Comparative Analysis of Image Registration using SIFT and RANSAC method

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ABSTRACT

Image registration is a prerequisite step prior to image fusion or image mosaic. It is a fundamental image processing technique and is very useful in integrating information from different sensors, finding changes in images taken at different times, inferring three- dimensional information from stereo images, and recognizing model-based objects. As a large dimension of the traditional SIFT descriptor and its complex algorithm and improved algorithm of SIFT is presented which can reduce the dimension and also can improve the time saving and complexity reducing and to improve the accuracy of matching, RANSAC is applied for removal the wrong matching points

Keywords— Image Registration, SIFT, RANSAC

I. INTRODUCTION

Image registration is multi spectral. Satellite image is a crucial problem for remote sensing applications, and remains challenging because of the inherent nonlinearity in intensity changes [1].

Image registration is the process of overlaying two or more images of the same scene taken at different times, from different viewpoints, and by different sensors. It geometrically aligns two images - the reference and sensed images [2].

Image processing which are possibly able to visualize objects inside the human body, are of special interest. Advances in computer science have led to reliable and efficient image processing methods useful in medical diagnosis, treatment planning and medical research. In clinical diagnosis using medical images, integration of useful data obtained from separate images is often desired. The images need to be geometrically aligned for better observation. This procedure of mapping points from one image to corresponding points in another image is called Image Registration. It is a spatial transform. The reference and the referred image could be different because were taken [3].

- At different times
- Using different devices like MRI, CT, PET, SPECT etc (multi modal).
- From different angles in order to have 2D or 3D perspective (multi temporal).

II. IMAGE REGISTRATION ALGORITHM

SIFT

A method to enhance the recognition of spatially distributed features, based on the scale invariant features transform is called SIFT method.

The Scale Invariant Feature Transform (SIFT) can detect and extract feature points which are invariant to changes in illumination, image noise, rotation, scaling, and small changes in viewpoint.

After features are extracted from images, the initial matching process can begin. Feature vectors from one image are compared to those from the other image in pairs. To give robustness, feature vectors from the other image which are within a certain similarity threshold are preserved. As a result, bad matches appear.

In image processing applications one class of problems sensitive to input variations is that involving image registration. It requires the transform estimation from just the image data, and the quality of the estimation can depend on the number and positions of the feature point's identified within the images. The reasons behind this are largely related to basic geometry: even simple relationships will be better served by input points that are as far apart as possible within the image (providing larger differences and reducing the impact of discretisation), while a nonlinear relationship such as radial lens distortion may have only a negligible impact over a large central part of an image but could be a very Significant influence on features selected nearer to the edges. Broadly speaking, a 'good' (wide- ranging, fairly uniform, and not too clustered) distribution of features is an important factor in ensuring the quality of registration [4].

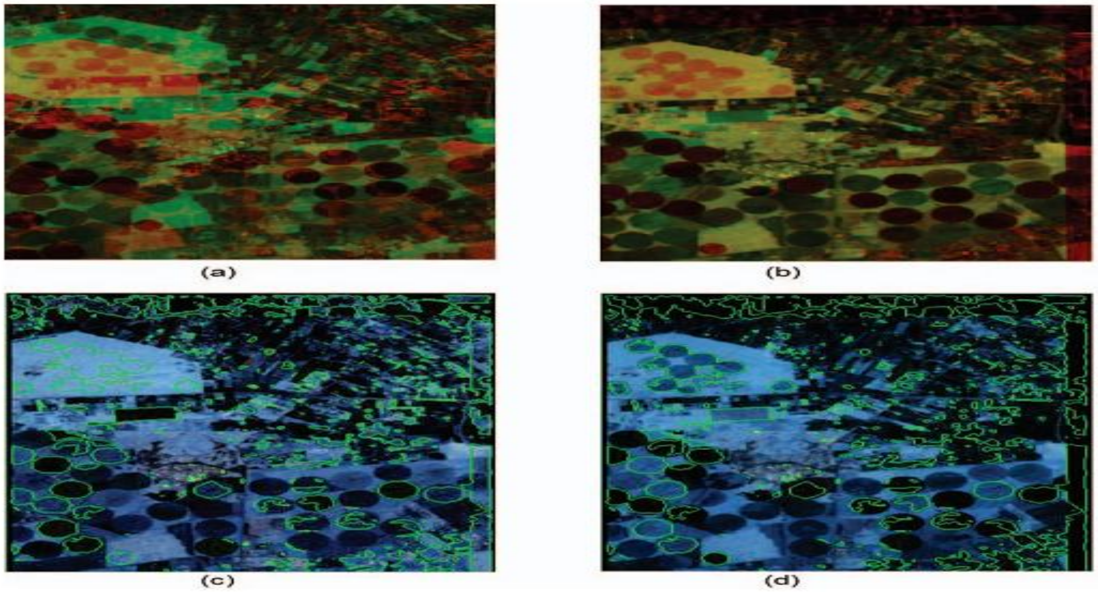


Figure 1 - Results on a sample LANDSAT5 image,(a) The two images before registration,(b) The two images after registration,(c) Changes in first image,(d) Changes in second image.

Experiment Result

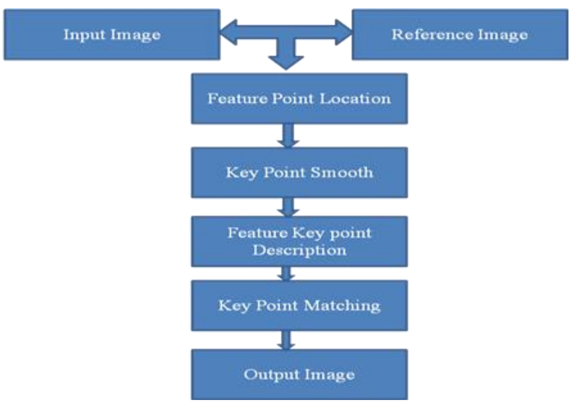


Figure 2– Flow chart of purposed method

The Experiment Algorithm Steps

1) Feature point location: It is used for to locate similar points between two images.

2) Key point smooth: Passed easily define points.

3) Feature Key point Description: Computing the gradient magnitude & orientation at each image sample point in a region around the feature point description.

4) Matching: When key point description was created computing minimum Euclidean distance for the invariant description for vector as similarity between two images.

Simulation Result

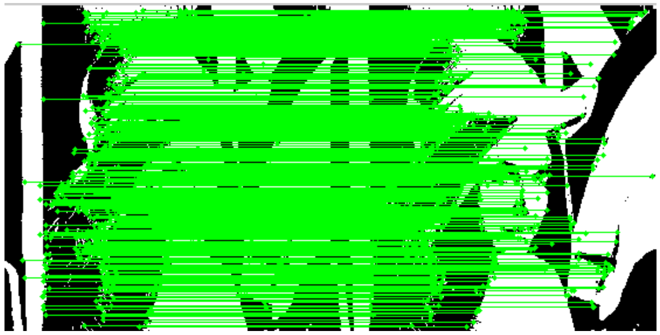


Figure 3- Output of lena Images

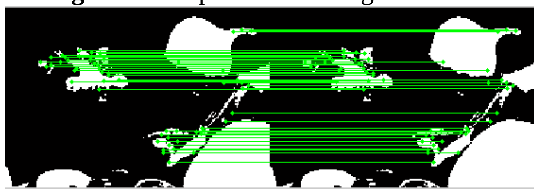


Figure 4-Experiment of Onion Result

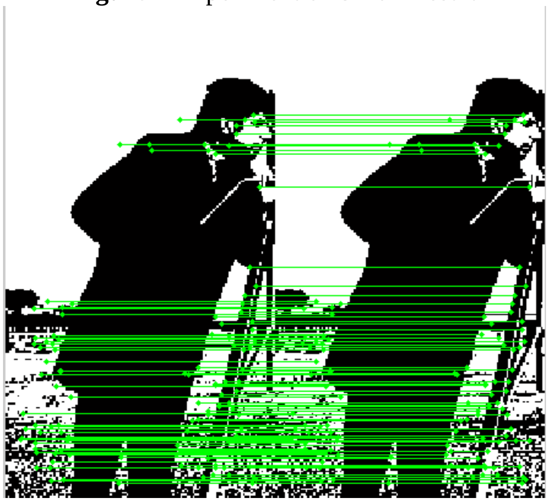


Figure 5-Experiment of Camera Man Result

Uses

1) Image alignment (Homo Graphy, fundamental matrix)
2) 3D reconstruction (e.g. Photo Tourism)
3) Motion tracking
4) Object recognition
5) Indexing and database retrieval
6) Robot navigation

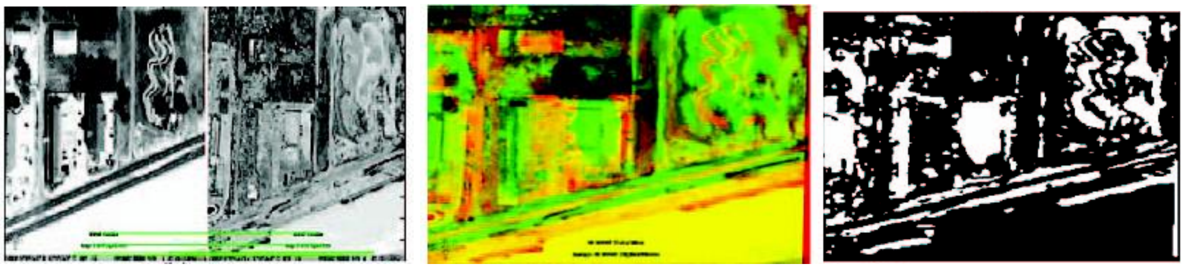
RANSAC

RANSAC (RANdom SAmple Consensus) is an iterative method to estimate parameters of a mathematical model from a set of observed data which contains outliers. It is a non-deterministic algorithm in the sense that it produces a reasonable result only with a certain probability, with this probability increasing as more iteration are allowed. The algorithm was first published by Fischler and Bolles in 1981.

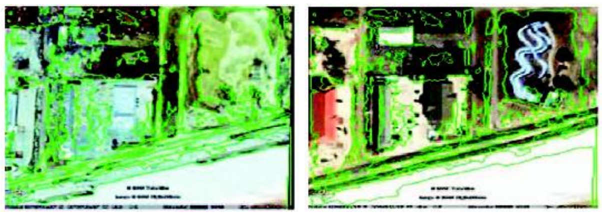
RANSAC is a re sampling technique that generates candidate solutions by using the minimum number observations (data points) required to estimate the underlying model parameters. As pointed out by Fischler and Bolles unlike conventional sampling techniques that use as much of the data as possible to obtain an initial solution and then proceed to prune outliers, RANSAC uses the smallest set possible and proceeds to enlarge this set with consistent data points [5].

The Algorithm Steps

(1) Select the randomly the no of points required to determine the images.
(2) Determine the how many points from the set of all points fit with a images.
(3) Select the optimum parameters according to the final parameters output.

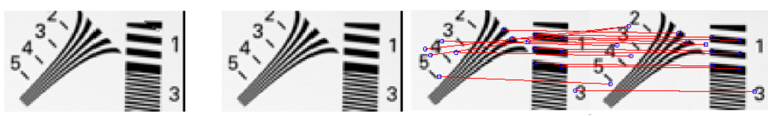


(a) (b) (c)



(d) (e)

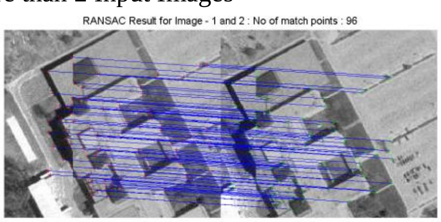
Figure 6 - Sample of results (a) Matched points after RANSAC, (b) The two images after registration, (c) The change mask, (d) Changes in first image, (e) Changes in second Image [6].



(a) (b) (c)

Figure 7 – (a) Input Image, (b) Reference Image, (c) RANSAC Point Matching [7].

Simulation Result More than 2 Input Images



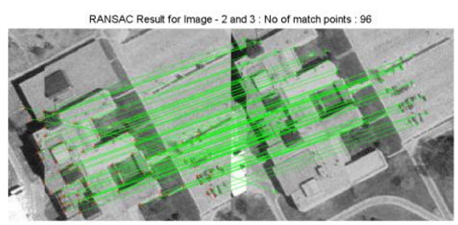
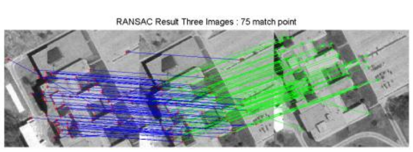


Figure 8 – Input image and reference image with output

Figure 9–Reference image and reference image with output



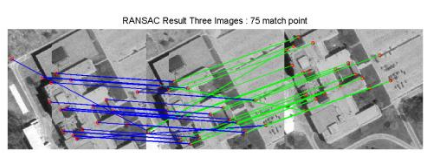


Figure 10– Input image and reference and reference images with output

Figure11 – Input image and reference and reference images with output

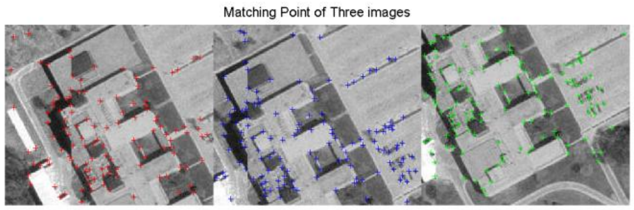
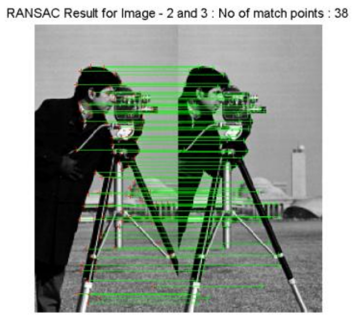


Figure 12 – Input image and reference and reference images with output



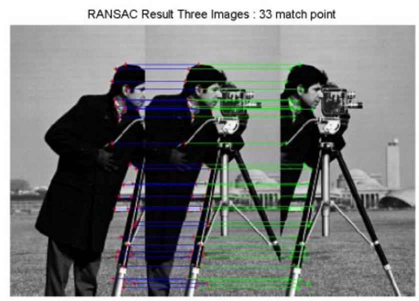


Figure 13 – Input image and reference output Figure 14 – reference and reference Figure 15– Input image and
reference and reference images with output

A comparison of SIFT & RANSAC Methods

SIFT (Scale Invariant Feature Transform)	RANSAC (RANdom SAmple Concensus)
The Scale Invariant Feature Transform (SIFT) can detect and extract feature points which are invariant to changes in illumination, image noise, rotation, scaling, and small changes in viewpoint. After features are extracted from images, the initial matching process can begin.	This method checks the number of elements of the input feature point data set which are consistent with the model just chosen.
Feature vectors from one image are compared to those from the other image in pairs. To give robustness, feature vectors from the other image which are within a certain similarity threshold are preserved. As a result, bad matches appear.	RANSAC repeats the two steps within a specified threshold until it finds the maximum number of elements within a model. It then selects this model and rejects mismatches.
SIFT idea was that by dividing the image into smaller windows, we would be able to match more features between the window and object.	In the transform fits a certain number of matches, it is considered a 'good' transform. Any points that do not match are discarded and then the transformation is recalculated using these new points.
SIFT is lengthy process involves multiple steps	In RANSAC when reinserted window it gives much better result with very short process.
SIFT is time consuming and costly method.	RANSAC is much more efficient than the Hough transform when SIFT Features are used.
Experiments shows that global localization can be achieved with just the current frame data in feature-rich environments, with the distinctive SIFT features.	Nevertheless, for symmetric environments or when there is a lack of features, global localization with the current frame may be uncertain and the robot should rotate or move around.

Iii Conclusion

These Algorithms recover good registered images for more than two input images using SIFT and RANSAC methods.
Both algorithms are also applicable when there is matching point between two images.
Image registration algorithm using SIFT and RANSAC method take few minutes to register images. So the delay execution is time is very less comparatively to other methods i.e. one minute This algorithms are applicable to stereo images to find feature points.

References

[1] Sang Rok Lee, "*A Coarse*-to-Fine Approach for Remote-Sensing Image Registration Based on a Local Method" International journal on smart sensing and intelligent system, vol.3, no.4, December 2010.
[2] Barbara Zitova,Jan Flusser, "*Image* registration methods: a survey "Received 9 November 2001; received in revised form 20 June 2003; accepted 26 June 2003.
[3] Medhav V.Wyawahare, Dr.Pradeep M.Patil, and Hemant k.abhyanka "Image Registration Techniques: An overview",Vishwakarm Institue of technology ,pune,Maharashtra state,India.Vol.2, No3, September 2009.
[4] R. Song, J. Szymanski "Well-distributed SIFT features" ELECTRONICS LETTERS 12th March 2009 Vol. 45 No. 6.
[5] Konstantinos G. Derpanis , "Overview of the RANSAC Algorithm" May 13, 2010.
[6] R. Song, J. Szymanski "Well-distributed SIFT features" ELECTRONICS LETTERS 12th March 2009 Vol. 45 No. 6.
[7] Haidawati Nasir, Vladimir Stankovic, and Stephen Marshall, "IMAGE REGISTRATION FOR SUPER RESOLUTION USING SCALE INVARIANT FEATURE TRANSFORM, BELIEF PROPAGATION AND RANDOM SAMPLING CONSENSUS", 18th European Signal Processing Conference (EUSIPCO-2010) Aalborg, Denmark, August 23-27, 2010.