A HYBRID BIOMETRIC AUTHENTICATION ALGORITHM

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Abstract:

A facial recognition system is a computer based application for automatically identifying or verifying a person from a digital image. One of the ways to do this is by comparing the selected facial features from the image and a facial database. Some facial recognition algorithms identify faces by extracting landmarks, or features, from an image of the subject's face. The accurate face is detected by the position relation of the face and the eyes. A new approach is proposed to improve face recognition in the paper. The face features are extracted using the DCT and EHMM algorithm is used to recognize the face and the eyes. A transform domain approach with HMM for face recognition is presented. DCT transformed vectors of face images are used to train ergodic HMM and later for recognition.

Keywords: face recognition, DCT,EHMM, Illumination, data generation, E-Voting

1.INTRODUCTION:

Biometrics refers to the automatic identification of a person based on physiological or behavioral. Bio means physical or behavioral and metrics means to mesure characteristics.The current authentication systems are characterized by an increasing interest in biometric techniques in this paper. Among these techniques are face,facial,thermogram,fingerprint,hand geometry,handvein,iris,retinal pattern,signature and voice print. In this paper are using physical biometrics are uniqueness ,permanence ,measurability, performance, users acceptability and robustness against circumvention[1]. In this paper the hybrid biometric authentication algorithm is present work on face recognition is carried out from the statistical analysis stand paint inherent advantages of DCT(Discrete Cosine Transform) and HMM(Hidden Markov Model) are exploited to get better performance.

Our face recognition system has two types. The first type is (i) DCT coefficients are computed for an x×y overlapping sub-image of all the traing face images. (ii) using DCT coefficients an HMM is trained to model the fsce imsge. The second step , recognition step, the unknown face image DCT coeffecicients are computed as in the training step. These coeffients are then used to compute the likelihood function, namely p[0,q/ƛ1]. The recognized face corresponds to the I which yields a maximum for p[0,Q*i/ƛ1],where Qi*=arg maxQ p[Q,S]. obtain recognition performance of 99.5%. the training step is performed only once and can be updated by training a new HMM for a new subject to be recognized

As follows this paper is organized, section 2 related previous work is described. Section 3 presents the background and detailed discuss about the biometric authentication method.

2.RELATED WORK:

The latest research on multimodel biometric system shows that may improve incompleteness of any unimodal biometric system . Brunelli et al. have proposed independent biometrics schemes by combining evidence from face recognition [2]. Substantial effort has gone into understanding the face recognition problem and developing algorithms for face recognition. A detailed survey is provided in[2,4], Most of the algorithms exploit neural networks [3] or problistic model like HMM[5,6], n-tuple classifier[7]or a combination of these paradigms[8].

An approach samaria and young[5] adopted a top down HMM model for a face. Their scheme uses grey level pixel values of the face image for training and recognition. With a test set of 50 face image of 24 individuals, success rate reported is 84%. All the training and test image were of the same size with no background . In the modified approach[6]authors use pseudo 20 HMM and the recognition rate 40 subjects(5 images per subject for training and another 5 each for recognition) recognition accuracy is reported to be 95.5%.

Eigenface based face recognition scheme of Turk and pentland[9] treats an image as a 2D random signal, and it's the covariance matrix is decomposed to extract principal conponents(eigenfaces)the scheme assumes that face images and images other than face are e is captured using a web camera[10]. A face is disjoint . authors report an accuracy in the range of 64% to 96%. The test set is 2500 face images(MIT face databases of 16 individuals digitized under different lighting conditions , head orientations and resolutions[11].

3.BACKGROUND:

Briefly, basic principles of HMM and DCT are highlighted in this sections.

3.1 DCT(Discrete Cosine Transform):

The discrete cosine transform (DCT) helps separate the image into parts (or spectral sub-bands) of differing importance(with respect to the image's visual quality)

Operation Of The DCT:

(i) The input image is N by M;
(ii) F(i,j) is the intensity of the pixel in row I and column j;
(iii) F(u,v) is the DCT coefficient in row k1 and column k2 of the DCT matrix.
(iv) For most images , much of the signal energy lies at low frequencies ; these appear in the upper left corner of the DCT.gher frequencies, and
(v) Compression is achieved since the lower right values represent higher frrquencies, and are often small-small enough to be neglected with little visible distortion.
(vi) The DCT input is an 8 by 8 array of integeras. This array contains each pixel's gray scale level
(vii) 8 bit pixel's have levels from 0 to 255

3.2 HMM(Hiden Markov Model)

(i) Get the observation sequence of test image(obs_test)

(ii) Given($\lambda 1$,…………………$\lambda 40$)

(iii)Find likely hood of obs_test with each λi

(iv)The best likelihood identifies the person

(v) Likely hood=p(obs_test/λi)

3.3 Biometric Authentication Method:

3.3.1.Face recognition :

In face recognition, problems are caused by different head orientation. So, if only the course in doing so, other face information will be last. Nevertheless, as a start we opt for this similar approach[8]. Firstly , a face image is camera. A face is then detected using template matching. The user, however,has to move into the template rather then the template moving to search the face location. Eyes are then automatically localized using a combination of histogram analysis, round mask convolution. Moments are used to extract the eye information because it is a simple yet powerful extractor. Normalized central moments are invariant to translation, rotation and scaling. A moment of order p+q of an image f_{xy} of N byN pixels with respect to a center($\bar{x}$, $\bar{y}$) is given in equation.

$$M_{pq}=\sum_{x}^{N-1} \sum_{y}^{N-1} f_{xy}(x-\bar{x})^{p} (y-\bar{y})^{q}$$

Instead of working on the RGB (red, blue,green) color space,worked on the HSI(Hue Saturation Intensity) color space as well. For each eye, a pair of moments is extracted from the green, blue,hue,saturation and intensity color space.These parameters make a vector of 10 dimensions for each eye. The magnitude of each item in the eye vector is compressed using the logarithmic function and then normalized into the range zero and one

3.3.2 Data generation :

Data generation consists of two steps. In the first step, a sub-image of the face image is picked. In the next step,the DCT coefficients of the sub-image are computed. These coeffecients are then used to form an observation vector. This procedure is repeated on a sequence of sub images. The sequence of sub image is generated by sliding a square window over the image in raster scan fashion from left to right with predefined overlap. Fig 1 shows the sampling of a hypothetical image . at every position of the window over the image are captured. These pixels represent a sub image of the original image. 2D DCT is computed for each of the sub images. Only few DCT coefficients are retained by scanning the DCT matrix in zig-zag fashion(fig 2) which analogous to that of image coding. The Zig-Zag scanned DCT coefficients are arranged in a vector from as per the scan(fig 2) i.e first DCT coefficient scanned will be first element of the vector and the next element will be scanned DCT coefficient and so on. This vector of DCT coefficients becomes the 1D observation vector for HMM training or testing.

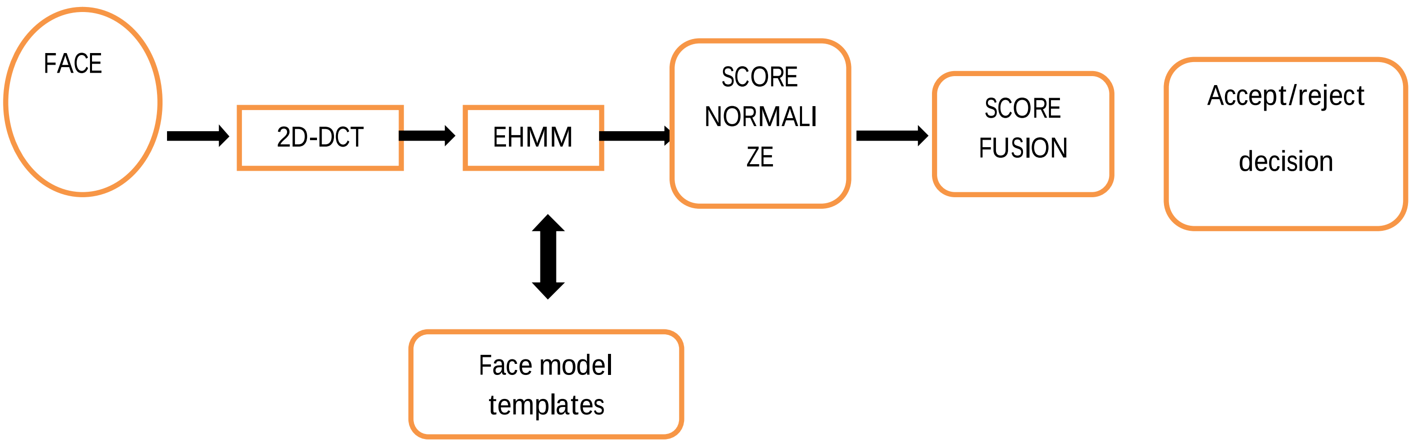
For every position of scan window have a corresponding observation vector . the dimension of the observation vector is determined by the number of DCT retained.

- DCT for Face Recognition
- HMM for Face Recognition
- Illuminaton

4.Proposed Hybrid Face Recognition Algorithm:

A proposed hybrid face recognition algorithm this paper are used for DCT and EHMM algorithm.

Hybrid Face Recognition Process:



4.1. DCT for Face Recognition:

The face recognition algorithm discussed in this paper is depicted . It involves both face normalization and recognition. Since face and eye localization is not performed automatically, the eye coordinates of the input faces need to be entered manually in order to normalize the faces correctly. This requirement is not a major limitation because the algorithm can easily be invoked after running a localization system such as the one presented or others in the literature. The system receives as input an image containing a face along with its eye coordinates. It then executes both geometric and illumination normalization functions as will be described later. Once a normalized (and cropped) face is obtained, it can be compared to other faces, under the same nominal size, orientation, position, and illumination conditions. This comparison is based on features extracted using the DCT. The basic idea here is to compute the DCT of the normalized face and retain a certain subsetof the DCT coefficients as a feature vector describing this face. This feature vector contains the low-to-mid frequency DCT coefficients, as these are the ones having the highest variance. To recognize a particular input face, the system compares this face's feature vector to the feature vectors of the database faces using a Euclidean distance nearest-neighbor classifier If the feature vector of the probe is **v** and that of a database face is **f**, then the Euclidean distance between the two is

$$d = \sqrt{(f_0 - v_0)^2 + (f_1 - v_1)^2 + \cdots + (f_{M-1} - v_{M-1})^2}$$

Where

$\mathbf{v} = [v0\ v1 \ldots vM-1]T$
$\mathbf{f} = [\ f0\ f1 \ldots fM-1]T$

and M is the number of DCT coefficients retained asfeatures. A match is obtained by minimizing d
Note that this approach computes the DCT on the entire normalized image. This is different from the use of the DCT , in which the DCT is computed on individual subsets of the image. The use of the DCT on individual subsets of an image, Also, note that this approach basically assumes no thresholds on d. That is, the system described always assumes that the closest match is the correct match, and no probe is ever rejected as unknown. If a threshold q is defined on d, then the gallery face that minimizes d would only be output as the match when $d < q$. Otherwise, the probe would be declared as unknown. In this way, one can actually define a threshold to achieve 100% recognition accuracy, but, of course, at the cost of a certain number of rejections. In other words, the system could end up declaring an input face as unknown even though it exists in the gallery. To obtain the feature vector representing a face, its DCT is computed, and only a subset of the obtained coefficients is retained. The size of this subset is chosen such that it can sufficiently represent a face, but it can in fact be quite small, as will be seen in the low-to-mid frequency 8×8 subset of its DCT coefficients. It can be observed that the DCT coefficients exhibit the expected behavior in which a relatively large amount of information about the original image is stored in a fairly small number of coefficients. In fact, that the DC term is more than 15,000 and the minimum magnitude in the presented set of coefficients is less than 1. Thus, there is an order of 10,000 reduction in coefficient magnitude in the first 64 DCT coefficients . most of the discarded coefficients have magnitudes less than 1.

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DCT Operations for face recognition

- Convert original image in to gray scale images
- The distance between the DCT's of the faces are computed.
- The faces with the shortest distances probably belong to the same person. Therefore this evaluation face is attribute to this person.
- And also used 2D-DCT because images are used two dimensional elements

4.2 HMM for Face Recognition:

To do face recognition, for every subject to be recognized, a separate HMM is trained i.e. to recognize M subjects we have M distinct HMMs at our disposal. An ergodic HMM is employed for the present work. The training of each of the HMM is carried out using the DCT based training sequence.

HMM Training:

Following steps give a procedure of HMM training

Step 1: Cluster all R training sequences, generated from R number of face images of one particular subject, i.e. *{Ow},* 1 *5 w 5* R, each of length *T,* in *N* clusters using some clustering algorithm, say k-means clustering algorithm. Each cluster will represent a state of the training vector. Let them be numbered from 1 to *N*.

Step 2: Assign cluster number of the nearest cluster to each of the training vector. i.e. *tth* training vector will be assigned a number i if its distance, say Euclidean distance, is smaller than than its distance to any other cluster *j* , j # i.

Step 3: Calculate mean ***{pi}*** and covariance matrix {Xi} for each state (cluster). where *Ni* is the number of vectors assigned to state ***i.***

Step 4: Calculate the *B* matrix of probability density for each of the training vector for each state. Here we assume that ***bj*** *(ot*) is Gaussian. For 1 **1.** *j 5 N* where, *ot* is of size *D* x 1

Step 5: The reassignment is effective only for those training vectors whose earlier state assignment is different from the Viterbi state. If there is any effective state reassignment, then repeat Steps **3** to 6; else STOP and the HMM is trained for the given training sequences.

Face Recognition: Once, all the HMMs are trained, then we can go ahead with recognition. For the face image to be recogmzed, the data generation step is followed as 1. The trained HMMs are used to compute the llkelihood function as follows: Let 0 be the DCT based observation sequence generated from the face image to be recognized,

1: Using the HMM and DCT algorithm, we first compute

Q^*_i = argmax *P[O,& / X i] Q*

2: The recognized face corresponds to that ***i*** for which the likelihood function *P[O,*QT/X I is maximum.

HMM for face recognitions:

1 .First the face image is scanned with a rectangular window from left-to-right and top-to-bottom and the observation vectors are extracted.

2 Then the sequence of observation vectors is introduced in each EHMM model and its corresponding likelihood is computed. Theoretically the probability of a sequence of observation vectors, given a model, is found using the forward backward *evaluation algorithm*. However, in practice that the DCT algorithm can successfully replace the evaluation algorithm. For our EHMM we use a doubly embedded Hidden Markov algorithm. At the end of this step we have the probabilities of the test image to match each of the EHMM models in the recognition database

3 The final step consists in comparing all the probabilities computed at the previous step and choosing at the previous step and choosing as winner the model which returns the highest probability

4.3: Illumination:

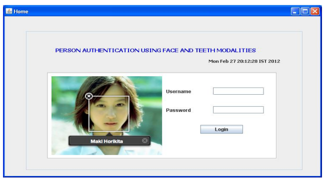
Illumination variations play a siginificant role in degrading the performance of a face recognition system, even though indicate that the correlation between face images under different lighting conditions remains relatively high. In fact, experience has shown that for large databases of images, obtained with different sensors under different lighting conditions , special care must be expended to ensure that recognition thresholds are not affected. To compensate for illumination variations in our experiments, apply histogram modification technique. That is , simply choose a target histogram and then compute a gray-scale transformation that would modify the input image histogram to resemble the target. It should be noted that another interesting approach to illumination compensation can be found in which computer graphics techniques are used to estimate and compensate for illuminant direction. This alleviates the need to train with multiple images under varying pose , but it also has significant computational costs.

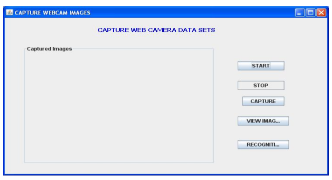
The key issue in illumination compensation. The main conclusion that can be drawn from the study is that illumination normalization is very sensitive to the choice of target illumination. Of course the result of illumination normalization really depend on the database being considered. For example, if the illumination of faces in a database is sufficiently uniform , then illumination normalization redundant.

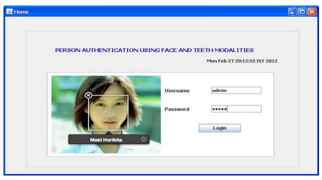
5.Experimental Results:

This section describes experiments with the developed face recognition system. These were fairly extensive , and the hallmark of the work presented here is that the DCT was put to the test under a wide variety of conditions.

- Face recognition was normally used in many advanced system This research was made on face recognition using DCT and EHMM algorithm was more efficiently.



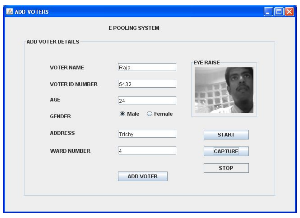




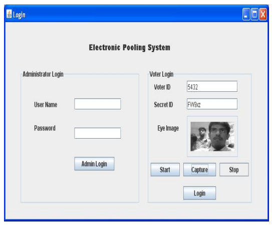
Illumination variation process:

Face recognition applied for E-Voting system: The E-VOTING SYSTEM is an online application designed to be operate by two users, the election controller and the voter. Face recognition can applied that the E-Voting for main aim is to avoid fake votes for high security.

- Biometrics voter registration system is a highly advanced biometric information system that allows to enroll and identify millions of voters quickly and unmistakable using biometric identifiers.
- possibility of election fraud is minimized at the same time considerably the voter identification process. Can be made easier by this process. .



- To support such a system pied issues are encountered with regard to how to best accomplish the voting in a secure way.
- Using Cryptography and Stegnography at the same time, we try to provide Biometric as well as Password security to voter accounts.
- The basic idea is to merge the secret key with the cover image on the basis of key image.
- The result of this process produces a steno image which looks quite similar to the cover image but not detectable by human eye.



CONCLUSION:

Facial recognition is most beneficial to use for facial authentication than for identification purposes, as it is too easy for someone to alter their face, features with a disguise or mask, etc. Environment is also a consideration as well as subject motion and focus on the camera. Image integral normalized gradient image (INGI) method is proposed to overcome the unexpected illumination changes in face recognition with limited side effects such as image noise and the halo effect. A newly emerging trend, claimed to achieve improved accuracies, is two-dimensional face recognition. This technique capture information about the shape of a face. This information is then used to identify distinctive features on the surface of a face, such as the contour of the eye sockets, nose, and chin . For the face data set considered, the results of the proposed DCT-HMM based scheme show substantial improvement over the results obtained from some other methods. Its currently investigating the robustness of proposed scheme with respect to noise and possible scale illumination variations. Face recognition were applied Sussesfully for E-voting.

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BIOGRAPHY

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