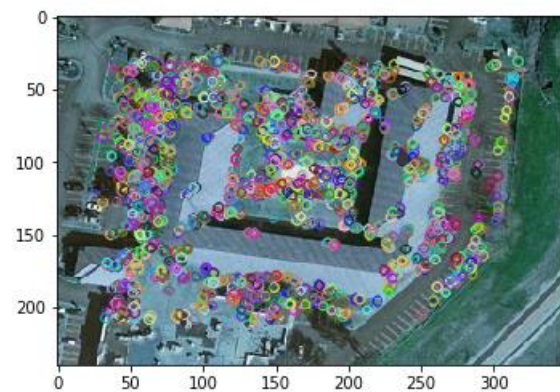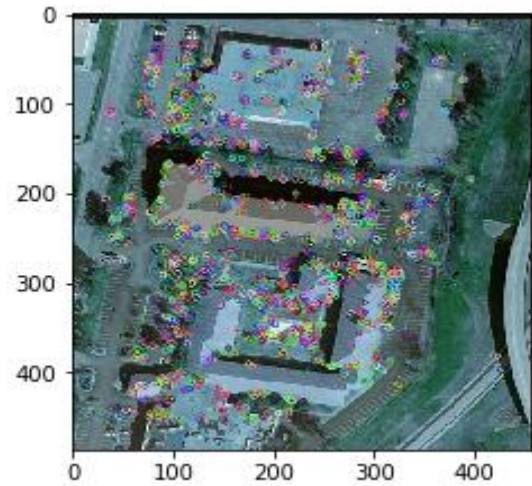
Fig. 4: Features are extracted.

3. Apply KNN

After Features are extracted then author applying KNN to match the features.
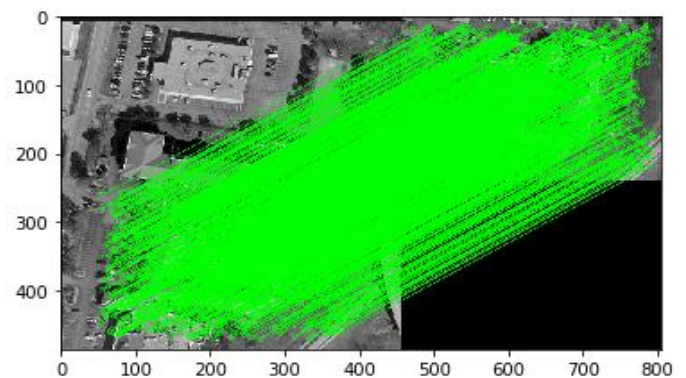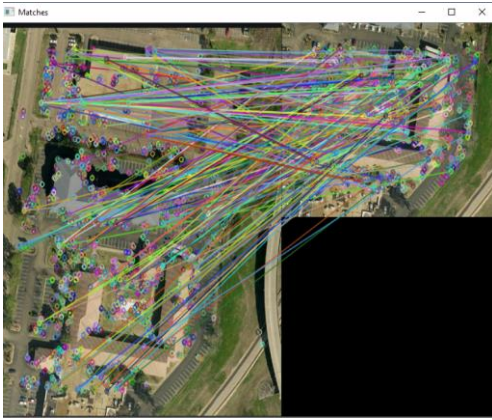

Fig. 5: KNN to match features.
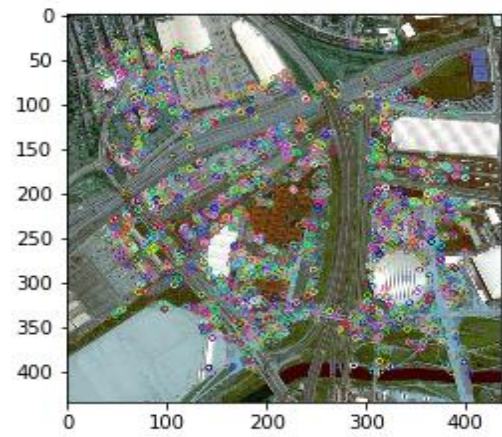
Fig. 6: Final fused image (Result-1)

Fig. 7: Original input image

Fig. 8: Image to be registered.

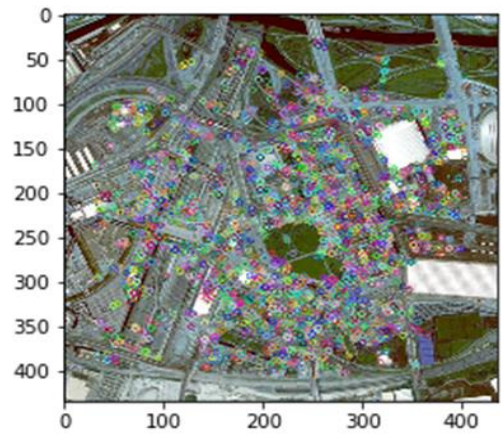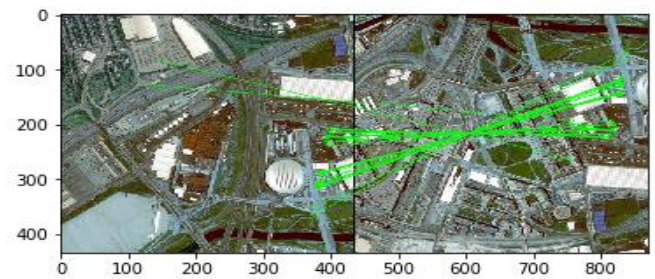Fig. 9: Features are extracted.

Fig. 10: KNN to match features.
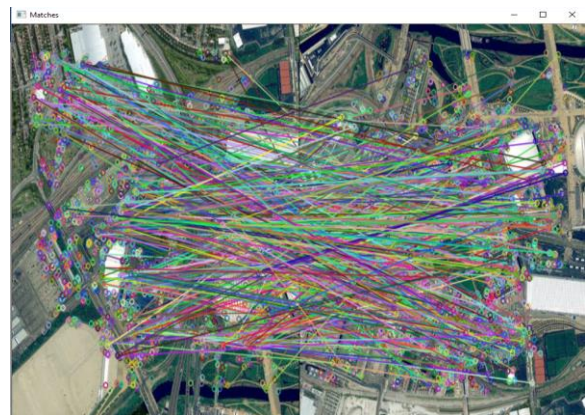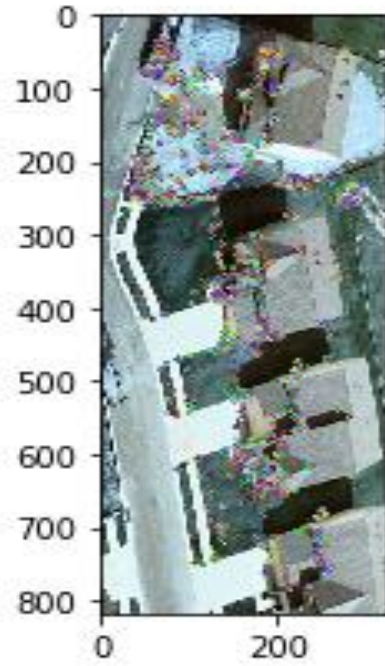

Fig. 11: Final fused image (Result-2)

Fig. 12: Original input image

Fig. 13: Image to be registered.
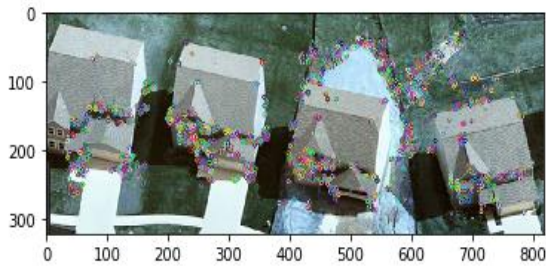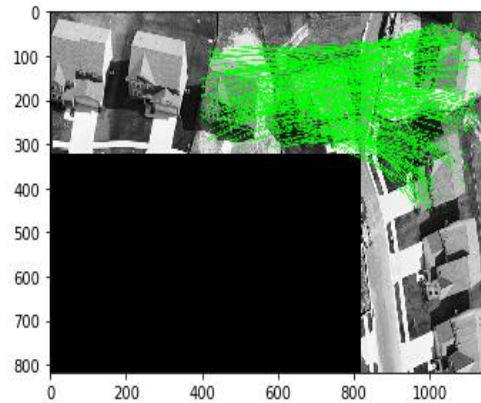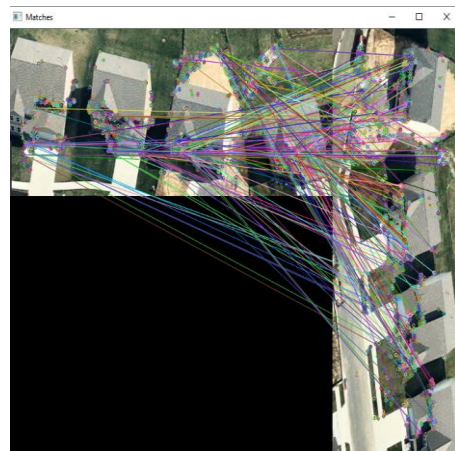

Fig. 14: Features are extracted.

Fig. 15: KNN to match features.

Fig. 16: Final fused image (Result-3)

V. ORB/SURF

S. No	ORB		
	No: matches	No: good matches	Time execution
R-1	3443	2316	1.50s
R-2	4434	2167	1.50s
R-3	3205	1980	1.70s

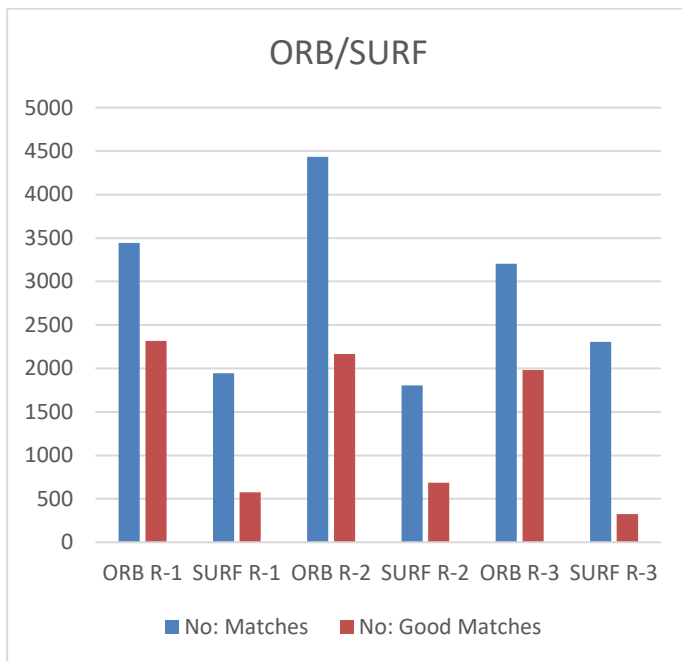| S.No	SURF		
	No: matches	No: good matches	Total Time execution
R-1	1946	575	2.03s
R-2	1804	685	1.77s
R-3	2304	323	1.80s

Fig. 17: Result compression of ORB with SURF

VI.CONCLUSIONS

The accuracy requirement cannot be reached by traditional image registration techniques that only use basic local features. It is concluded from the results that ORB (Oriented FAST and Rotated BRIEF) algorithm is used in our proposed frame work is rotation invariant and resistant to noise which gives an efficient alternative to SIFT, SURF algorithms.

VII. REFERENCES

[1]. Xin Zhao, Hui Li, Ping Wangg.An Image Registration Method Using Deep Residual Network Features(2021)

[2]. Hajano, S., Naz, B. and Talpur, S., Area and Feature Based Image Registration Using Template Matching and SURF Algorithm. In Proc. of the Int. Conf. on Computational Sciences and Technologies (pp. 109-113) (2020).

[3]. Sabeen Gul, Sheeraz Memon, Bushra Naz," Image Registration Model For Remote Sensing Images", Research Article "EAI Endorsed Transactions on Internet of Things Online First" 2019.

[4]. Yung, Chun Pang, et al. "Efficient feature-based image registration by mapping sparsified surfaces." Journal of Visual Communication and Image Representation 55 (2018): 561-571.

[5]. Ma, Wenping, Zelian Wen, Yue Wu, Licheng Jiao, Maoguo Gong, Yafei Zheng, and Liang Liu. "Remote sensing image registration with modified SIFT and enhanced feature matching." IEEE Geoscience and Remote Sensing Letters 14, no. 1 (2016): 3-7.

[6]. Ma, J.; Zhou, H.; Zhao, J.; Gao, Y.; Jiang, J.; Tian, J. Robust Feature Matching for Remote Sensing Image Registration via Locally Linear Transforming. IEEE Trans. Geosci. Remote Sens. 2015, 53, 6469–6481

[7]. Zhang, Qian, Zhiguo Cao, Zhongwen Hu, Yonghong Jia, and Xiaoliang Wu. "Joint image registration and fusion for panchromatic and multispectral images." IEEE geoscience and remote sensing letters 12, no. 3 (2014): 467-471.

[8]. Subramanyam, M. V. "Automatic feature based image registration using SIFT algorithm." In 2012 Third International Conference on

Computing, Communication and Networking Technologies (ICCCNT'12), pp. 1-5. IEEE, 2012.

[9]. Joglekar, Jyoti, and Shirish S. Gedam. "Area based image matching methods—A survey." Int. J. Emerg. Technol. Adv. Eng 2, no. 1 (2012): 130-136.

[10]. Pandya, Megha M., Nehal G. Chitaliya, and Sandip R. Panchal. "Accurate image registration using SURF algorithm by increasing the matching points of images." International Journal of Computer Science and Communication Engineering 2,no.1 (2013):14-19.

[11]. Hong, Gang, and Yun Zhang. "Combination of feature-based and area-based image registration technique for high resolution remote sensing image." In 2007 IEEE International Geoscience and Remote Sensing Symposium, pp. 377-380. IEEE, 2007.

Cite this article as :

Syed Abdul Hanan Ahmed Shah, Shahnawaz Talpur, Bushra Naz, "A Discriminative Image Registration Model with Hybrid Feature Detector", International Journal of Scientific Research in Computer Science, Engineering and Information Technology (IJSRCSEIT), ISSN : 2456-3307, Volume 9, Issue 3, pp.272-278, May-June-2023. Available at doi : https://doi.org/10.32628/CSEIT2390369
Journal URL : https://ijsrcseit.com/CSEIT2390369