A novel approach for pre-processing of face detection system based on HSV color space and IWPT

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***Abstract*— Face detection system is challenging area of research in the field of security surveillance. Preprocessing of facial image data is very important part of face detection system. Now days various method of facial image data preprocessing are available, but all these method are not up to mark. Now we have a novel approach for preprocessing of face detection system based on HSV color space and integer wavelet packet transform method. And finally in this paper we have used LBP (local binary pattern) and SVM classification process are used.**

Keywords- facial image, HSV color space, IWPT, SVM.

I. Introduction

In today's world human face detection is a prelude required step of face recognition systems as well as very important process in security based applications. Human often uses faces to recognize persons and advancement in computing capability over the past few decades. The development of face detection system is quite essential in a variety of application such as robotics, security system, and intelligent human-computer interfaces, etc. A number of face detection methods such as those using Eigen-faces [1] and neural network [2], have been developed. In these methods however a large amount of computation is required, making the processing extremely time consuming. Initial step of any processing of face is detecting the location in images where faces are present. But face diction from a single image is difficult because of variability in scale, locations, pose, and color.

There are many methods for the detection of face; color is an important feature of human face. Using skin color as feature for extracting a face increases the detection rate. Face recognition can be used for both verification and identification. Verification is done by comparing the two images. If the two images got matched means the input image is verified. Identification is done by comparing the input image with more than one image and finding the closest match of that input image. The method presented in this paper consists of three steps- skin reorganization, face reorganization and face recognition. The innovation of the proposed method is using skin reorganization filter as a preprocessing step for face reorganization. Now in this paper we proposed new preprocessing technique using integer wavelet packet transform and HSV color space for better preprocessing of facial image data. Integer wavelet packet transform function is a special function of transform function from these function we decompose the facial image data without loss of information. And approach of this paper is HSV color space for better intensity of facial image instead of RGB model. The remainder of this paper is organized as follows. Section II briefly reviews the literature. A new approach for preprocessing of facial image data is explained in Sect. III. Finally, section IV presents conclusions and future scope

II. Literature Review

By Mayank Vatsa, Richa Singh [1] proposed method for facial image preprocessing as Age Transformation using Mutual Information Registration the face images are pre-processed and quality of the image is normalized, we minimize the age difference between gallery and probe face images. One way to address the challenge of facial aging is too regularly update the database with recent images or templates. However, this method is not feasible for applications such as border control and homeland security, missing persons and criminal investigations address this challenge, researchers have proposed several age simulation and modeling techniques. These technique model the facial growth that occurs over period of time to minimize the difference between probe and gallery images. Unlike, the conventional modeling approach, we proposed mutual information registration based age transformation algorithm to minimize the age difference between gallery and probe images. Mutual information is a concept from information theory in which statistical dependence is measured between two random variables [3, 4].

Researchers in medical imaging have used mutual information based registration algorithms to effectively fuse images from different modalities such as CT and MRI [3], [4]. We have used this algorithm because there may be variations in the quality of pre-processed scanned and digital face images, and the registration algorithm should contend with these variations. Age difference minimization using registration of gallery and probe face images is described as follows:

Let F_G and F_P be the detected and quality enhanced gallery and probe face images to be matched. Mutual information between two face images can be represented as,

$$M(F_G, F_P) = H(F_G) + H(F_P) - H(F_G, F_P) \quad (1)$$

Where, H (.) is the entropy of the image and H (F_G, F_P) is the joint entropy. Registering F_G with respect to F_P requires maximization of mutual information between F_G and F_P, thus maximizing the entropy H (F_G) and H (F_P), and minimizing the joint entropy H (F_G, F_P). Mutual information based registration algorithms are sensitive to changes that occur in the distributions as a result of difference in overlap regions. To address this issue, Hill et al. [3] proposed normalized mutual information that can be represented as,

$$N\,M\,(F_G\,,\,F_P) = \frac{H(F_G)+H(F_P)}{H(F_{G,}F_P)} \qquad (2)$$

The registration is performed on the transformation space, T, such that

$$T = \begin{pmatrix} a & b & 0 \\ c & d & 0 \\ e & f & 1 \end{pmatrix}$$

Where a, b, c, d are shear, scale, and rotation parameters, and e, f are the translation parameters. Using the normalized mutual information and exploring the search space, T, we define a search strategy to find the transformation parameters, T *.

$$T\,^* = \arg\max \{N\,M\,(F_{P,}\,T\,(F_G))\} \qquad (3)$$

Gallery and probe face images (F_G and F_P) are thus registered using the transformation T *. This registered algorithm is linear in nature. To accommodate nonlinear variations in faces, multi resolution image pyramid scheme is applied which starts with building the Gaussian pyramid of both the gallery and probe images. Registration parameters are estimated at the coarsest level and used to warp the face images in the next level of the pyramid. The process is iteratively repeated through each level of the pyramid and a final transformed gallery face image is obtained at the finest pyramid level.

In this manner, the global variations at the coarsest resolution level and local non-linear variations the finest resolution level are addressed. Once the age difference between the gallery and probe face image is minimized, face recognition algorithm can be efficiently applied to verify the identity of the probe image, By Hazym Kemal Ekenel, Hua GAO[3]proposed method for facial image preprocessing Discrete Cosine Transform-Based Local Appearance Model .

Local appearance face recognition is bases on statistical representations of the non- overlapping local facial regions and their combination at the feature level. The underlying idea is to utilize local information while preserving spatial relationships. In[5], the discrete cosine transform (DCT) is proposed to be used to represent the local regions. It has been shown to be a better representation method for modeling the local facial appearance compared to principal component analysis(PCA) and the discrete wavelet transform (DWT) in terms of face recognition performance. Feature extraction from depth images using local appearance-based face representation can be summarized as follows:

The input depth image is divided into blocks of 8x8 pixels size. Each block is then represented by its DCT coefficients. These DCT coefficients are ordered using the zigzag scanning pattern [6]. From the ordered coefficients, M of them is selected according to the feature selection strategy, resulting in an M-dimensional local feature vector. Finally, the DCT coefficients extracted from each block are concatenated to construct the overall feature vector of the corresponding depth image. In order to compare the introduced local DCT-based representation with the depth representation, we calculated the ratio of within class variance with each representation on a training set which has also been used for identification experiments.

We calculated the ratio of within class variance to between class variance for each representation unit and then averaged it over the representation units and the subjects. We obtained an average ratio of 0.5 with DCT-based local representation, and 0.67 with the depth representation. The lower ratio of within class variance to between class variance obtained by the proposed representation scheme indicates its better discrimination capability compared to the depth representation

III. A New Approach for Facial Image Preprocessing

In this section we have discuss the transform of facial image data and resolve the color of skin into HSV color space and local binary pattern method. First we have discuss integer wavelet packet transform function.

A. Integer Wavelet Packets Transform

In this section the wavelet transform and of the filter bank scheme are given, and the wavelet packets transform are introduced. The block scheme of the single level wavelet transform is shown in Fig.1.

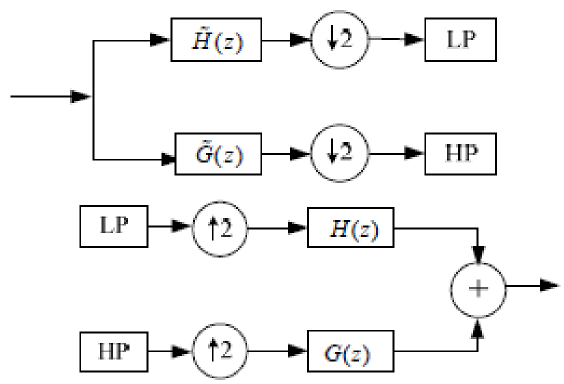

Fig. (1) One level transforms function

The low-pass analysis filters and the high-pass ones are followed by down sampling of a factor two. At the reconstruction side, the low-pass and band-pass branches are psampled and filtered with the synthesis filters $H(z)$ and $G(z)$ in order to obtain the original signal A wavelet transform on J levels is obtained by iterating the filter bank J-1 times on the low-pass branch. The wavelet transform coefficients consist of the J high-pass and the erminal low-pass node sequences output by the filter bank tree. Given a perfect reconstruction filter bank, the iterated scheme represents an either orthonormal or biorthogonal (non-redundant) representation of the original signal. Differently from the wavelet transform, the J-level WPT are achieved by iterating the one level filter bank on both the low-pass and the high-pass branch, and then applying a pruning algorithm to select a suitable representation. An algorithm has been proposed in [5], which selects the best representation of a sequence across the entire tree based on some proper cost function, which must measure the compactness of the representation.

B. HSV colour model

The HSV stands for the Hue, Saturation, and Value based on the artists (Tint, Shade, and Tone). The coordinates system in a hexacone is shown in Figure 1. (a) And Figure 1. (b) a view of the HSV color model. The Value represents intensity of a color, which is decoupled from the color information in the represented image. The hue and saturation components are intimately related to the way human eye perceives color resulting in image processing algorithms with physiological basis

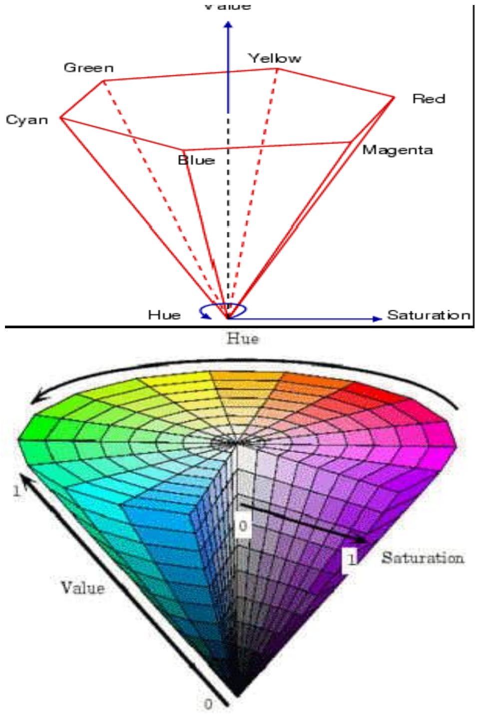

Fig. (2) HSV color model

C. SVM classifier

Support Vector Machines are based on the concept of decision planes that define decision boundaries. A decision plane is one that separates between a set of objects having different class memberships. A schematic example is shown in the illustration below. In this example, the objects belong either to class GREEN or RED.

The separating line defines a boundary on the right side of which all objects are GREEN and to the left of which all objects are RED. Any new object (white circle) falling to the right is labeled, i.e., classified, as GREEN (or classified as RED should it fall to the left of the separating line).

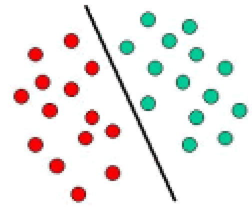

Fig. (3) Classification of data through SVM

The above is a classic example of a linear classifier, i.e., a classifier that separates a set of objects into their respective groups (GREEN and RED in this case) with a line. Most classification tasks, however, are not that simple, and often more complex structures are needed in order to make an optimal separation, i.e., correctly classify new objects (test cases) on the basis of the examples that are available (train cases). This situation is depicted in the illustration below. Compared to the previous schematic, it is clear that a full separation of the GREEN and RED objects would require a curve (which is more complex than a line.

Steps for processing of preprocessing of facial image data

(1) Processed scanned image of face into transform function.
(2) Apply integer wavelet packet transform function for decomposition of image on the basis of low and high frequency without loss of data.
(3) Built packet of image data.
(4) Apply HSV color model for better resolution for facial skin.
(5) Finally used SVM clasifer for classification of low data and high data
(6) Then apply LBP (local pattern method)

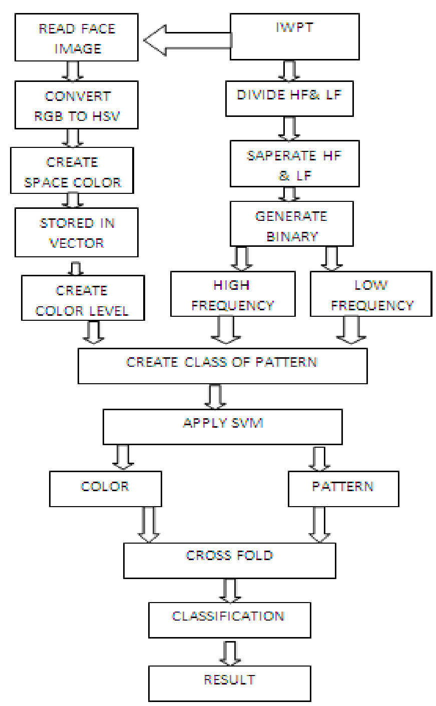

Fig.(4) Flow chart

IV. Conclusion and Future Scope

In this paper we discuss a combined pre-processing method for facial image data for better processing of raw data for training and detection of face. We have seen here by mathematics integer wavelet packet transform is a lossless decomposition technique and very efficient process for image transformation. Now in future we have implanted this approach and find some result and these results compare with standard methods

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