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Naiting of Ensemble of Texture Descriptors and Artificial Neural Network for Facial Recognition

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Abstract: In this Advanced Era, Digital Image Processing plays an invigorating role in our day to day life. Exploitation of Digital Image Processing systems for Real Time Applications indeed requires efficient computing techniques, the proposed system mainly focuses on Very Large Scale Integration (VLSI) chip based implementation of Digital Image Processing Applications, since it suits better for real time processing. Digital Image Processing has wide range of applications such as Security systems, Biometric Authentications, Medical Imaging, Digital Camera, Multimedia Management, Enhancement of CCTV images, Human Computer Interaction. Face detection and recognition is challenging due to wide variety of faces & complexity of noises & image backgrounds. With the aim of maximizing the Face Recognition Rate, has been designed (i) Ensemble Pattern of Pre-processing Technique and (ii) Artificial Neural Network. For Face Recognition, it makes use of two datasets, the Face Recognition Dataset (FERET) & Labelled Faces in the Wild Dataset (LFW).The aim of FERET and LFW is to identify and verify a given match respectively. Artificial Neural Network classifier, Edge detection and filters are used. The design is based on VLSI and for simulation process MATLAB & Model SIM is used.

Keywords: Face Recognition; Ensemble of Descriptors; Artificial Neural Network; Labelled Faces in the Wild

I. Introduction

Face Recognition is one of the key areas under research in recent times. It plays an invigorating role in pattern recognition and human computer interaction, is widely used in personalised healthcares, surveillance systems. Many facial recognition applications have been proposed recently. The main objective of this proposed system is to compare two images and to identify whether both same person or not. The identification is difficult because, the two images of the same person can vary considerably in time, pose, facial expression, illumination conditions, occlusions, and image quality etc. Most of the face recognition techniques performs well when facial images are captured in optimal conditions where lighting is controlled and samples provide full frontal views, but when facial images are captured in the wild – where pose, age, and facial expressions change and where environmental conditions such as lighting are less than ideal – performance deteriorates. The difficulty lies in teasing out the specific features indicative of identity from the mass of features expressing other conditions. The ensemble pattern of pre-processing techniques works well in the wild.

II. The Proposed Approach

The main idea of the proposed approach is to design an ensemble pattern of pre-processing techniques and it is trained on different descriptors extracted from the face image. This approach has designed several perturbations at different steps in the classification process: in the image pre-processing, feature transformation, and matching steps. The general schema of the complete approach is illustrated in Fig. 1.

As illustrated in Fig. 1, the proposed approach can be broken down into the following steps:

A. Deblurring Filter

In Digital image processing, The Wiener filter is used to produce an estimate of a desired or target random process by Linear Time-Invariant (LTI) filtering of an observed noisy process, assuming known stationary signal and noise spectra, and additive noise. Here the noise is completely removed.

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B. Face Detection

Initially the precise position of the face image is detected and the resulting face is cropped and aligned according to eye position.

C. Frontalization

The frontalization is an approach which is used to create or synthesize frontal views of faces from the detected face.

D. Pose Creation

It is to tackle pose variation, the proposed system makes use of three additional poses obtained by vertical flipping of the image. In other words, we train four classifiers: the first using the original images for the two faces to be matched; the second using the vertical flip of the second face; the third using the vertical flip for the first image; and the fourth using the vertical flip for both images. The four systems are then simply combined by sum rule.

E. Pre-Processing

Several enhancing methods have been tested in this work in order to make the feature extraction more robust to changes in illumination, noise, etc. The parallel use of different approaches is performed in order to obtain diversity among the classifiers. The input of this step is the frontalized image, and the output is a set of images pre-processed according the following approaches: Adaptive single scale retinex, Anisotropic smoothing, Difference of Gaussians.

F. Feature Extraction

This step is performed separately on each image resulting from the previous pre-processing method in order to obtain different descriptors from each image. The descriptors are Local Binary Patterns (LBPs), Histogram of Gradients, POEM and Monogenic Binary Coding.

G. Feature Transformation

The dimensionality of each descriptor is reduced using Principal Component Analysis (PCA) before classification.

H. Classification

An ANN classifier is used. The general-purpose classifiers is trained on each reduced descriptor.

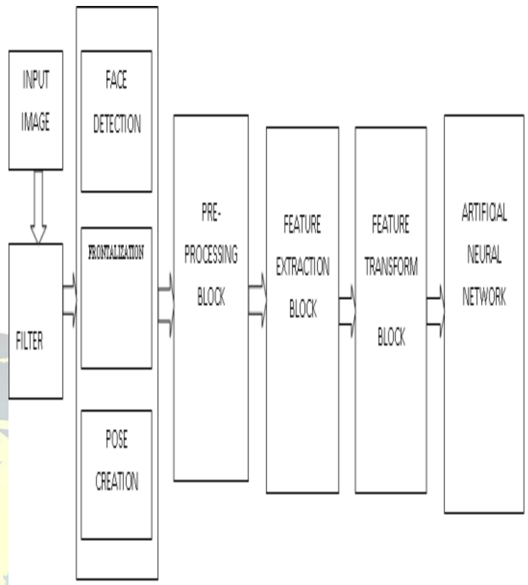

Fig 1 Schema of the proposed ensemble

III.PRE-PROCESSING TECHNIQUES

A. Adaptive Single Scale Retinex

To deal with the 'graying out', 'noise enlargement' and 'halo' effects existing in classical Retinex image enhancement algorithms, an adaptive single scale Retinex scheme based on luminance is proposed. The original luminance is added to the obtained reflectance to restrain 'graying out' and 'noise enlargement' effects. Compared with other algorithms, the simulation results indicate that the proposed adaptive single scale Retinex scheme based on luminance can acquire more details, less 'halo', less noise and better colour fidelity. It is a variant of the retinex technique, this approach was originally developed to improve scene details and colour reproduction in the darker areas of an image. This technique normalizes illumination using the spatial information between surrounding pixels.

B. Anisotropic Smoothing

It is a simple automatic image-processing normalization algorithm or a technique. AS begins by estimating the illumination field and then compensates for it by enhancing the local contrast of the image in a fashion similar to human visual perception. This technique has proven highly effective with standard face recognition algorithms across many face databases.

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C. Difference Of Gaussians

The feature enhancement algorithm that involves the subtraction of one blurred version of an original image from another, with less blur version is called difference of Gaussian. The Gaussian Kernel suppresses only high-frequency spatial information.

IV. RESULTS

The first experiment was aimed at evaluating the different descriptors when combined with the ensemble pattern of pre-processing methods. The experiments were carried out on the LFW dataset. The classifier used in these experiments is Artificial Neural Network (ANN).

V. SIMULATION RESULTS

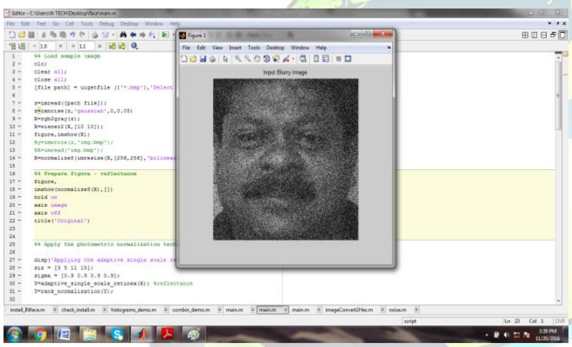

Fig 5.1 Input Blurry Image

Fig 5.1 shows the input blurry image. Here the input blurry image is taken and it will be given to input of noise removal filter called wiener filter. This noise present in the input image is must removed to produce better recognition results. The blurred noise is removed by using wiener filter.

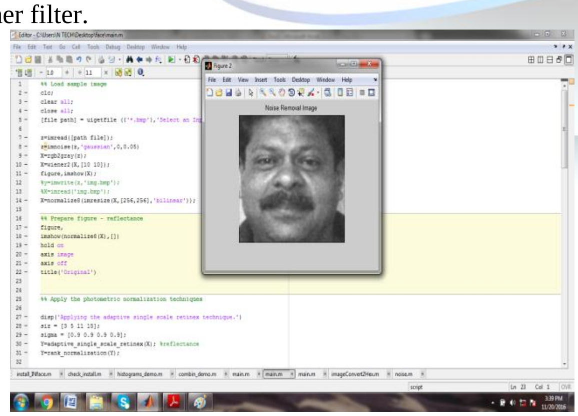

Fig 5.2 Deblurred Image

Fig 5.2 shows that deblurred image. Here the input deblurred image is given as the input for wiener filter. The Wiener filter is a filter used to produce an estimate of a desired or target random process by linear time-invariant (LTI) filtering of an observed noisy process, assuming known stationary signal and noise spectra, and additive noise. The noise is removed and deblurred image is given as the input for further pre-processing techniques.

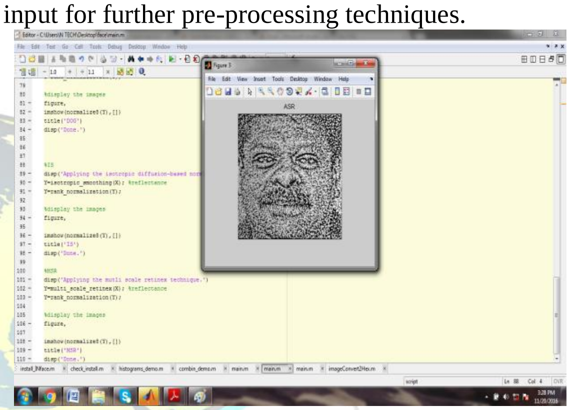

Fig 5.3 Adaptive Single Scale Retinex Image

Fig 5.3 shows that the adaptive single scale retinex image. This method is used to improve scene detail and colour reproduction in the darker areas of an image. This technique normalizes illumination using the spatial information between surrounding pixels. This will enhance the image.

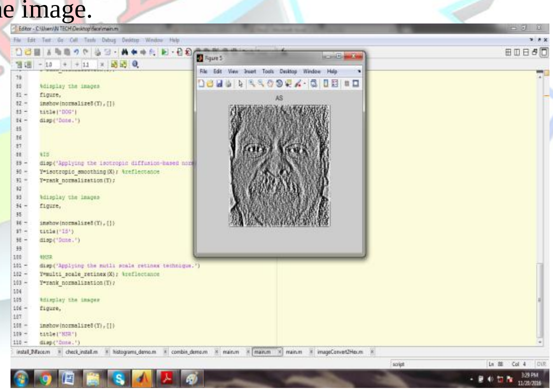

Fig 5.4 Anisotropic Smoothing

Fig 5.4 shows that the anisotropic smoothing image. This method is image-processing normalization algorithm, AS begins by estimating the illumination field and then compensates for it by enhancing the local contrast of the image in a fashion similar to human visual perception.

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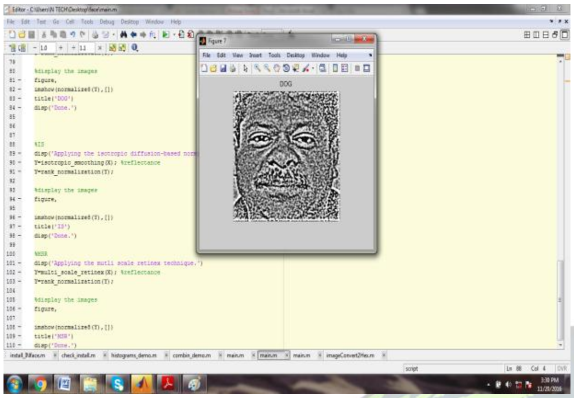

Fig 5.5 Difference of Gaussian

Fig 5.5 shows that Difference of Gaussian image. This is a normalization technique that relies on the difference of Gaussians to produce a normalized image. A band-pass filter is applied to an input image before the feature extraction step.

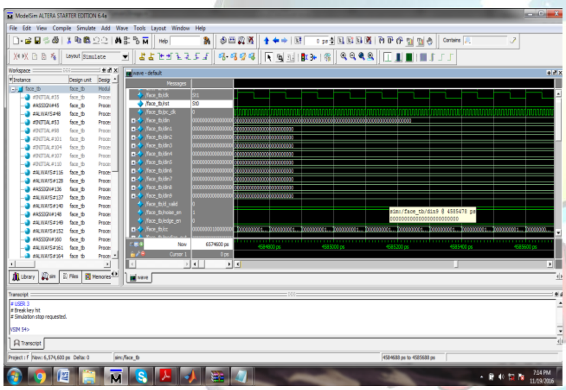

Fig 5.6 Model Sim Output

Fig 5.6 shows that the Modelsim output. This output will shows that training and testing stages of ANN. This will provide the output of which user is given as input. Here User3 is output because the user3 is given as input.

VI. CONCLUSION

Human beings recognize faces relying on both global face features and local details of the facial organs. In this project a hierarchical ensemble of global and local classifiers is proposed to simulate the observations in bionic sense by exploiting both global features and local features. It is shown that the proposed method outperforms all the compared state-of-the-art and baseline algorithms, which illustrates the robustness of the proposed method against the appearance variations of expression, lighting etc. The proposed method hopefully can inspire a new thinking and new way to tackle the face recognition problem. In the proposed method, an ensemble pattern of pre-processing obtained the best results on facial recognition. The proposed method has applied various pre-processing approaches to avoid illumination on facial images. After that features are extracted based on feature descriptors. For Classification purpose ANN is used. The proposed method is validated in both MATLAB and Modelsim. Experimental results show that the ensemble classifier greatly outperforms its component classifiers which have large error diversity. The proposed method has achieved verification rates of 96%.

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