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Non Binary Local Gradient Contours for Face Recognition

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As the features from the traditional Local Binary Patterns (LBP) and Local Directional Patterns (LDP) are found to be ineffective for face recognition, we have proposed a new approach derived on the basis of Information sets whereby the loss of information that occurs during the binarization is eliminated. The information sets expand the scope of fuzzy sets by connecting the attribute and the corresponding membership function value as a product. Since face is having smooth texture in a limited area, the extracted features must be highly discernible. To limit the number of features, we consider only the non overlapping windows. By the application of the information set theory we can reduce the number of feature of an image. The derived features are shown to work fairly well over eigenface, fisherface and LBP methods.

Keywords: Face Recognition, Gradient Contour, Information Sets, KNN, Local Binary Pattern, Local Directional Pattern, Support Vector Machine.

1. INTRODUCTION

In face recognition, the major issue to be addressed is the extraction of features which are discriminating in nature [1], [2]. The accuracy of classification depends upon which texture feature of the face are extracted e.g., geometrical, statistical, local or global features in addition to representation of these features and the design of corresponding classifier. Normally, the feature extraction algorithm should produce little variance of features within the class and large variance between the classes. There are typically two common approaches to extract facial features: geometric-feature-based and appearance-based methods. The geometric-feature-based [[3], [4]] method encodes the shape and locations of different facial components, which are combined into a feature vector that represents the face. An illustration of this method is the graph-based method [5], that uses several facial components to create a representation of the face and process it.

The Local-Global Graph algorithm [5] approach makes use Voronoi tessellation and Delaunay graphs to segment local features and builds a graph. These features are combined into a local graph, and then the skeleton (global graph) is created by interrelating the local graphs to represent the topology of the face. The major requirements of geometric-feature-based methods is accurate and reliable facial feature detection and tracking, which is difficult to accommodate in many situations. In the case of appearance based methods, there are many methods for the holistic classes such as, Eigenfaces [6] and Fisherfaces [7], which are built on Principal Component Analysis (PCA) [6], to the more recent 2D-PCA [8], and Linear Discriminant Analysis [9] are also examples of holistic methods. The [10] and [11] makes use of image filters, either on the whole face to create holistic features, or some specific face-region to create local features, to extract the appearance changes in the face image.

The proposed approach is found to be effective on images having variation in expression, illumination and pose. The experiments are reported on ORL, Sheffield and Yale face database. The new features are the result of better representation of the uncertainty in the local area like a window, which preserves the information of complete window. The experiments reveal that, better the representation of an uncertainty, better will be the recognition rates.

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