REGISTRATION STUDY OF GREAT RESOLUTION DIFFERENCE REMOTE SENSING IMAGE BASED ON INVARIANT FEATURE

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1. INTRODUCTION

The registration of high resolution panchromatic image and the low resolution multi-spectrum image plays a growing vital role in the remote sensing applications which has become a hot topic of recent studies. Aiming at this problem, the SIFT algorithm, which has been widely used in multi-scale image registration field, is studied and has been improved. During this paper, a locally adaptive registration algorithm of the remote sensing image based on SIFT is proposed. A series of experiments were carried out based on the improved approach proposed in this paper that have been proven its superiority. The precision of the registration between the high and low resolution images is lower than 1.5 pixels by obtaining uniformly distributed matching points. The experimental results also show that the improved algorithm can realize registration of great solution difference images effectively and accurately, which also show an enormous potential in remote sensing application projections.

2. THE PRINCIPLE OF IMPROVED SIFT ALGORITHM

Although there is a great development in the field of automatic matching technology of remote sensing images, there are still many tough problems [1][2][3][4]:

1) The problem of remote sensing image registration with great different resolutions is still unsolved.

2) Some problems, such as registration of remote sensing image with different phases, different resolutions, how to get some control points uniformly distributed and how to remove mismatched points, are ill-considered.

3) Regarding the huge data quantity of remote sensing image, how to realize high accuracy registration and meet fast real-time matching requirements is also a big difficult problem now.

In view of above difficult problems, this paper has made some improvement on SIFT(Scale-invariant feature transform) image registration algorithm, realizes the uniform distribution of the feature points by using mesh block method, and increases the matching speed by over 10 times.

The flow chart of algorithm proposed in this paper can be seen in figure 1. In the flow chart, the uniform blocking of image and local adaptive matching are the key steps of algorithm in this paper, which not only increasing the speed of SIFT feature points extraction and matching but also improve the accuracy of SIFT feature points matching.

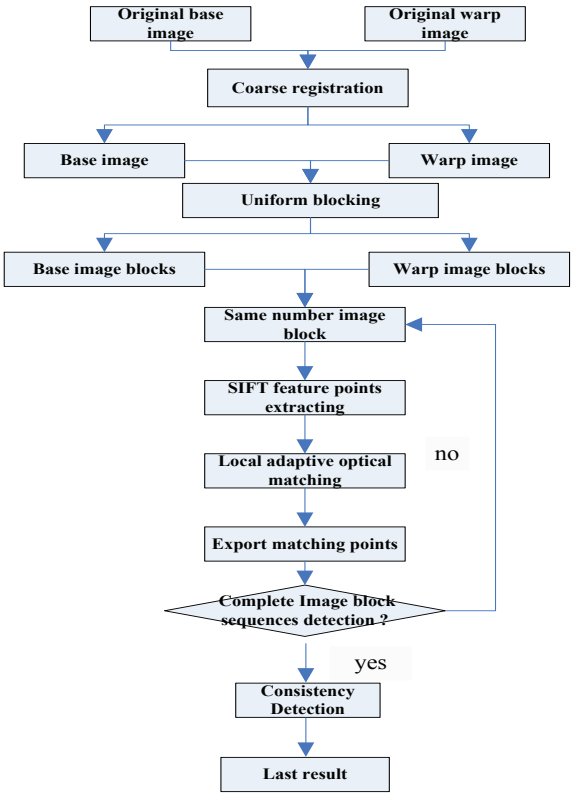
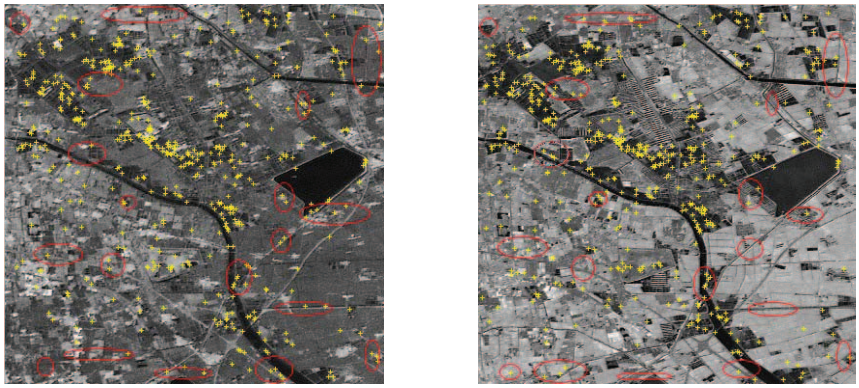


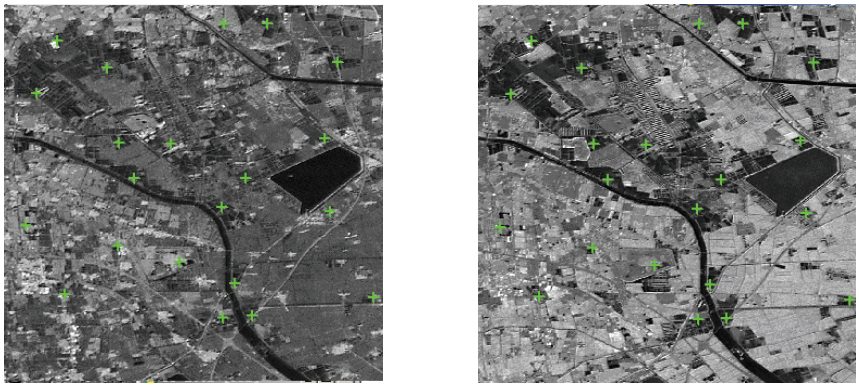
Fig.1 The flow chart of algorithm

3. EXPERIMENTS AND RESULTS

In order to prove the superiority of the improved algorithm, there were two experiments conducted as follows. At first, the registration experiment between the multi-spectral images was shown in the figure 2, which respectively gave the results of original algorithm and improved algorithm. From the picture, it can be seen that there were a lot of wrong matching points which had been labeled with red line in the original registration result. But, in the registration result of improved algorithm, matching points were accuracy and uniform. The comparison between the original and improved algorithm was shown in the Table1 in detail. From the comparison, it can be seen obviously that the improved algorithm proposed in this paper is advanced.



(a)The registration result conducted by origin SIFT algorithm



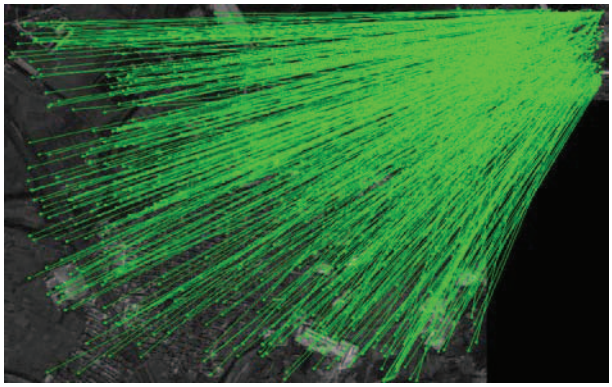
(b)The registration result using the new algorithm proposed IN this paper

Fig.2 The BJ-1 image registration result comparison between original and improved algorithm

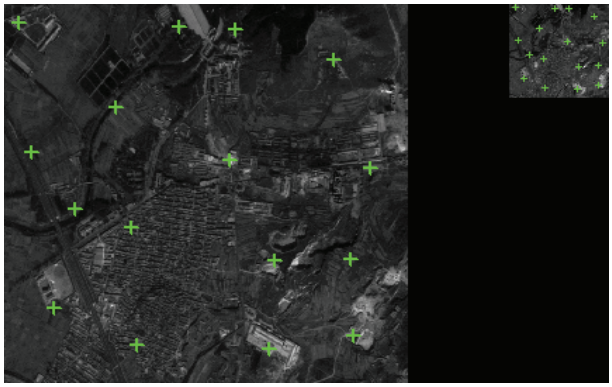
The second experiment was the registration between SPOT panchromatic image and SPOT multi-spectral image. Their space resolution is 4 times difference. The SPOT images registration result conducted by origin SIFT algorithm is shown in the Fig.3 (a). From Fig.3 (a), we can see that there are a lot of matching points extracted, but the mismatching points are also obvious. As the comparison, the registration result of new algorithm in this paper is shown in the Fig.3 (b), which realizes the uniform distribution of feature points and high matching accuracy. The detailed comparison result can be seen in the Table 1.

Table.1 The first experiment result comparison between origin algorithm and improved algorithm

Experiment	Algorithm	Matching points	Mismatching points	Accuracy Rate	Time complexity
The first experiment	Origin algorithm	268	124	54%	147s
	Improved algorithm	21	0	100%	52s
The second experiment	Origin algorithm	489	225	68%	103s
	Improved algorithm	16	0	100%	38s



(a) The registration result conducted by origin SIFT algorithm



(b)The registration result using the new algorithm proposed in this paper

Fig.3 The SPOT image registration result comparison between original and improved algorithm

4. CONCLUSIONS

This paper improves the primitive SIFT algorithm and works out a local adaptive SIFT (LA-SIFT) registration algorithm which can uniformly extract SIFT feature points and realize high precision registration. At the same time, LA-SIFT algorithm greatly reduced the time complexity, which has been proved in the experiments in this paper.

5. References

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