PIXEL BASED CLASSIFICATION ON COLOR IMAGES IN STATISTICAL TEXTURE ANALYSIS

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***Abstract*-When using statistical approach in texture analysis for image classification, more problems are to be met. Particularly gray level co-occurrence matrices approach is applied in discriminating different textures in images results better accuracy but with the high computational cost. In addition a single window classification for each pixel compromises the classification accuracy rate. This paper concentrates on image classification implementation by using a statistical method in pixel by pixel with maximum likelihood estimates. The experiments have been tested with the color images and results shows that the improvement in classification rates achieved, when compared to a single window classification.**

Keywords: Texture analysis, Classification, Co-occurrence matrices

1. INTRODUCTION

Texture classification and segmentation is an important research area from industrial to bio-medical images. Previously a number of different texture analysis methods have been introduced namely statistical, structural, transform based and model based methods [2,3,7] Normally textures are studied through statistical and syntactical methods. The statistical method measures the coarseness and the directionality of textures in terms of averages on a window of the image [5, 6, 8]. On the other hand syntactical method describes the shape and distribution of the entities. The statistical method has the main features which are to be extracted that includes the autocorrelation function, power spectra, difference gray level statistics, co-occurrence matrices and from sum and different statistics [9, 10, 11].

The main objective of this paper is to classify the images on a pixel basis, where each pixel is associated with textural features extracted from co-occurrence matrices that differs the pixel itself. Here the windows related with the adjacent pixels are mostly overlapping resulting the pixels can be obtained by updating values already found. On the other hand a new method is to be introduced to classify color images based on the study of statistics of the color components.

2. PREVIOUS WORKS

This section illustrates the co-occurrences matrices approach which was used already by different authors for the purpose of classification of images. Previously many authors have discussed on the image classification in statistical texture analysis based on pixel and on color images. F. Argenti et al (1990) proposed a fast algorithm for texture analysis using co-occurrence matrices to improve the classification accuracy. Begona Acha et al (2000) presented a method to classify color images in to different groups based on texture and color images. Volker metzler (2000) described a novel method to improve classification accuracy of the common co-occurrence matrix approach on standard textures significantly. Bradley et al (1995) combine co-occurrence matrices and the scale space approach for texture analysis by regarding the distance d as scale parameter σ. Randen et al (1999) compared filtering approaches with co-occurrence matrices and found some filters performing superior for selected textures. But no

authors so far proposed a method for classifying color images based on pixel to pixel using co-occurrences matrices. So this paper aims at achieving a better classification accuracy on color images which is based on statistical method.

3. PROPOSED PIXEL BASED IMAGE CLASSIFICATION ON COLOR IMAGES

Any image that comprises small entities or cells, whose shape, dimensions and spatial distribution distinguishes different texture classes. To classify the texture, those entities sizes are to be compared to pixel resolution. In order to find the spatial relationships effectively, the classification method is used and Grey-level co-occurrence matrix (GLCM) is one of the most widely used statistical texture measures. The idea of the method is to consider the relative frequencies for which two neighboring pixels are separated by a distance on the image. Since the GLCM collects information about pixel pairs instead of single pixels and which is called by a name as second-order statistics. Texture measures, such as homogeneity, contrast, and entropy are derived from the co-occurrence matrix. The different sets of color images of vistex dataset have been tested for the classifications. For color texture characterization, the essential statistical parameters are Kurtosis and skewness, normalized moments of third and fourth order respectively.

The color image is represented by three co-0rdinates: the luminance (L) and the two chrominances C1 and C2. To characterize the images by the centroid vector of the two chrominances (C1, C2), each one represents a pixel. The proposed algorithm for the classification of color images using co-occurrences matrices approach is explained as follows.

Algorithm

Step1

The first window W(x, y) relates to the pixel (k, l) of f(x, y) is fixed.

Step2

The neighboring windoẃ'(x, y) that relates to (k+1,l) is fixed.

Step 3

Pixels separated by δ in the neighboring window W(x ,y) and Ẃ'(x, y).

Step 4

Co-occurrence matrix $\acute{M}_{s^1}(x, y)$ relates to Ẃ'(x, y) is got by updating the matrix relative to W(x, y).

Step 5

Decrementing by one entries $\acute{M}_{\delta}(x, y)$ due to the pairs of the left hand columns and incrementing in the right hand column yields $\acute{M}_{s^1}(x, y)$.

Step 6

The parameters extracted from co-occurrence matrices relates to Ẃ'(x, y) is calculated by updating the adjacent pixel (k, l).

Step 7Co-occurrences parameters are to be found where the mean and standard deviation of row sums of matrix and are analogous statistics of the column sums.

The flow chart for the above algorithm has been illustrated in Figure 1.

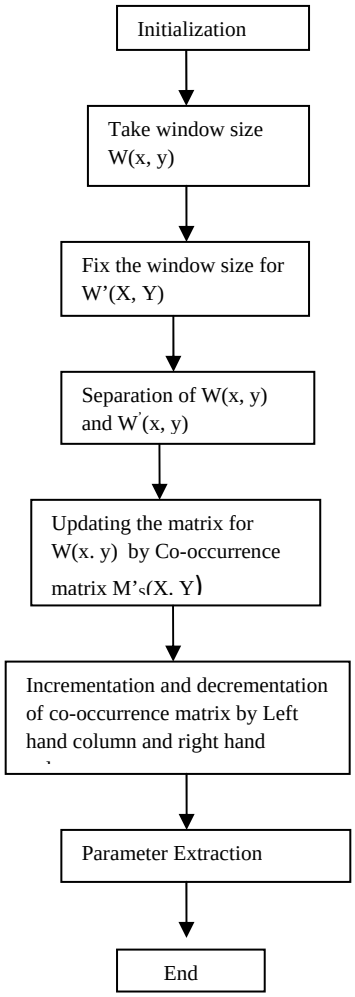

Figure 1: co-occurrence matrices for parameter extraction

4 .EXPERIMENTAL RESULTS AND OUTPUT

30 color images have been obtained from vistex dataset and the two statistical parameters kurtosis and skewness are taken for the classification purpose. The sample image from vistex (brick) is shown in Figure 2. The co-occurrence matrices parameters are extracted by the proposed algorithm and the experimental results are compared with the existing work[13] shown in the Table 1.Three different window sizes have been taken for the experimental purpose and it is confirmed that there is a clear difference in the classification accuracy.

Figure 2 : Sample Brick image from Vistex data base

The classification accuracy of the proposed algorithm (PBCM) have been calculated after extracting the co-occurrences parameters and it is found that by applying pixel to pixel approach there is a better classification accuracy which is shown in Figure 3. and Figure 4

Table 1: Comparison of proposed algorithm and the existing one.

Different classification methods	Different window size		
	Classification Accuracy (%)		
	8×8	16×16	64×64
Existing Methods	83	85	87
Pixel Based Co-occurrence Method(PBCM)	86	88	90

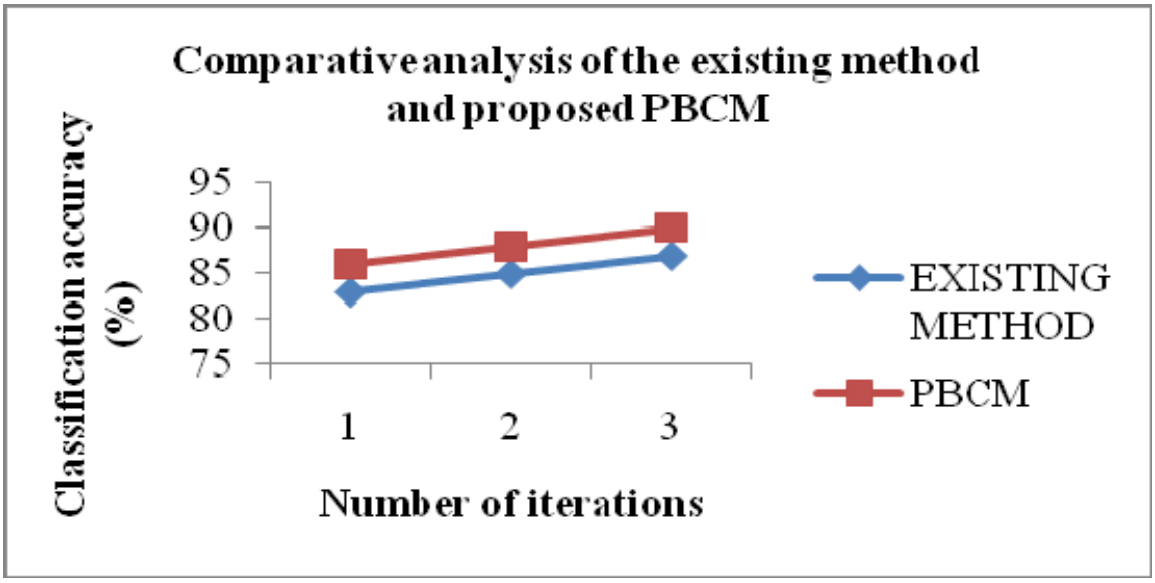

Figure 4 Classification accuracy Versus number of iterations

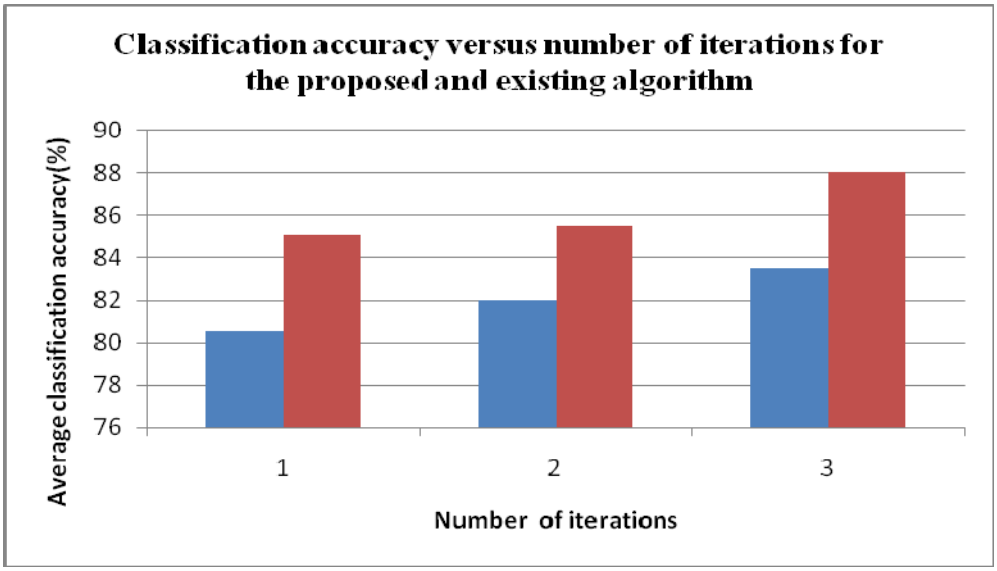

Figure 3: Classification accuracy of the existing method and the proposed method

5. CONCLUSION

The proposed algorithm based on pixel classification on color images has been implemented and applied. The features on color images are extracted by means of GLCM statistical method though the concept of overlapping window for neighboring pixels. The experiments were undergone for different window sizes and the proposed method also is compared the existing method and it is concluded that the classification accuracy of the color images have been so attractive. Here the tests were conducted for the color images and in the future work the overlapping concept can be applied for the other supervised and unsupervised methods. The results of the proposed algorithm may be very useful in medical image applications, where more accuracy in terms of classification is required.

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