Volume 5, Issue 9, September 2015 ISSN: 2277 128X
International Journal of Advanced Research in Computer Science and Software Engineering
Research Paper
Available online at: www.ijarcsse.com

An Efficient Approach for Human Face Recognition

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Abstract-Face recognition is one of the important fields for their wide range of applications in different areas. Our job is to implement an efficient approach for human face recognition. This paper presents an efficient approach to address the representation issue and the matching issue in face recognition process. The implemented face recognition approach is concentrated on the image performance in order to generate required features from the face image. The obtained result indicated a good performance of face image is generated from the tested system.

Keywords: face detection, face recognition, face identification,

I. INTRODUCTION

As biometric technologies are improved very fast, so many devices and applications are introduced in the recent years.Face recognition is a broad interdisciplinary nature of the interest such as: computer recognition and pattern recognition; biometrics and security; multimedia processing and computer vision; psychology and neuroscience. It is a field of research that complain the necessity of interaction between computer scientists and psychologists.Everyone has a face and everyone readily displays the face, so face recognition has the advantage of ubiquity and of being universal over other major biometrics. Face recognition also has the advantage that the acquisition devices are cheap and are becoming a commodity.Face recognition has been employed in wide range security related applications such as surveillance, airports, organizations, banks, mug shot identification, e-passport, and access control.Although face recognition has made huge progress in the recently, there have been several concerns preventing its wider deployment, such as the effectiveness in field test, the performance under uncontrolled conditions, and privacy concern [1,2].

II. FACE RECOGNITION STANDARD

Many identification systems comprise three elements [3]:

- attributed identifiers (such as name, Social Security number, bank account number, and driver's license number)
- biographical identifiers (such as address, profession, and education)
- biometric identifiers (such as photographs and fingerprint).
  The facial recognition process normally has four interrelated phases or steps as shown in Figure (1) [4].
- the first step is face detection
- the second is normalization
- the third is feature extraction
- the fourth cumulative step is face recognition.

These steps depend on each other and often use similar techniques.

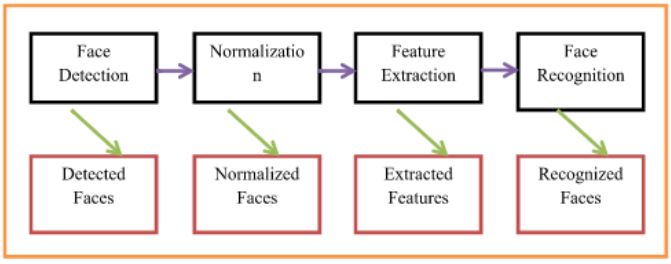

Figure (1) facial recognition process

III. RELATED WORKS

Many algorithms and approaches are published in this field of face recognition andwe will concern some of the resent researches:

RabiaJafri and Hamid R. Arabnia (2009), provided an overview of the well-known methods in each of these categories and some of the benefits and drawbacks of the schemes mentioned therein are examined. Then, a discussion outlining the incentive for using face recognition, the applications of this technology, and some of the difficulties plaguing current systems with regard to this task has also been provided. This paper also mentioned some of the

propselalgorithms developed for this purpose and attempts to give an idea of the state of the art of face recognition technology [5].

S.B.Thorat et al. (2010), focused on 3-D facial recognition system and biometric facial recognition system. We do critics on facial recognition system giving effectiveness and weaknesses. This paper also introduces scope of recognition system in India. There are some weaknesses of facial recognition system, there is a tremendous scope in India. This system can be effectively used in ATM's, identifying duplicate voters, passport and visa verification, driving license verification, in defense, competitive and other exams, in governmentand private sectors. As a result there are no technological or financial barriers for stepping from the pilot project to widespread deployment [6].

MuzhirShaban Al-Ani1 and AlaaSulaiman Al-Waisy (2011), presented an efficient approach using a kernel machine based approach for learning such nonlinear mappings to provide effective view-based representation for multi-view face detection. In this paper Kernel Principal Component Analysis (KPCA) is used to project data into the view-subspaces then computed as view-based features. Multi-view face detection is performed by classifying each input image into face or non-face class, by using a two class Kernel Support Vector Classifier (KSVC). Experimental results demonstrate successful face detection approach over a wide range of facial variation in color, illumination conditions, position, scale, orientation, 3D pose, and expression in images from several photo collections [7].

MuzhirShaban Al-Ani1 and AlaaSulaiman Al-waisy (2012), proposed a novel face recognition approach based on wavelet-curvelet technique. This algorithm based on the similarities embedded in the images that utilize the wavelet-curvelet technique to extract facial features. The implemented technique can overcome on the other mathematical image analysis approaches. This approaches may suffered from the potential for a high dimensional feature space, Therefore, it aims to reduce the dimensionality that reduce the required computational power and memory size. Then the Nearest Mean Classifier (NMC) is adopted to recognize different faces. In this work, three major experiments were done. Two face databases (MAFD & ORL, and higher recognition rate is obtained by the implementation of this techniques [8]).

Wonjun Hwanget at. (2013), proposed a novel unifying framework using a Markov network to learn the relationship between multiple classifiers in face recognition. They assumed that we have several complementary classifiers and assign observation nodes to the features of a query image and hidden nodes to the features of gallery images. They connected each hidden node to its corresponding observation node and to the hidden nodes of other neighboring classifiers. For each observation hidden node pair, they collected a set of gallery candidates that are most similar to the observation instance, and the relationship between the hidden nodes is captured in terms of the similarity matrix between the collected gallery images. Posterior probabilities in the hidden nodes are computed by the belief propagation algorithm [9].

Patrick Grother and Mei Ngan (2014),tracked that improvement of face recognition technologies and its conduct of regular independent, free, open, and public evaluations has fostered improvements in the state of the art. One-to-many face identification systems are mostly used in conjunction with trained human facial reviewers. The systems are configured to operate in two regimes: first, with a low threshold that necessitates adjudication of many false positive candidates by a reviewer specifically employed to do so; second, with a high threshold, in which false positive outcomes are rare and human intervention is only needed infrequently. Low false positive rates are accompanied by higher false negative rates [10].

IV. IMPLEMENTED APPROACH

As we mentioned above any face recognition system can be implemented via four steps, these steps are: face detection, normalization, feature extraction then face recognition. Feature extraction is the most important step in the recognition system. The implemented approach concentrated on the feature extraction process in which highlights and increases the face performance. The overall face recognition system can be implemented via many steps as shown in figure (2):

- Step 1: Color to Gray Scale Conversion, this step is started after the face image acquisition process in which the color face image in converted into gray scale face image.
- Step 2: Image Enhancement, this is an important step to highlight the face image details, in which we applied histogram equalization that redistributed the pixels over the image scale.
- Step 3: Image Resizing, this step aims to standardized the face image size in order to be compatible with the overall system.
- Step 4: 3rd Level 2D_DWT, in this step three levels of two dimensional discrete wavelet transform (2D DWT) are applied to the resized image in order to extract the required features. The implemented system goes in details to generate suitable features that required for the decision.Daubechiesare selected as wavelet families to be the best wavelet used for the system.

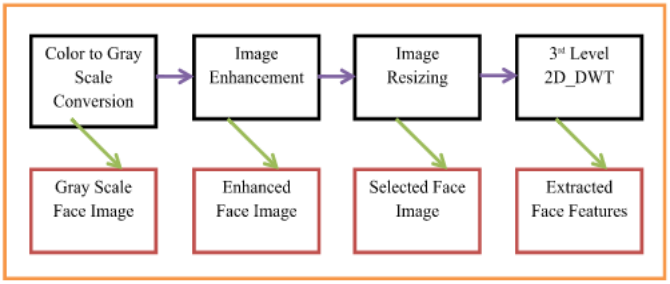

Figure (2) implemented face recognition algorithm

V. RESULTS AND ANALYSIS

After application of all steps of the implemented system we demonstrate the results in each step. The gray scale image is resized and selected the face image; this image and their histogram are shown in figure (3). Then an equalized histogram is implemented to the resized image in order to highlight the face details, this image and their histogram also are shown in figure (3), in which we can see that there is a normal distribution of pixels of the face image.

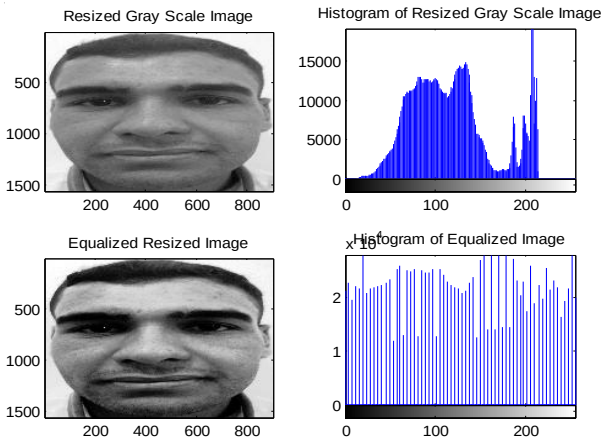

Figure (3) resized gray scale image and equalized histogram

The feature extraction step is the main core of the implemented system, in which we applied the 3rd level two dimensional discrete wavelet transform and the Daubechies are selected as wavelet families to be implemented. These levels are implemented via db2 and these levels are demonstrated in figure (4). The decomposition of 2D discrete wavelet transform of the used face image is shown in figure (5).

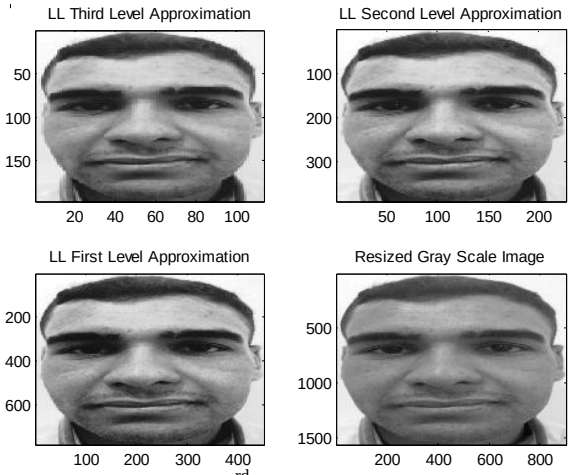

Figure (4) applying of 3rd level discrete wavelet transform

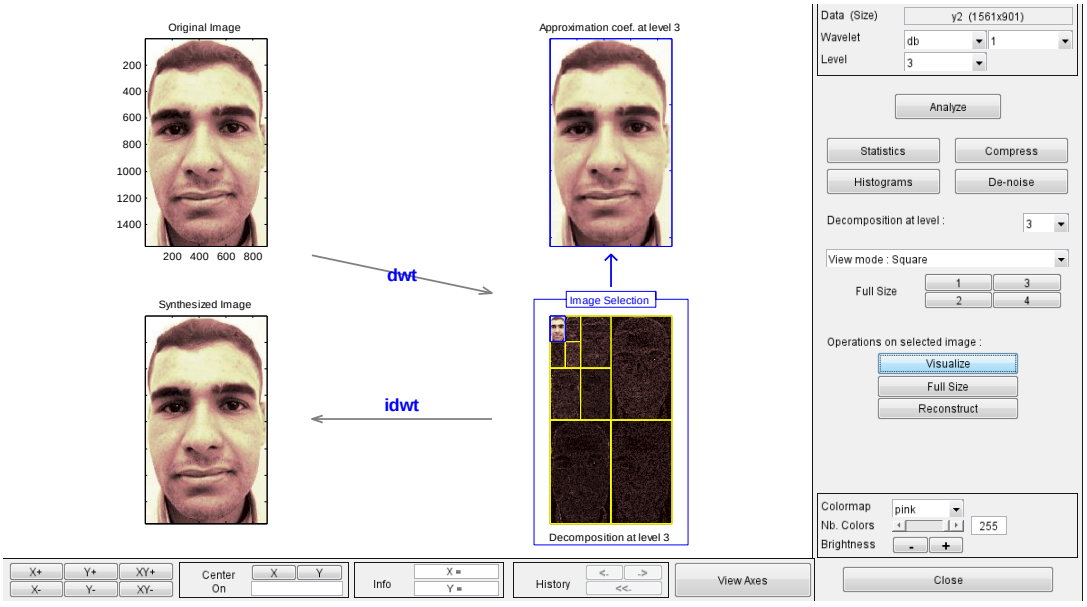

Figure (5) 2D wavelet decomposition

VI. CONCLUSIONS

Face recognition algorithms are faced with many problems such as ages, directions, orientations, background, lighting, …etc. In this project many face images are collected via simple digital camera, in addition multiple face images are collected for each person. We proposed an efficient approach for human face recognition in which it used 3rd level of Daubechies wavelet families.The implemented approach gives an accurate recognition results in addition a big reduction of the image dimensions that reduce the required computation and memory consumption.

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