SUB-CLASSIFICATION OF FARMLAND IN HIGH RESOLUTION RS IMAGES BASED ON TEXTURAL AND SPECTRAL FEATURES

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1. INTRODUCTION

As the development of the remote sensing (RS) technology, the spatial resolution of RS images has reached 0.6m or higher level. In addition to rich spectral information, the structural, figure and textural features appear more obvious in high resolution images. At the same time, it also brings new challenges in high resolution image processing[1]. In order to increase the accuracy and speed of image processing, it is necessary to integrate other useful information, such as structural, figure and textural information, in high resolution remote sensing image processing.

The key problem focused on how to extract useful information automatically and efficiently from high resolution remote sensing images. In order to increase the classification accuracy, the texture analysis and other methods had been applied to the remote sensing image classification for several decades [2]. However, the past algorithms were mainly dealt with the low and middle resolution RS images. Now, an obvious improvement had been gotten in the field of high spatial resolution RS image processing.

In order to classify high resolution RS images efficiently, a new method is proposed to build class hierarchy by multi-resolution segmentation [3]. The classification is divided to two steps. Firstly, the father classes including forest land, farmland, buildings, water system and road are obtained by initial segmentation. Furthermore, the sub-classification is carried out using different methods respectively. In this paper, a sub-classification algorithm of farmland is proposed to classify the farmland to several sub-classes according to the application. It integrated textural and spectral features together to increase classification accuracy. The two kinds of features are extracted from high resolution RS images to form a eigenvector, which is used to get an initial segmentation of the images. And then, the edges of different classes are adjusted by means of the spectral features of the edge pixels.

2. THE TEXTURE ANALYSIS ALGORITHMS

In this part,, the texture analysis algorithms in image classification are studied [4]. The different resolution images are processed by different level texture features. The results are compared to find more suitable algorithm and parameters. Although many texture features can be defined according to gray level co-occurrence matrix, five of them are chosen by experiments to use in image segmentation. They are energy f1, entropy f2, contrast f3, homogeneity f4 and covariance f5. Thus, eigenvector of each block is established as $\left(w_1 f_1, w_2 f_2, w_3 f_3, w_4 f_4, w_5 f_5, w_g g\right)$. Where, wi is the weight of corresponding fi while wg is the weight of the mean gray g of this block. After that, a BP neural network is built to adjust the weights by choosing the training area. The criterion of adjustment is to maximize the distances among the sub-classes center.

Moreover, the sub-classification algorithm is given based on the set of eigenvectors. It is divided into two steps. At the first step, the initial segmentation image will be gotten by the following process. First of all, the original image is divided into many sub-blocks with size of M×M. Texture feature of every sub-block is calculated [5]. And then, a feasible clustering algorithm is chosen to classify them to certain amount classes. And different classes are marked by different gray levels. Edges between different areas in initial segmentation image are ladderlike. In order to get smooth and rational edge, it is necessary to perform the following edge fining algorithm. The algorithm, initial value and parameters of clustering should be confirmed in this step. At the second step, a feasible edge fining algorithm is proposed to deal with the initial segmentation image. At first, the boundary sub-blocks are distinguished by their classes and locations. Then, each boundary sub-block images are subdivided into four lower sub-blocks with size of (M/2)× (M/2). Texture and spectral feature of this level sub-block images are calculated. Finally, the distances of this level sub-block image to its adjacent classes are calculated. It will be marked as corresponding class according to distances. Actually, boundary sub-blocks should be altered to their neighbouring classes, which assured the integrality of the area of the segmentation. If the result is not satisfied a certain condition, the second step will repeat and the spectral feature will gradually become the primary factor to reclassify the edge pixels.

3. EXPERIMENTS AND RESULTS

Finally, a high spatial resolution RS image is given as the original image. The initial segmentation and the final classification images are given and compared as Fig. 1. It is better The result shows that it has a higher classification accuracy than the methods using only spectral or texture information.

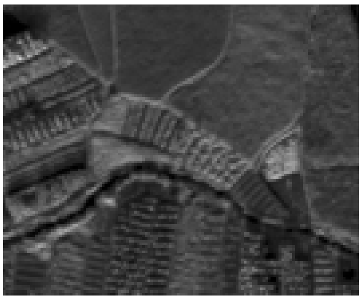

Fig. 1 The classification result

4. REFERENCES

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