ABSTRACT

Texture classification problem consists of different determining textures present in an image given as a set of texture patterns of interest. Many texture classification problems usually require the computation of a large amount of texture features in order to characterize their associated patterns. This implies that texture classifiers frequently combine big sets of features without taking into account their relevance and redundancy. Thus, lowering the dimensionality of a feature set is necessary for preserving the most relevant features and reducing the computational cost derived from unnecessary features that do not contribute to increase the quality of the available information for each class.

One of the most popular methods used to measure the textural information of images is, the *'Gray Level Co-occurrence Matrix'* (GLCM), that describes images by statistically sampling how certain grey levels occur in relation to other grey levels. The GLCM approach has become the benchmark for the image classification standards. The major draw back of GLCM approach is its high dimensionality that is why it is not suitable to many real time and data mining applications. To address this present thesis proposed novel preaches based on *'Texture unit'* (TU) and *'Local binary Pattern'* (LBP).

One of the other most popular statistical methods used to measure the textural information of images is the *'Texture Unit'* (TU) approach, which gives reasonable information of a 3×3 neighborhood

i.e., in all eighty directions, for image analysis. The TU efficiently characterizes local texture information for a given pixel of an image and its neighborhood. But a major inconvenience of this descriptor is the large range of its possible values (i.e., 6561) and at the same time these values are not correlated.

To address the above problems the present thesis combined the features of *Texture Unit Matrix* and GLCM and derived a new matrices called CSFTU-CM (*Centre Symmetric Fuzzy Texture Unit – Co-occurence Matrix)* and *'Average Fuzzy Left and Right Texture Unit'* (AFLRTU) CM for efficient texture classification. The proposed CSFTU-CM and AFLRTU -CM reduces the size of the TU matrix from 6561 to 67 in the case of original texture spectrum and 2020 to 67 in the case of *'Fuzzy Texture Spectrum'* (FTS) approach. Thus, it reduces the overall complexity.

The *'Local Binary Pattern'* (LBP) operator has been proved to be a theoretically simple yet very effective statistical texture descriptor in terms of the characteristics of the local structure. A LBP can generate 256 (0 to 255) different patterns. These patterns are grouped in to 59 uniform and 197 non uniform LBP patterns. Many researchers have considered only ULBP patterns for texture classifications due to their small numbers and claiming that most of the textures are dominated by only uniform LBP's. But after a careful, critical and significant study on the existing literature, the present study found that ULBP have some shortcomings: they discard some important texture information, suffer much from non-monotonic illumination variation and do not

describe the stochastic characteristics of texture efficiently and also sensitive to noise. To overcome this, the present thesis defined *'Semi Uniform LBP'* (SULBP). To overcome the noise effect on LBP the present study derived *'Local Directional Pattern'* (LDP) instead of LBP using Kirsch mask. The proposed study derived *'Semi Uniform patterns on LDP'* (SULDP). The derived SULDP is an efficient image classification and analysis, which will have a significant role in image mining. The novelty of the proposed method is, the Haralick features are applied on the derived SULDP-CM, which has shown excellent classification results by reducing the overall dimension of the derived matrix dimension, thus reducing the overall complexity. The concept of LBP is further extended in the present chapter, by deriving a run length matrix on LBP using fuzzy principles. So far no researcher has attempted to build fuzzy based run length matrix on LBP. That's why the proposed *'Run Length Matrix on Fuzzy LBP'* (RLM-FLBP) is an innovative idea and it overcomes the disadvantages of the previous run length methods of texture classification that exist in the literature.