Chapter 3

A Texture Segmentation Algorithm and Its Application to Target Recognition

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ABSTRACT

Image segmentation is an important research direction in pattern recognition and image understanding, but existing texture segmentation algorithms cannot take full advantage of some texture information of texture image, such as the direction, width, density of ridge line, and so on, and can also not effectively carry out the segmentation of various texture image quality. In order to efficiently implement the texture image segmentation, strengthen the amassing of region segmentation, improve the accuracy of segmentation, achieve more accurate target recognition, this paper defines the direction of the texture, calculates the width of ridge line, gives the distance characteristics between textures, and establishes the mathematical model of the texture border, accordingly presents a new texture segmentation algorithm and compares with other texture segmentation algorithms. The simulation results show that the segmentation algorithm has some advantages to texture segmentation, such as has higher segmentation precision, faster segmentation speed, stronger anti-noise capability, less lost information of target, and so on. The segmented regions hardly contain other texture regions and background region. Moreover, this paper extracts the characteristic points and characteristic parameters in various segmented regions for texture image to obtain the characteristic vector, compares the characteristic vector with the standard template vectors, and identifies the type of target in a range of threshold value. Experimental results show that the proposed target recognition approach has higher recognition rate, faster recognition speed, and stronger anti-noise characteristics than the existing target recognition approaches.

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INTRODUCTION

In recent years, texture image segmentation is an important topic in the fields of computer vision, pattern recognition, and image processing (Wu et al. 2012). At present, it is widely used in many fields, such as fingerprint identification in the public security system, surgical image processing in medicine, textile testing and image retrieval. Therefore, the technology research in texture image segmentation is of important theoretical and practical significance.

At present, there were a lot of image texture segmentation algorithms. However, these algorithms all had some disadvantages. The histogram threshold value division algorithm did not need any prior information of image and had smaller calculation, but it did not take into account local spatial information, it is difficult to ensure the continuity of the divided region, also had lower reliability when a complex image was divided (Rachidi, Chappard et al., 2008). The basic ideas of region growing for image segmentation was to collect some pixels with similar attributes together to constitute a region, its segmentation effect relied on the seed selection and the growth order, its relative parameter selection was more difficult, and its calculation accuracy to noise was sensitive (Nikou, Galatsanos et al., 2007). The segmentation algorithm based on edge detection could achieve the borderline, but the edge outline was required a follow-up action in order to keep its continuum. It was difficult to determine the region at the not obvious border zone (Evans and Liu, 2006). The segmentation algorithm based on neural network had good results, but the category of its segmentation was too much, and its computational complexity was also larger (Ong, Yeo et al., 2002). The traditional Markov random field (MRF) (Long and Younan, 2013) had the better segmentation effect to micro-texture, but the segmentation result to macro-texture was not good because there were often a lot of islands or small areas, which was contrary to the result of subjective perception and effect of expectation.

In Fuzzy clustering segmentation algorithms, the fuzzy c-means (FCM) (Yu, 2011) clustering was most widely used, because it had some good characteristics, such as it accorded with human cognitive characteristics, its description was the simple and clear, it was easy to be implemented, and so on. But this algorithm also had some disadvantages, such as its performance depended on the initial clustering centers, anti-noise capacity was insufficient, its convergence speed was slow, etc. In 1973, Haralick (Haralick and Shanmugam, 1973) presented the famous GLCM. Soh and Tsataoulis presented an average algorithm by different scales and directions to reduce the computation of GLCM (Soh and Tsatsoulis, 1999). GLCM in texture analysis was a good way, widely used to translate the gray values into the texture information. Yu gave a texture extraction method of WGLCP, but its operation speed was slow (Yu et al., 2012).

From comprehensive analysis known, the existing texture segmentation algorithms could not reflect very well texture characteristic of texture image, could not make full use of texture direction information images of texture image, and could not very effectively carry out the segmentation of various texture image quality. It will not be able to effectively carry out the segmentation for texture image if the gray mean values and mean-square deviation of gray corresponding to the region are only considered. Therefore, other attributes need to be further in-depth studied in corresponding region, in order to obtain more desirable segmentation indexes. The effective region of texture image has good texture characteristic, but the background region as relatively smooth region does not have good texture characteristic. This paper takes fully into account some good texture characteristics of effective texture region which are the direction, width and distance of ridge line, etc. Moreover, based on the gray mean value and the mean-square deviation of gray, respectively, five different segmentation indexes are obtained to constitute a characteristic vector, then the characteristic vector is used to achieve the effective segmentation of...