RDCT Based Face Recognition

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Abstract— *Biometric based person recognition is currently one of the key issues in security applications. face recognition, which is one of the less expensive modalities and the closest one to visual human recognition of the other human beings. The performance of a face recognition system differa because of variety of factors such as illumination, facial pose, expression, age span, hair, facial wear, and motion. Accuracy and speed are the main issue in this field. This approach uses we use Radon transform and distcrete cosine transform to derive efficient and affective facial features. Complexity in computation is minimum in this face recognition system.*

Keywords— *Radon Transform, low dimensinality, Discrete cosine transform, zero mean white noise, in-plane rotation.*

I. Introduction

Face recognition is gaining importance in human day to day life. The wide availability of powerful and low-cost desktop and embedded computing systems has created an great interest in automatic processing of images in a number of applications, including multimedia management, surveillance, biometric authentication , and human-computer interaction. Research and development in automatic face recognition follows naturally. Face recognition is more adavantageous than iris and fingerprint besides being natural and nonintrusive, the most important advantage of face recognition system is acceptance. Face can be captured at a distance and in a covert manner, this is main advantage. Face recognition, is important biometric system which is important owing to rapid advances in image capture devices (surveillance cameras, camera in mobile phones), availability of amounts of face images on the Web, and increased demands for higher security.

Face identification involves one-to-many matching. In it query face is compared against number of faces in the enrollment database. It is done to associate the identity of the query face to one of those in the database. Dofficulties in face recognition are facial accessories, aging effects, size of face, shape etc.

In this paper, efficient and effective facial features are derived by using Radon and distcrete cosine transform. Computational complexity is minimum in this aproach.

II. LITERATURE REVIEW

Venkatesh and Ramasubramanian [1] gave method based on the combination of human visual system characteristics, PCA, DCT.

2D DCT features and pseudo 2-D hidden Markov models based face recognition system was proposed by Eickeler et al. [2].

Local appearance based face recognition was given by Stiefelhagen and Ekenel[3]. Here non-overlapping blocks of the image are considered. Then DCT coefficients of them calculated. Zig-zag scanning is used to make those coefficients in order. Concatenation of DCT coefficients gives feature vector.

Sanderson et al. [4] Used DCT mod2 feature extraction technique proposed in [5] to give pose the mismatch issue. In this approach DCT coefficients are used.

Global and local facial features are combined and used by Zhou et al. [6]. Improved LDA is applied on features to enhance discrimination capability .

Face recognition system by using low frequency components was developed by Lai et al. [7].

III. METHODOLOGY

In this approach, low frequency components are enhanced by using Radon transform and DCT is used to derive facial features from radon space.

A projection of a two-dimensional function *f(x,y)* is a set of line integrals. The radon function computes the line integrals from multiple sources along parallel paths, or *beams*, in a certain direction. The beams are spaced 1 pixel unit apart. To represent an image, the radon function takes multiple, parallel-beam projections of the image from different angles by rotating the source around the center of the image

Equation of radon transform is given as

$$R(r,\theta) = R\{f(x,y)\} = \iint_{-\infty}^{\infty} f(x,y)\,(r - x\cos\theta - y\sin\theta)\,dxdy$$

Where r is the distance of the line from the origin, θ is angle between distance vector and x-axis and R denoted the radon transform.

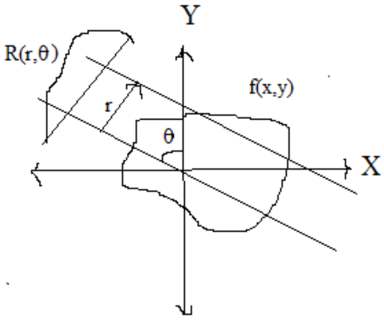


Figure.1. Radon transform

Low frequency components which are useful for face recognition are amplified using radon transform.

Discrete cosine transform transforms sequence of real data points into real spectrum. It avoids the problem of redundancy.

DCT is defined as

$$F(u,v)=\frac{1}{\sqrt{2N}}\left(\frac{2}{M}\right) C_i C_j \sum_{i=0}^{N-1}\sum_{j=0}^{N-1} p(i,j)\cos\left[\frac{(2i+1)u\pi}{2N}\right]\cos\left[\frac{(2j+1)v\pi}{2N}\right]$$

Where The input image is N by M; F(u,v) is the DCT coefficient in row k1 and column k2 of the DCT matrix.

IV. SYSTEM ARCHITECTURE

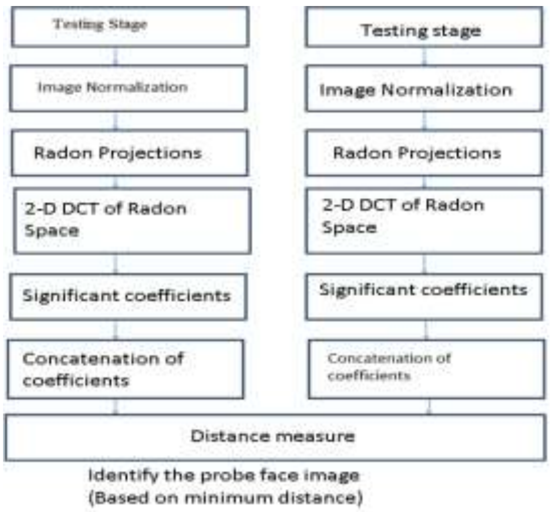


Figure.2. System Architecture of Proposed System.

A. Database

Database used in this approach is ORL (Olivetti Research Laboratory) database. ORL database consist of total 400 images. 40 different subjects have 10 images of each. Variety of images in ORL database due to size, facial expressions and pose. Some side movements are accepted. Images are taken against dark uniform background.

Figure.3. ORL database (one subject with ten different images)

B. Normalization

In an image normalization range of pixel intensity values changes. By using image normalization, images are brought to range which is normal to the senses. Face normalization is performed to normalize the face geometrically and photometrically. This is necessary because state-of-the-art recognition methods are expected to recognize face images with varying pose and illumination.

C. Feature Extraction

Facial features obtained in this system are frequency components in different directions. Low frequency components useful for face recognition are amplified by Radon transform. Number of projections are taken in radon transform. These projections are taken in angles between 0 to 179 degrees. Recognition rates are calculated. The recognition rate improves upto 60 projections but not for more than that projections. So 60 projections are taken. Frequency features are derived by using DCT applied on radon space. Increment in DCT coefficients upto 25% shows improvement in recognition rate but for more than 25% coefficients performance doesn't change. Concatenation of selected DCT coefficients gives facial feature vector. Features derived in this approach are effective and efficient. They give minimum standard deviation.

D. Classification

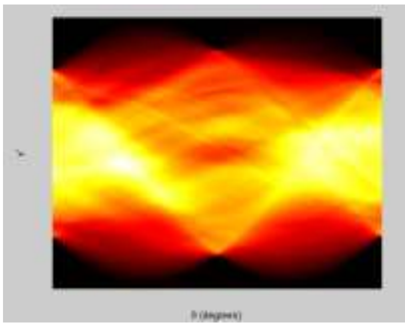
. k-NN classifier is used in this approach. In pattern recognition, the *k*-Nearest Neighbors algorithm (or *k*-NN for short) is a non-parametric method used for classification. The input consists of the *k* closest training examples in the feature space It is based on the L1 and L2 distance measure. If L1

distance gives better performance than L2 distance, then we present all the results given by L1 distance.

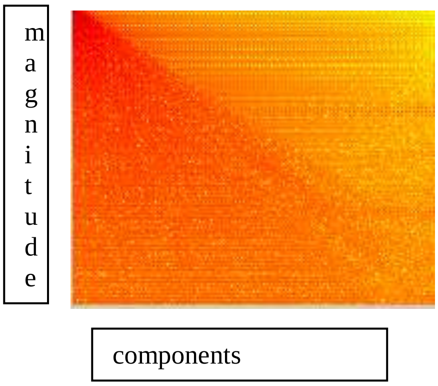
V. EXPERIMENTAL RESULTS

Number of projections were taken between the angles 0 to 179 degrees. Angle 180 degree is not considered because it gives identical result to 0 degree. It is observed that recognition rate remains same after 60 projections. So we take only 60 projections. Frequency features are derived by using DCT applied on radon space. Concatenation of Selected DCT coefficients gives facial feature vector.

(a)



(b)



(c)

Figure.4. (a) Input face image (b) Radon transforms (c) DCT applied in radon space

Figure.5. Output of a face recognition system using RDCT

A. Rotation invariance

Rotation is converted into translation by using Radon transform. DCT is invariant to translation. So proposed face recognition system becomes invariant to rotation by using radon transform and DCT. This is one of the best advantage of this approach.

B. Zero mean white noise

In signal processing, white noise is a random singal with a constant power spectral density. Noise was added to testing images. Training images kept as it is. No noise was added in those images. Results shows that the proposed approach has not affected by zero mean white noise.

VI. CONCLUSION

In proposed approach, low frequency components useful for face recognition are enhanced by using Radon transform. DCT applied on adon space is used to get facial feature vector. This system gives effective and afficient facial features. This system is not variant to in-plane rotation. It is not affected to zero mean white noise.

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