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A Video-Based Door Monitoring System Using Local Appearance-Based Face Models

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Abstract: ***Creating a good face recognition system is a big challenge in image processing research. We present a real-time video-based face recognition system (FRS). Our system identifies subjects while they are coming into a room. This system first detects faces for proper registration. Then system applies local appearance-based face recognition algorithm on individual face. The identity estimate will be provided by confidence score of each classifier.In this system a local appearance based face recognition algorithm is proposed by us. This algorithm utilizes local information which is extracted using Discrete Cosine Transform (DCT). The system is implemented using MATLAB on Windows platform. The performance of the system is tested on the manually created video face database.***

Key Words: DCT, FRS

I. INTRODUCTION

Face detection and recognition from video is challenging field. In this field computer vision research is utilized. It has applications in military and commercial products. Lots of efforts has been done on this area by people of different countries; but still lots of work is remained to do. There is still lots of research related to this field is going. This area comes under pattern recognition; the biggest challenge in this field is practical implementation of system for identifying people. Mostly applications of this system are in security system; where we have to teach machine to do task. Practically system should be accurate because; if any mistake is there in identification can create big problem. In this system there should not be any user intervention. Mainly this system has applications in home security system, electronic surveillance at airport, security systems at shops etc. where people are unknown about the security system. It has various commercial face recognition systems applications; where security of goods, product is important. The different application of this area is video processing on internet and multimedia. This application includes tagging photos on social networking sites, identifying celebrities in video. The important application is in processing videos from satellite; it has huge applications in security system.In today's scenario wide range of technologies are available. These technologies are utilized for identification of person. These system creates password or Personal Identification Number (PIN) for identifying person. But the biggest hurdle in using these systems is the identity of a person like password or PIN can be stolen by other person and other person can access his or her personal data like bank details or can withdraw money from account. To overcome these problem lots of research has been done in biometrics area. Biometrics is also a big challenging field where unique features of person are used for identification and verification of person. Biometrics utilizes unique features of a person like fingerprints, eye retina. Biometrics has huge applications in pattern recognition. But identification using eye retina and fingerprint is expensive application; also we have to restrict the movement of a person to whom we want identify and verify; thus it has less practical applications.

II. SIGNIFICANCE OF THE SYSTEM

In today's scenario wide range of technologies are available. These technologies are utilized for identification of person. These system creates password or Personal Identification Number (PIN) for identifying person. But the biggest hurdle in using these systems is the identity of a person like password or PIN can be stolen by other person and other person can access his or her personal data like bank details or can withdraw money from account. To overcome these problem lots of research has been done in biometrics area. Biometrics is also a big challenging field where unique features of person are used for identification and verification of person. Biometrics utilizes unique features of a person like fingerprints, eye retina. Biometrics has huge applications in pattern recognition. But identification using eye retina and fingerprint is expensive application; also we have to restrict the movement of a person to whom we want identify and verify; thus it has less practical applications.

III. LITERATURE SURVEY

n image processing research various approaches are developed for face recognition. In the beginning there was mainly focus was on image based approach, but there are some disadvantages of this approach; thus nowadays video-based approach is more preferred.

Video based approaches have overcome the shortcomings of image based face recognition.Zhou et al. [24] utilize sequence importance sampling (SIS) and joint posterior probability distribution for face tracking and recognition simultaneously. Liu and Chen [6] use eigen face image sequences using hidden Markov models(HMM). In this approach they utilize models and problem with models is that it is based on probability distribution function; and they make strong assumptions of data in the training set. Thus it is less effective. Arandjelovic and Zisserman [7]did work on multiple query images using appearance-based approach and used modified Euclidean distance for classification. Sivic et al. [8] used histogram based approach for face recognition.The purpose behind doing this project is to build a robust face recognition system for smart environments like lecture room, meeting hall. It has mainly applications in security system. The biggest advantage of face recognition form video is that the person can be identified automatically without any interventon.

IV. METHODOLOGY

We have proposed a video-based face recognition system for the real-time setting. The overview of the proposed system is shown in Fig.1. In our approach we are going to first capture the video from camera and after that detecting and tracking will be done by system. After face detection we are going to apply Discrete Cosine Transform (DCT) on faces and features will be extracted. The features are skin color, eyes, nose; after that faces will get registered. Then registered faces will get utilized for finding identity estimate. The system utilizes a classification algorithm which is a local appearance-based face representation [10,11] and utilizes the variation in data.A local appearance-based face recognition algorithm is used[10,11] for face recognition; it has some advantages like it can be robust against expression changes, illumination variation and head pose variation. In our proposed approach local face features are utilized. The representation of local facial features and they are combined at the feature level, which conserves the spatial relationships of features. The algorithm uses discrete cosine transform (DCT) for local appearance representation. It is advantageous to utilize DCT because it has a data independent base which makes it good to use for practical purpose. Also there is no need to prepare separate training data to compute a subspace. Also it provides detail frequency information, which is very useful for handling changes in facial expressions. This detail frequency information can be utilized to overcome hurdles like illumination variation, change in exressions etc.

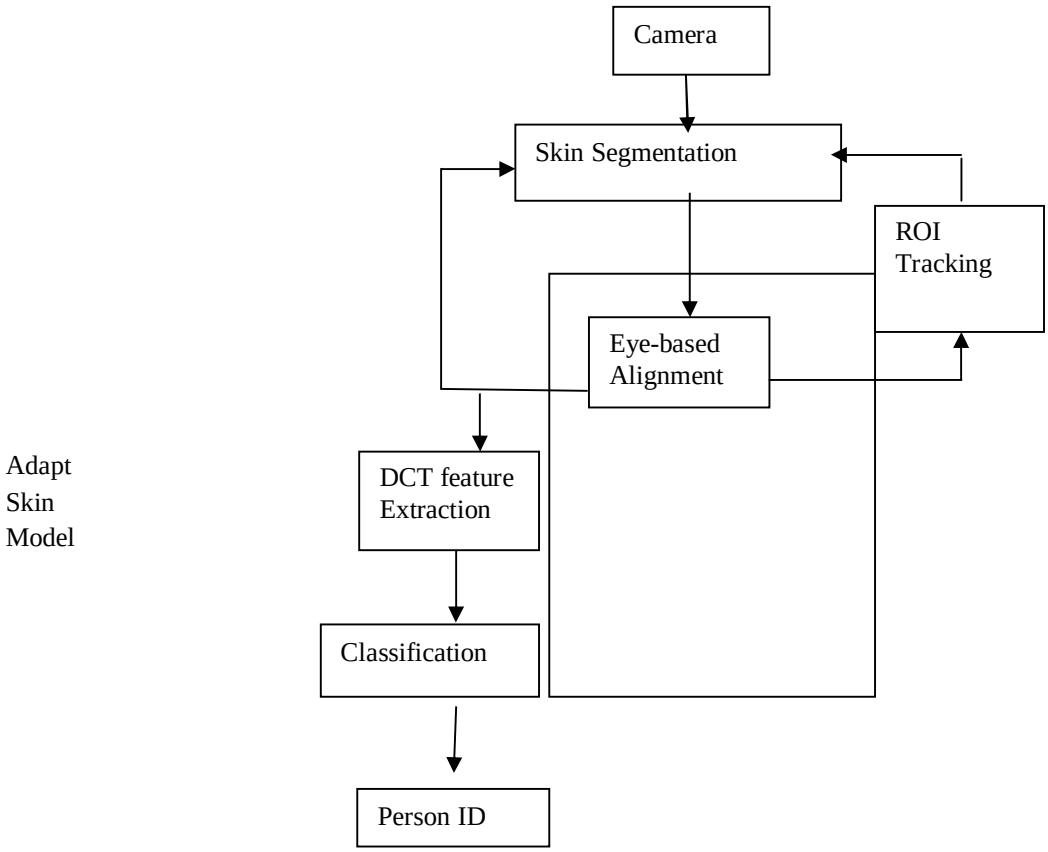

Fig.1Overview of the Recognition System

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A. Discrete Cosine Transform

Discrete cosine transform (DCT) is famous signal processing and analysis tool, it has wide applications in feature extraction and compression due to its compact representation . The 2-D discrete cosine transform of N×N image is defined as

$$D(i,j) = \frac{1}{\sqrt{2N}} C(i)C(j) \sum_{x=0}^{N-1}\sum_{y=0}^{N-1} p(x,y)\cos\left(\frac{(2x+1)i\pi}{2N}\right)\cos\left(\frac{(2y+1)j\pi}{2N}\right) \quad (1)$$

$$C(u) = \begin{cases} \frac{1}{\sqrt{2}} & if\ u = 0 \\ 1 & if\ u > 0 \end{cases}$$

$P(x,y)$ is the x,y[th] element of the image represented by the matrix P . N is the size of the block that the DCT is done on. The equation calculates one entry (i,j[th]) of the transformed image from the pixel values of the original image matrix.For the standared 8x8 block that JPEG compression uses, N equals 8 and x and y range from 0 to 7. Therefore $D(i,j)$ would be an in eq. 2

$$D(i,j) = \frac{1}{4} C(i)C(j) \sum_{x=0}^{7}\sum_{y=0}^{7} p(x,y)\cos\left(\frac{(2x+1)i\pi}{16}\right)\cos\left(\frac{(2y+1)j\pi}{16}\right) \quad (2)$$

Cosine functions are used by DCT, thus the resulting matrix will be dependent on the horizontal, diagonal and vertical frequencies . Thus when DCT of an image is created; there will be an image block results in a matrix with lot of variations in frequencies it looks very random .

B. Face Recognition Using DCT

We used local appearance-based face algorithm for representation in this approach, a detected face image is normalized and divided into blocks of 8×8 pixel size. On each 8×8 pixels block, DCT will be applied. The obtained DCT coefficients are ordered in such a way that it looks zig-zag scanning (Fig.2)

0	1	5	6	14	15	27	28
2	4	7	13	16	26	29	42
3	8	12	17	25	30	41	43
8	10	18	24	28	38	44	53
9	18	24	32	35	43	54	55
19	21	32	38	44	48	55	62
20	32	36	47	46	52	54	63
34	35	45	49	53	56	61	64

Fig.2 The order of DCT coefficient in zig-zag scan pattern

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From the above Fig.2 the coefficients are ordered, according to the feature selection strategy, M of them are selected resulting an M-dimensional local feature vector. Finally, the DCT coefficients extracted from each block are linked to construct the feature vector (Fig.3)

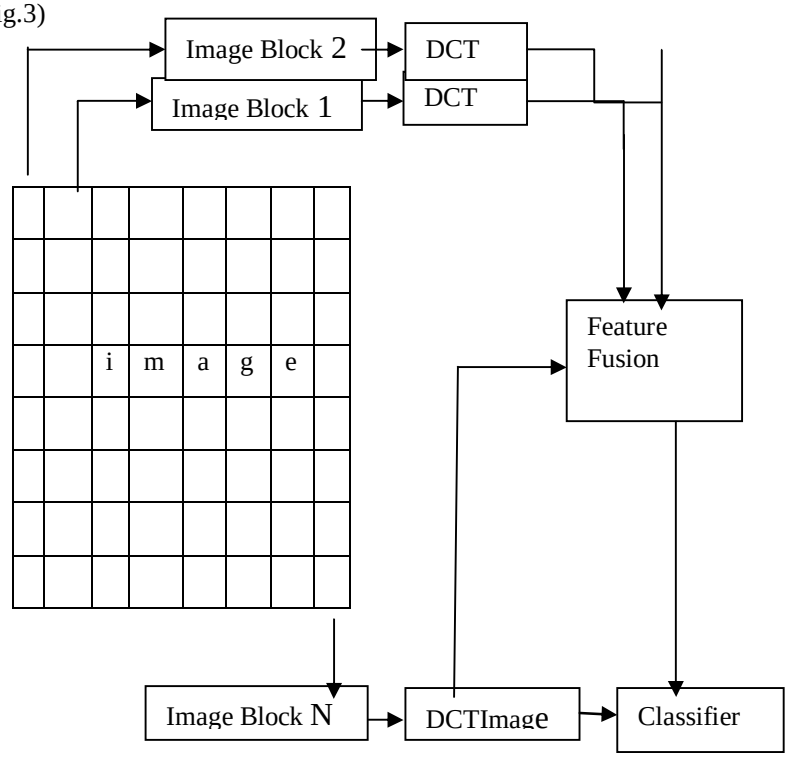

Fig 3.The diagram of feature extraction

C. Local Appearance Based Face Representation

Local appearance based face can be applied as ,first faces are detected and after that these detected faces are converted to normalized face image then that image is divided into blocks size of 8 ×8 pixel size. Each block has its own value and these values are its DCT coefficients. The top-left DCT coefficients are not useful because it only represents the average intensity value of the block and those are get removed. Using zig-zag scanning of remaining DCT coefficients is done and the highest information is extracted .

D. Person Identification

Following diagram shows the overview of person identification system

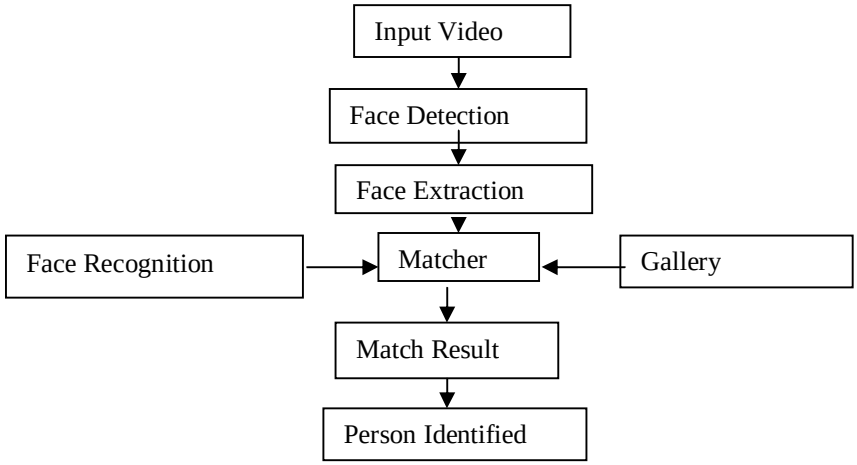

Fig.4 Person Identification

The basic face recognition system is shown in Fig 4.the faces are first detected. The features are of faces are extracted and passed to a matcher, *i.e.* a face recognition algorithm, which does the comparison of new features with the features you got from new faces. The recognition system does the task of verification by matching the probe against the gallery entry corresponding to the claimed identity. The system accepts or reject the probe according to the match score. If match score lies above a certain operating threshold then the claim will get accepted otherwise the claim is rejected.

E. System Performance

For verification of person we can claim that he or she is particular person. The recognition system does the verification according to the matching score got against the gallery entry and the claimed identity. If match score lies above a certain operating threshold then the claim will get accepted otherwise the claim is rejected. The performance of the system is measured in FAR,FRR and ERR

*1)FAR:*The face recognition system verifies person if match score lies above a certain operating threshold then the claim will get accepted otherwise the claim is rejected. The false acceptance rate is percentage of probes a system falsely accepts even though their claimed identities are incorrect.

*2) FRR***:** The face recognition system verifies person if match score lies above a certain operating threshold then the claim will get accepted otherwise the claim is rejected. The False reject rate(FRR)is percentage of probes a system falsely rejects despite the fact that their claimed identities are correct.

*3) ERR:*It is often used to summarize verification performance. A verification algorithm achieves perfect performance ;if it reaches a 0.0% FRR at 0.0% FAR.The performance trade-off associated with using different parameterization in a verification system are quantified using both ERR and FAR

V. EXPERIMENTAL RESULTS

Parameters	Value of Current System	Values of Old System
RR	89%	60%
FAR	10%	30%
FRR	11%	35%

VI. CONCLUSION AND FUTURE WORK

In this project a local appearance-based face recognition approach, which utilizes the discrete cosine transform for local representation and which preserves the spatial information of the extracted DCT features. The system performance is measured on the manually created database of 10 different people. Sometimes system fails to identify the person because of change in illumination conditions and occlusion is the biggest problem for person identification

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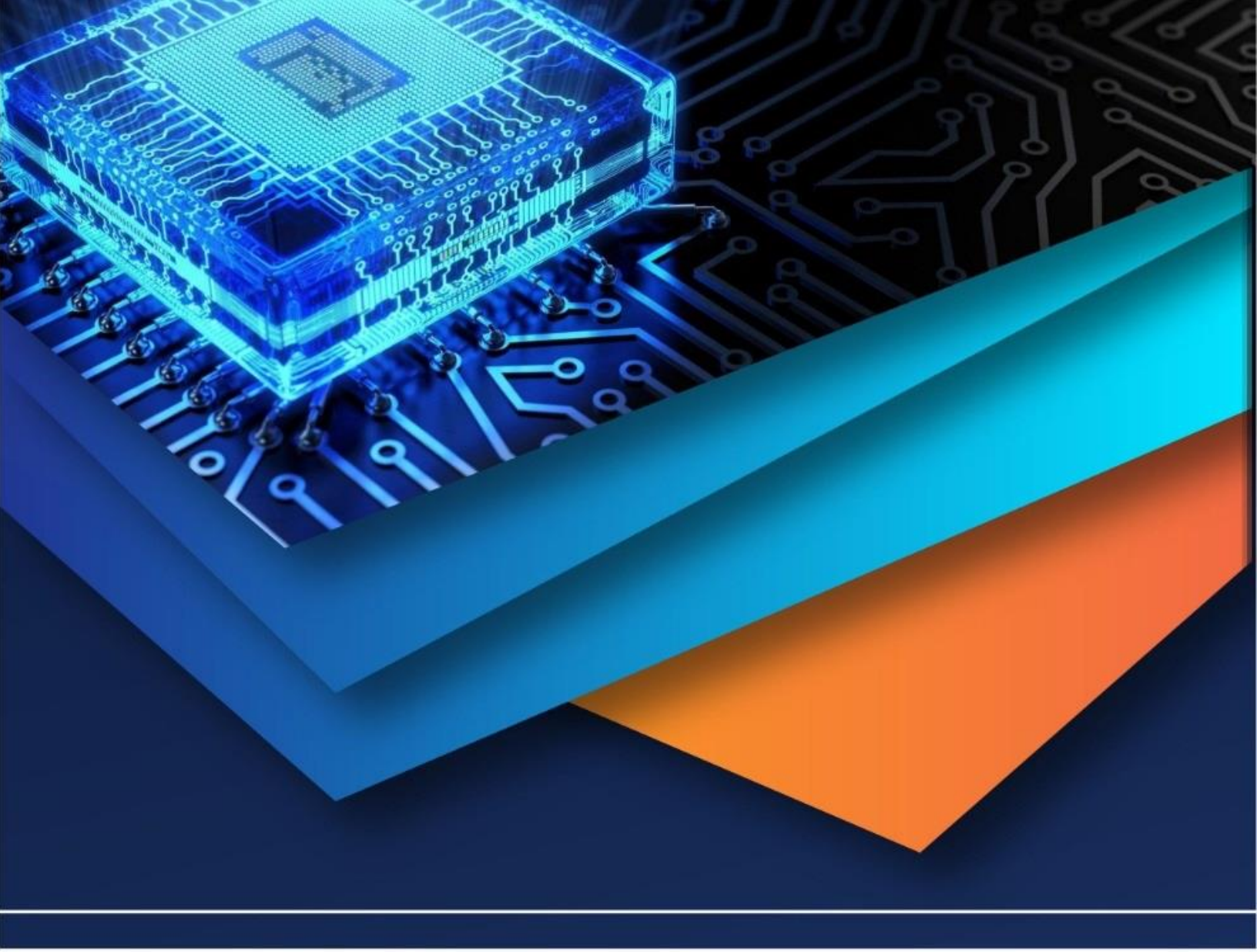

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