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RESEARCH ON SIFT IMAGE RECOGNITION ALGORITHM COMBINED WITH RANSAC

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Abstract: SIFT feature extraction algorithm has good invariance in illumination, scale transformation and affine transformation. Background information is far more than the target information in the image. In order to improve the matching efficiency of the SIFT algorithm, a scheme is proposed in this paper. By using the RANSAC algorithm to optimize the spatial extreme point detection method, the wrong matching point is eliminated and the matching efficiency of the algorithm is improved.

Keywords: SIFT Descriptor; scale invariant feature transform; RANSAC

1. INTRODUCTION

Image recognition should match the target, which requires the use of image matching and correction. This article from these two aspects to use SIFT feature matching algorithm[1] for image feature extraction, and then use the RANSAC algorithm to optimize the matching process.

2. SIFT ALGORITHM PRINCIPLE

SIFT algorithm needs key point detection and acquisition on the basis of scale space so as to ensure that the key points have the property of scale invariance[2]. Gaussian kernel convolution can be used to obtain the Gaussian scale space of the image, and the Gaussian difference scale space can be obtained by subtracting the image of the adjacent scale space.

In order to find out the extreme point of DoG function, every pixel in the image should be compared with all the adjacent points. The middle detection point should be compared with a total of 26 points which includes the same with the adjacent points in the 8 adjacent points and the upper and lower adjacent scales of the corresponding 9 × 2 points to ensure that extreme points are detected in both the scale space and the two-dimensional image space[3]. The above extremum points have instability points, and the position of the extremum points needs to be precisely located by the set of cubic quadratic functions. The Hessian matrix method is used to eliminate the unstable edge points.It is also to filter low contrast key points and improve Matching stability and noise immunity.

SIFT has the feature of rotation invariance. Through the gradient direction distribution features of the neighborhood pixels of the key points, the direction parameters are determined for each key point to determine the main direction.

$$\begin{cases} m(x,y) = \sqrt{(R(x+1,y) - R(x-1,y))^2 + (R(x,y+1) - R(x,y-1))^2} \\ \theta(x,y) = \tan^{-1} \dfrac{(R(x,y+1) - r(x,y-1))}{(R(x+1,y) - R(x-1,y))} \end{cases} \quad (1)$$

The maximum value in the histogram is the main direction of the image gradient in the neighborhood of this feature point, and takes the 80% of the dominant direction values in other directions as the auxiliary direction, which can improve the robustness of the algorithm.

The eigenvector is calculated in order to describe the features of the pixels within the neighborhood of the feature point more accurately. Take the feature point as the center to take the 8 × 8 window, the feature points in the center position; Each small cell represents a pixel, and then every 4 × 4 small blocks on the cumulative gradient, draw a gradient histogram of 8 directions,thatis a seed point. The dimension of each descriptor in Lowe's algorithm is 4 × 4 × 8 = 128 dimensions[4].

3. IMPROVE SIFT ALGORITHM TO IMPROVE MATCHING

There are many wrong matching points in the SIFT algorithm matching process, by RANSAC (random sampling consistency) algorithm to eliminate the wrong matching point, improve the accuracy. RANSAC algorithm in the image correction algorithm is more classic algorithm, which is characterized by high stability, good accuracy, andgood

screening capabilities for the error matching point. Specific steps are as follows:

(1) Add the initial optimal interior point number N_i is 0, randomly extract four sample data from the I data set[5](the four points can not be in a straight line), and calculate according to the four sample points Transform the matrix parameter H, the model is denoted as M;

(2) The remaining coordinate values from $(I-4)$ data points and the model M and the distance to be matched are calculated in turn. If the error is less than the threshold T, the point is added to the interior point set I, and if it is greater than the threshold, it is used as the exterior point.

(3) Compare the number of elements in the interior point set I, if N_i is greater than N_i, update the value of N_i and update the number k of iterations at the same time. The number of iterations k is constantly changing, and if not greater than the maximum number of iterations:

$$k = \frac{\log(1-p)}{\log(1-w^m)} \quad (2)$$

Where p is the confidence level, usually 0.995; w is the ratio of the interior points; m is the minimum sample required for the calculation model is4.

(4) After multiple iterative calculations, the model with the largest number of interior points and the smallest error function is selected, and the accuracy of the model obtained at this time is relatively high[6].

4. EXPERIMENTAL RESULTS AND ANALYSIS

The improved SIFT algorithm is compared with the original SIFT algorithm. Select the test image from the experimental database for feature matching experiments, the experimental results as shown below comparison of the results of two algorithms.

Figure a **Figure b**

Table 1. Experimental results

	Match logarithm	Matches the correct number of points	Correct rate
Original SIFT algorithm	25	22	88%
The proposed algorithm	20	19	95%

Table 2. Experimental results

Image size	Original SIFT algorithm		The proposed algorithm	
	Match logarithm	Correct rate	Match logarithm	Correct rate
480×320	80	88%	63	95%
800×480	216	90%	145	97%
1280×720	356	90%	286	97%

Firstly, the algorithm extracts the feature points from the original image, obtains 997 feature points by extracting the original image, and has 1522 feature points to be matched. It can be seen from the experimental results that the original SIFT algorithm detects 25 matched points after searching and matching, but there are more error matching. The proposed algorithm eliminates most of the error matching points and improves the matching accuracy.

In addition, in order to verify the improved accuracy of the SIFT algorithm in this paper has improved, respectively, the test image size of 480 × 320,800 × 480,1280 × 720, respectively SIFT algorithm and the proposed algorithm for comparison.

The results of Table 2 show that the improved algorithm accuracy rates are basically above 95%, reducing the number of mismatches to improve the accuracy, achieving a high accuracy.

5. CONCLUSIONS

In this paper, the image recognition method based on SIFT algorithm proposed improves the target object matching in the image by RANSAC algorithm. It can eliminate a large number of false matching points and improve the accuracy of target recognition. It is also has a good match for partially occluded target objects Degree, and suitable for the more complex image background.

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