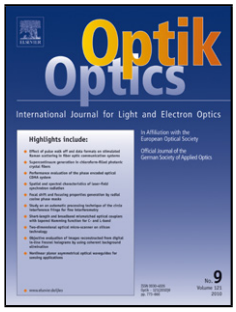

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Author: Qinghua Zeng Yunshu Wang Jianye Liu Sheng Liu

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A matching algorithm for large viewpoint changes images

Qinghua Zeng[1,2,3] Yunshu Wang[1,2] Jianye Liu[1,2] Sheng Liu [3]

1.Jiangsu Key Laboratory of Internet of Things and Control Technologies (NUAA), Nanjing, China, 210016

2. College of Automation, Nanjing University of Aeronautics and Astronautics (NUAA), Nanjing, China, 211106

3.AVIC Luoyang electro-optical equipment research institute, Henan, China, 471009.

Abstract: Images with large viewpoint variation are hard to match by traditional image matching methods. To overcome the disadvantages of traditional perspective invariant image matching method, a perspective scale invariant feature transform(PSIFT) method based on improved artificial bee colony(IABC) for large viewpoint is proposed in this paper, which called IABC-PSIFT. The viewpoint variation of camera is described by perspective transformation model. According to the characteristic of the perspective transformation model, the colony choosing equation and probability equation of artificial bee colony algorithm are improved to obtain the optimal simulate viewpoint efficiently. The parameters of the proposed method are ascertained through experimental analysis. The experiment of image with large viewpoint is compared by using traditional affine invariant methods and the proposed method respectively. The results show that the proposed method can obtain more matching points while maintaining the same accuracy to that of the other affine invariant methods. Moreover, the efficiency of proposed method is improved compared with ASIFT.

Key words: image matching; large viewpoint; perspective invariant; artificial bee colony.

1 Introduction

Image matching is a kind of technology, which is widely applied in target tracking [1], environment reconstruction [2] and visual navigation [3]. It is designed to establish corresponding relation for similar targets within two images. These two images are different from each other in size, rotation, translation, illumination and viewpoint. Therefore, invariant features in the two images should be extracted to realize image matching.

Point feature is the most common image feature. Previously, the feature points were mainly detected by comparing extreme values of gradient change in neighborhood. Harris [4], Forstner [5] and FAST [6] are the commonly algorithms. David Lowe from Columbia University proposed SIFT [7] algorithm to deal with size, rotation and translation invariances. It also has certain robustness with illumination and viewpoint change [8]. However, due to the poor affine invariant, the SIFT operator may reduce the performance greatly or even become invalid when two images have very large viewpoints [9].

Aiming at image matching problem under large viewpoint difference, Ancuti et al. [10] used kernel correspondences of keypoints to estimate the geometric transformation between regions of the images. Similarly, the second-order moment was used to transform the local stable regions to circular areas in [11], and the match propagation based on the seed pair associated with Perspective-invariant was proposed in [12]. These methods established surrounding regions of initial keypoints and estimated the transformation relation between the regions in two images. Different from above methods, Morel and Yu [13] proposed the ASIFT algorithm on the basis of improving matching performance of the SIFT operator by simulating viewpoint change of camera in different positions. Thereafter, many scholars made improvements on the ASIFT algorithm. Podbreznik and Potočnik [14] proposed a self-adaptive ASIFT-SH algorithm integrating image segmentation and local homograph matrix based on ASIFT, which can estimate relevance of building under different viewpoint, to improve accuracy of the estimated value. Ishii et al. [15] implemented a stereo object matching approach with high precision and strong robustness by integrating the phase-only correlation algorithm and adopting the ASIFT algorithm. Codreanu et al. [16] used a GPU to check quality of standard datasets, thereby to enhance the performance of the ASIFT algorithm.

One big problem for ASIFT application is its huge calculation amount. There are two methods to improve the efficiency of ASIFT. The first method is to use more efficient matching method, such as ASURF [17] and AFREAK [18]. But the robustness of these methods is not as good as ASIFT. Another method is to use more efficient stimulation strategy. In the traditional viewpoint simulation, discrete values are obtained through traversal method which means exhaustive image stimulation covering a whole 3D viewpoint space. The process of viewpoint simulation shows low efficiency, and is not the optimal one. Many scholars have made contributions to efficient methods. Liu et al. [19] reduced traverse times and matching times of viewpoint simulation with an orthogonal experimental method, but failed in