PREFACE

Texture emerged as a powerful visual primitive to succinctly describe image content. Texture analysis and characterization was widely studied over the last three decades in a variety of applications, including medical imaging, age classification, facial expression recognition, face recognition, remote sensing, pattern recognition, industrial inspection and texture based image retrieval. One of the fundamental problems of Computer Vision, Image Processing and Pattern Recognition is how to describe and represent a shape. Good shape representation and description schemes are of paramount importance in developing efficient image compression, image classification, recognition, analysis, data retrieval, content based video processing, shape matching, object recognition algorithms. A good shape representation should provide an accurate and complete description of the given shape. From the above it is clear that texture and shape are important characteristics for the analysis of many types of images. That's why the research on texture and extraction methods of shape features has received considerable attention in recent years.

The present thesis is organized into seven chapters. The first chapter deals with introduction texture in classification problems, literature survey, objectives of the present study, input stone textures and facial images that are considered for classification purpose.

The structural approaches play an important role in classification, analysis and segmentation issues. The main aim of texture classification is to find a best matched category for a given texture among the existing textures. In order to accomplish this, one needs to have a prior knowledge of the classes to be recognized. The following aspects should be considered in developing texture classification algorithms based on texture primitives.

1. Illumination (gray scale) invariance: deals with how much sensitive the algorithm is to the changes in gray scale. This is particularly important in industrial machine vision where the lighting conditions may be unstable.
2. Rotation invariance: deals with whether the algorithm copes, if the rotation of the images changes with respect to the viewpoint.
3. Robustness with respect to noise: deals with how well the algorithm tolerates noise in the input images.
4. Generality: considers whether the algorithm can facilitate texture synthesis, i.e. regenerating the texture that was captured using the algorithm.
5. Window/Sample size: considers how large the size of sample the algorithm requires for being able to produce a useful description of the texture content.

Aiming the above and importance of shape features in classification problems the present thesis derived various methods for age classification, stone texture classification and face recognition issues.

The second chapter integrated the structural approaches LBP and textons by considering their advantages and close association with shape features. The second chapter derived texton based LBP to preserve local features at a high rate and evaluated complex shape features on them for an efficient age classification.

Texture orientation plays an important role in rotation invariant classification. To achieve this in the third chapter Texture orientation matrix (TOM) is formed by deriving bitwise OR operator on Sobel and Canny edge detectors with an orientation of ten degrees at each step. Then Fuzzy logic is applied to reduce the grey level range and based on this textons are identified. On the identified textons, texture shape features are evaluated for an efficient stone texture classification.

One of the crucial problems in image processing is that most of the times the researchers evaluated various methods for analysis, classification and recognition on entire image. This leads to lot of complexity. To address this the fourth chapter derived a model that reduces the 5 x 5 image sub matrix in to a 2 x 2 sub matrix by using shape primitives and evaluated the LBP pasterns. A fuzzy logic is also applied to reduce the grey level range while preserving the significant

attributes of the texture. This makes the proposed model suitable to GLCM. The proposed scheme is evaluated for face recognition.

The fifth chapter derived Texture Shape Features (TSF) on the reduced model of the image for an effective age classification that classifies the age into five different groups i.e. 0 to 12, 13 to 25, 26 to 45, 46 to 60 and above 60. Since bone structural changes do not occur after the person is fully grown i.e. the geometric relationships of primary features do not vary. Therefore secondary shape features are identified and explored in this chapter for an efficient age classification.

The sixth chapter of the present thesis introduced the concept of morphology. Mathematical Morphology provides an efficient framework for analyzing object shape characteristics (such as size and connectivity) due to its geometry-oriented nature which are not easily accessed by linear approaches. This chapter derived Shape Primitives (SP) based on texton with Local Directional Pattern (LDP). The proposed research used Integrated Logical Compact LDP with OR operation on textons. The local descriptor LDP is more consistent in the presence of noise and illumination changes, since edge response magnitude is more stable than pixel intensity. The proposed rotational invariant technique is applied on stone texture classification.

Each method is experimented with a huge database. The results are compared with the existing methods. In almost all cases the proposed methods yielded a significant and efficient result than existing methods.

At the end of each chapter a brief summary is given, indicating the key advantages and outcome of each of the proposed methods. In the seventh chapter overall summary and future scope is given.