ISSN 1746-7659, England, UK
Journal of Information and Computing Science
Vol. 10, No. 1, 2015, *pp*. 063-074

Texture Classification based on Fuzzy Based Texton Co-occurrence Matrix

Rasigiri Venkata Lakshmi [1], E. Srinivasa Reddy [2] and K. Chandra Sekharaiah [3]
[1] Research Scholar, Dept. of CSE, University college of Engg, .JNTUK, Kakinada, India – 533003
[2] Principal, University College of Eng & Technology,ANU, Guntur, 522510, India
[3] Professor, JNTU SIT, Hyderabad, 500 085, India
rasigiri.venkatalakshmi@gmail.com, edara_67@yahoo.com, chandrasekharaiahk@gmail.com
(*Received October 29, 2014, accepted December 25, 2014*)

Abstract. The Applications of Pattern recognition like wood classification, stone and rock classification problems, the major usage techniques ate different texture classification techniques. Generally most of the problems used statistical approach for texture analysis and texture classification. Gray Level Co-occurrence Matrices (GLCM) approach is particularly applied in texture analysis and texture classification. The GLCM gives better results with accuracy but its take much time for computation. The texture analysis methods mainly depends upon how the particular texture features characterizes texture image. The accuracy of a particular texture analysis method depends what type of features are extracted from a texture image for classification, whether these features correctly classifies the textures or not. The accuracy of texture analysis method depends not only the texture features are important but also the way in which texture features are applied is also an important and significant for a critical, particular and perfect texture classification and analysis. The present paper derived a new texture analysis method i.e. co-occurrence matrix based on fuzzy rules and water shed texton patterns. The present paper applies fuzzy rules on Original texture image based on water shed texton patterns and generates Co-occurrence matrices derived a new matrix called Fuzzy based Texton Co-occurrence Matrices (FbTCoM) for texture classification. The present paper integrates the advantages of co-occurrence matrix and texton image by representing the attribute of co-occurrence matrix using water shed texton pattern based on fuzzy rule. The co-occurrence features extracted from the FbTCoM provides complete texture information about a Texture image. The proposed method is experimented on Vistex, Brodatz textures, CUReT, MAYAGAN, PBOURKE, and Google color texture images. The experimental results indicate the proposed method classification performance is superior to that of many existing methods.

Keywords: Co-occurrence Matrix, Texton, Fuzzy rule, Texture Classification

1. Introduction

Texture classification and segmentation is an important research area from industrial to bio-medical images. Basically the classification problem is identifying pragmatic texture sample from one of the several possible texture classes reliably with low computational cost for texture classification. This property implies that the choice of the textural features should be as compressed as potential and yet as sharp as potential. In other words, the texture features should give efficient complete information about the textural characteristics of the texture image. The ultimate goal of texture characterization systems is to recognize different textures. For texture classification effective algorithm is essential to discover a set of texture features with good discriminating power is needed for designing a method. Previously a number of different texture analysis methods have been introduced namely statistical, structural, transform based and model based methods [1, 2, 3] 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 [4, 5, 6]. 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, Fourier transform texture analysis methods, Hidden Markov random field models for classification, local linear transformation methods, power spectra, difference gray level statistics, co-occurrence matrices and from sum and different statistics [7, 8, 9, 10, 11, 12, 13].

Initially, first order or second order statistics of textures was used for texture analysis. Haralick [6]. Weszka [14] were proposed the co-occurence matrix features for texture analysis. They were compared texture feature extraction methods based on the Fourier power spectrum, second order pixel value statistics,

the co-occurrence matrices statistics and pixel value run length statistics. The co-occurrence features based methods were give good results when compare with the other existing feature extraction methods. This fact is confirmed in a study by Conners and Harlow [15]. In [16], Haralick features are obtained from wavelet decomposed image yielding improved classification rates.

S.S Sreeja Mole [17] in this method classifies the textures 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 and the classification rate in this method is about 90%. Jing Yi Tou [18] uses both the Grey-level Co-occurrence Matrices (GLCM) and Gabor filters are for texture classification and they it becomes popular. By using this method *achieved a recognition rate of 88.52%.* Guang-Hai Liu [19] this method uses the combination of two popular techniques for texture classification; those are the Grey-level Co-occurrence Matrices (GLCM) and Textons. The preset method uses the combination of three popular methods like the Grey-level Co-occurrence Matrices (GLCM), Fuzzy rules and Textons for texture classification. This method can achieve higher classification rate compare to existing methods. The present paper derived a new co-occurrence matrix based on fuzzy based textons for texture classification. The new co-occurrence matrix is called as Fuzzy Based Texton Co-occurrence Matrix (FbTCoM)

This paper is organized as follows. In Section 2 describes the generation of FbTCoM and extraction of it's texture features. Section 3 discusses results and discussions. Conclusions are given in Section 4.

2. Generation of Fuzzy based Texton Co-occurrence Matrix (FbTCoM) and Features

Many researchers have proposed so many algorithms for extracting color, texture and other features of an image texture. Color is one of the most important and central visual characteristic. Due to this reason color histogram techniques were become popular in nature which is specified the literature. The main drawback of color histogram technique is, it does not provide any information about spatial. Significant and large quantity of texture and shape information is provided by texture patterns. One of the patterns proposed by motifs [20] represents the image which is useful for texture analysis and classification. The proposed FbTCoM method consists of three steps which are listed below. In the first step of the proposed FbTCoM method is, if the texture image the color then the texture image is converted in to grey level image by using any HSV color model. The following section describes the RGB to HSV conversion procedure.

2. 1. RGB to HSV color model conversion

Recent literature revel various color models in color image processing. In order to extract facial image features from color image information, the proposed method utilized the HSV color space. In the RGB model, images are represented by three components, one for each primary color – red, green and blue. Hue is a color attribute and represents a dominant color. Saturation is an expression of the relative purity or the degree to which a pure color is diluted by white light. HSV color space describes more accurately the perceptual color relationship than RGB color space because it is adopted with a non-linear transform. The present paper has used HSV color space model conversion, because the present study is aimed to classify the human age in to four groups with a gap of 15 years.

HSV color space is created by Hue (H), saturation (S) and value (V). Hue is the property of color such as red, green and blue. Saturation is the intensity of a specific color. Value is brightness of a specific color. However, HSV color space separates the color into three categories i.e. hue, saturation, and value. Separation means variations of color are observed individually.

The transformation equations for RGB to HSV color model conversion is given below.

$$V = \max(R, G, B) \tag{1}$$

$$S = \frac{V - \min(R,G,B)}{V} \tag{2}$$

$$H = \frac{G - B}{6S} \quad if \quad V = R \tag{3}$$

$$H = \frac{1}{3} + \frac{B - R}{6S} \quad if \quad V = G \tag{4}$$