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An Improved ORB Algorithm for Feature Extraction and Homogenization Algorithm

Qiancheng Bei, Haiying Liu*, Yuncheng Pei, Lixia Deng, Wenbin Gao
School of Electrical Engineering and Automation
Qilu University of Technology (Shandong Academy of Sciences)
Jinan, Shandong Province, 250353, China
980103061@qq. com

***Abstract*—After the original Oriented FAST and Rotated BRIEF (ORB) feature extraction algorithm performs feature extraction on the image, most of the feature points will appear in the area with richer texture, while the image area with less texture will produce fewer feature points. In addition, a large number of feature points will be gathered in a certain area of the image, resulting in redundant expression of the image. In view of the above defects, firstly, the candidate feature points are preliminarily screened by the adaptive threshold Features from Accelerated Segment Test (FAST) corner point extraction method, and then the quadtree method is used to further screen the feature points, so that the extracted feature points are evenly distributed in the image, eliminate the phenomenon of feature point aggregation. Experimental results show that the improved algorithm has high stability, and has a certain ability to adapt to image regions with weaker textures. Compared with other algorithms, the calculation time is much faster, and it can meet the real-time requirements.**

Introduction

In the field of computer vision, the feature points in the image contain important information of an image, which is an important way to describe the image[1]. The characteristic points in the image reflect the points with sharp changes in gray value or the points with extreme curvature on the edge curve of the image, which mainly include corner points, edges and blocks[2]. Feature extraction is the prerequisite for subsequent image matching and processing, so feature point extraction has a wide range of applications in visual SLAM, three-dimensional reconstruction, target recognition and other fields.

ORB algorithm

The ORB algorithm was proposed by Ethan Rublee et al. in 2011. The basic idea of the algorithm inherits the FAST algorithm, introduces the BRIEF descriptor to describe the feature points, and improves on the original basis, adds scale invariance and rotation invariance, increases the robustness of the algorithm. The ORB algorithm is characterized by its fast speed and is not affected by noise and image transformation to a certain extent.

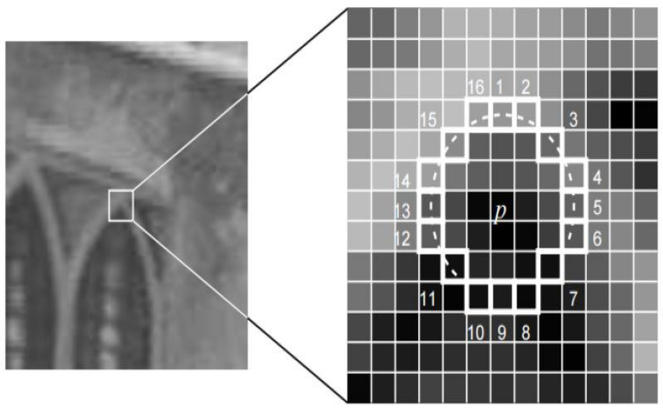

Fig.1FAST corner extraction diagram

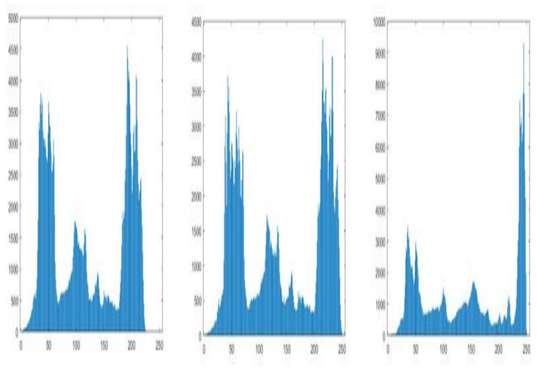

Fig.8Corresponding gray histogram

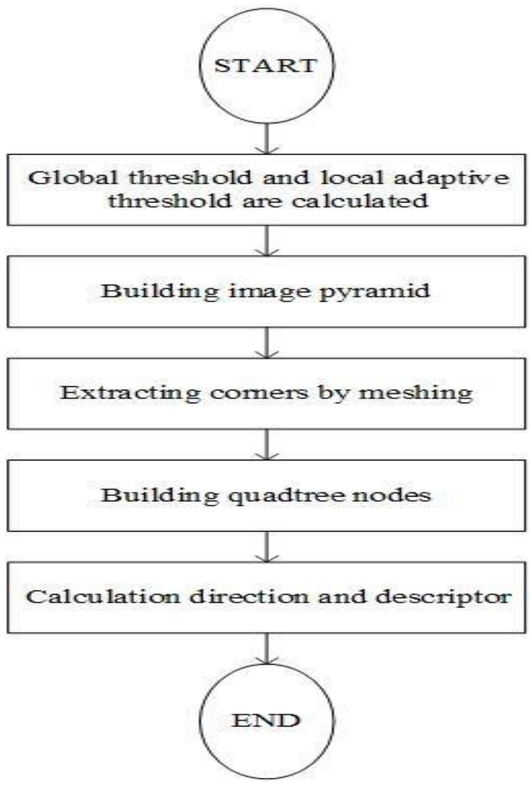

Fig.2 Improved algorithm flow chart

Fig.9Running results of SIFT algorithm under different contrast in the same scene

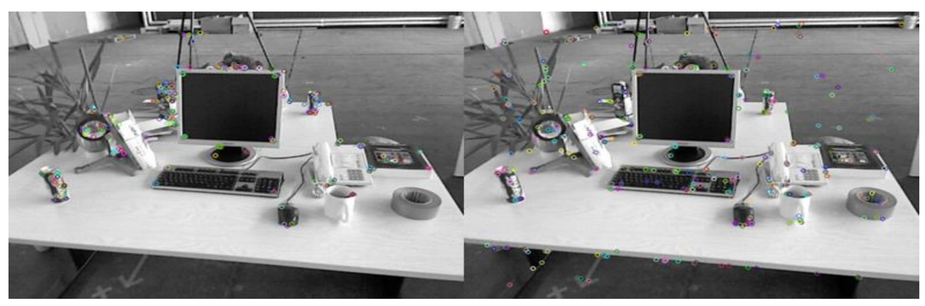

Fig.3 Comparison of the effects of ORB algorithm and optimized ORB algorithm in rich texture scenarios

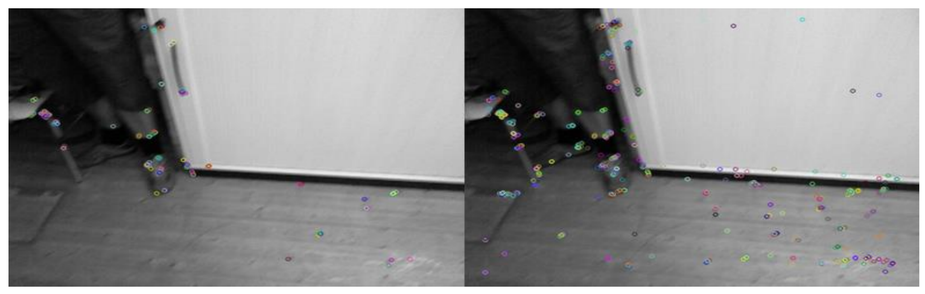

Fig.4 Comparison of the effects of the original ORB algorithm and the optimized ORB algorithm in the context of lack of texture

Fig.5 Running results of ORB algorithm under different contrast in the same scene

Fig.6 Running results of improved ORB algorithm under different contrast in the same scene

Fig.7 Experiment diagram

Conclusion

In this paper, the ORB feature extraction algorithm is improved by using global threshold, local adaptive threshold and homogenization of feature points. By comparing the feature extraction results of strong texture image and weak texture image before and after the improvement of ORB algorithm, it can be found that in the case of weak texture information, the improved ORB algorithm can extract 476 feature points (set to 500), which is better than the 136 feature points extracted by ORB algorithm. It shows that the improved algorithm has good adaptability to weak texture region. In addition, the experiment also compares the feature extraction results of different algorithms with different contrast in the same scene, and it is found that the extraction time of the improved ORB algorithm can reach less than 10ms, which is significantly better than other algorithms. Moreover, the average aggregation degree of the feature points extracted by the improved ORB algorithm is 10%, which is much lower than that of the previous improved algorithm. The feature points can be distributed evenly in the image region and overcome the problem that a large number of feature points gather together to express the same image region. In general, the improved algorithm has certain adaptability to the environment and can meet the requirements of real-time system. However, this algorithm still has some shortcomings, such as the lack of robustness to scale transformation, which is a problem we need to study and solve in the future.