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International
Journal
Of Modern Engineering Research (IJMER)

Image Redundancy and Its Elimination

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ABSTRACT*: a rigorous work on static and dynamic appearance based classification systems for face is on but, it is proving to be a challenging task for researchers to design a proper system since human face is complex one. Decades of work was and is focussed on how to classify a face and on how to increase the rate of classification but, little attention was paid to overcome redundancy in image classification.*

This paper presents a novel idea which focuses on redundancy check and its elimination. The paper after drawing inferences from previous work gives out a novel idea for exact face classification and elimination of redundancy.

Keywords: *Face recognition, Feature based methods, singular value decomposition Euclidean distance Original gray value matrix.*

I. INTRODUCTION

The human machine recognition of human face is a challenging problem due the changes in the face identity and variation between images. Systems that recognize human faces have been applied in many applications such as security system, mug shot matching etc. The work takes a leaf out of the previous algorithms in which it is proven that fever face features can be used for face classification and thereby curse of dimensionality is nullified. Having got the features, problem of effective algorithmic use is solved by singular value decomposition (SVD) [7,8,9] wherein singular value 'S' which signifies the direction of variation is countered with a controlling factor alpha for facial variation elimination. This idea was given in the paper Fractional Order Singular Value Decomposition (FSVDR) [1]. But, by doing so for a given value of alpha and for a given query image it is found that more than one face is classified at the classifier which gives out the redundancy

The face recognition and classification is a great challenging problem since face images are highly variable due to individual appearance, three-dimensional facial expression, facial hair, makeup, and so on and these factors change from time to time. Furthermore, device inherent parameters and surroundings will also add to the problem. It is also illustrated by previous work that within class variations will affect the classification rate.

II. BRIEF REVIEW OF LITERATURE

Eigen face approach is one of the earliest appearance-based face recognition method, which was developed by M. Turk and A. Pentland [3] in 1991. This method utilizes the idea of the principal component analysis and decomposes face images into a small set of characteristic feature images called Eigen faces. Biggest challenge in face recognition still lies in the normalization and pre-processing of the face images so that they are suitable as input into the recognition module. The basic concept behind the Eigen face approach is that the information lies in a small portion of image face space.

The Eigen face images calculated from the eigenvectors of L span a basis set with face images are described. As mentioned before, the usefulness of eigenvectors varies according their associated Eigen values. This suggests picking up of only the most meaningful eigenvectors and ignore the rest, in other words, the number of basic functions is further reduced from M to M' (M'<M) and the computation is reduced as a consequence.

The Eigen faces approach for face recognition could be summarized as follows:

- Collect a set of characteristic face images of the known individuals. This set should include a number of images for each person, with some variation in expression and in the lighting (say four images of ten people, so M=40).

- Calculate the (40 x 40) matrix L, find its eigenvectors and Eigen values, and choose the M' eigenvectors with the highest associated Eigen values (let M'=10 in this example).
- Combine the normalized training set of images according to Eq. (6) to produce the (M'=10) Eigen faces $\mu_k, k = 1,\ldots\ldots,M'$.

But, this fails the recognition rate under varied faces and hence attention shifted to singular value decomposition (SVD) [7, 8] algorithm.

The singular value decomposition is an outcome of linear algebra. This produces the original image with each succeeding nonzero singular value. Furthermore, to reduce storage size even further, images may approximate using fewer singular values.

The singular value decomposition of a matrix A of m x n matrix is given in the form,

$$A = U\Sigma V^T$$

here U is an m x m orthogonal matrix; V an n x n orthogonal matrix, and $\sum$ is an m x n matrix containing the

$$\sigma_1 \geq \sigma_2 \geq \cdots \geq \sigma_n \geq 0$$

singular values of A.
along its main diagonal.

These singular values are used for facial feature decomposition to represent an image but, these features are found to be effected by facial variations as well as environmental variations. To take care of these variations a controlling factor is introduced and a novel method known as Fractional Order Singular Value Decomposition is proposed by un Liu, Song can Chen, Xiao yang Tan [1].

For each face image matrix A which has the SVD, its FSVD 'B' can be defined as,

$$B = U \sum^{\alpha} V^T$$

Where U, Σ and V are the SV matrices, and in order to achieve the above underlying ideas, δ is a fractional parameter that satisfies $0 \leq \alpha \leq 1$.The fractional parameter and its optimal selection is an important criterion in making the face recognition process more accurate so that redundancy can be checked.

III. MODULAR DESIGN AND ALGORITMIC STEPS

A modular design approach is adopted whereby the system was separated into smaller individual stages. Each stage in the designed architecture performs an intermediate task before integrating the modules into a complete system. The face recognition system developed performs three major tasks – pre-processing of given face image, extracting the face feature for recognition, and performing classification for the given query sample. The system operates on two phase of operation namely training and testing phase.
The developed face recognition system is shown in figure 1.

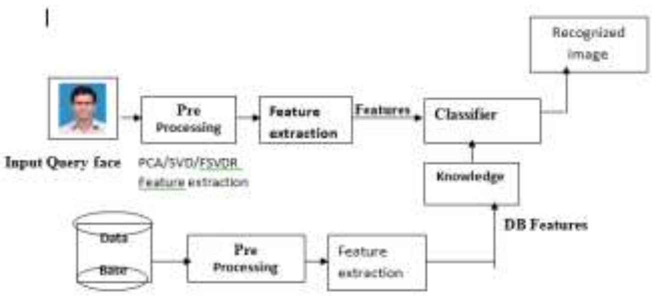

Figure 1: Face Recognition System**.**

The input image is randomly picked up from the self built data base & Yale data base. They are used for training and evaluated for the recognition accuracy. The face image is then transformed to operational compatible format, where the face image is resized to uniform dimension (128x128), the data type of the image sample is transformed to double precision and passed for feature extraction. Singular values are then computated for face recognition. The unit calculates the U, V, S matrix using SVD operation for given face image. On computation SVD features, for the calculation of FSVD features this unit takes the fractional factor α for the computation of a matrix B=U $S^{\alpha}V^{T.}$ The obtained facial expressions are the SV which are used as facial feature for face recognition. These features are passed to the classifier unit for the classification of given face query with the knowledge created for the available database. Database samples are trained for the knowledge creation for classification. During training phase when a new facial image is added to the system the features are calculated and aligned for the dataset formation. This data set consists of the image index and its corresponding features extracted. This feature table is created for the entire database image and passed for recognition.

Let the face image in the data Base be represented as F (i) K, where i represent the total number of samples for K^{th} class face image. Then the SVD feature for the given face image is calculated as:

1) Apply SVD on each of the face image for each class in the database, such that $\Psi i = UiSiVi^{t}$. where, $U = [u_1, u_2, u_m]$, $V = [v_1, v_2, v_n]$, and

$S = [0\ X_i\ 0]$, $X_i = diag\ (s_i)$, s_i are the computed Singular vector for each face image.

(2) The obtained Singular Vector is applied with the fractional value α and a modified SVD values are obtained as, $Bi = Ui\ Si^{\alpha} Vi^{t}$

(3) Each training face image $F_i^{(k)}$ is then projected using these obtained face feature image.

(4) For the obtained representing image apply a DR method PCA, where the Eigen features are computed and for the maximum Eigen values Eigen vectors are located and normalized for this projected image.

(5) A test face image $Tr \sim \epsilon\ R^{m\times n}$ is transformed into a face feature matrix $Yr\ \epsilon\ R^{r\times c}$ by $Yr = UrSrVr^{t}$.

(6) For the developed query feature a image representation is developed and passed to the PCA.

(7) For the computed face feature the distance between a test face image T and a training face images $X_i^{(j)}$ is calculated and the minimum distance is the recognized image.

(8) The recognised image is such that it is only one for the test face image T which illustrated that redundancy is nullified.

IV.CONCLUSION

Although many face recognition approaches by human beings and machines were developed in past, it is still difficult to design an automatic system for the task because in real world parameters do vary. It is a known fact that every image matrix can always have the well-known singular value decomposition (SVD) and can be regarded as a composition of a set of base images generated by SVD and further it is pointed out that base images are sensitive to the composition of the face image.

SVD has the advantage of providing a better representation and achieves lower error rates in face recognition but it has the disadvantage that it drags the performance evaluation. So, in order to overcome that, a controlling parameter 'α', which ranges from 0 to 1, is introduced for better results and by setting a threshold at sorting it is also seen that it reduces classification redundancy.

REFERENCES

[1]. Jun Liu, Song can Chen, Xiao yang Tan "Fractional order singular value decomposition representation for face recognition" *ELESVER Journal 26 March* (2007).

[2]. M. Kirby, L. Sirovich, "Application of the Karhunen–Loeve procedure for the Characterization of human faces" IEEE Trans. Pattern Anal. Mach. Intell. 12 (1990) 103–108.

[3]. M.Turk, A.Pentland, "Eigen faces for recognition", J. Cognitive Neurosci. 3 (1) (1991) 71–96.

[4]. J. Yang, D. Zhang, et al., "Two-dimensional pca: a new approach to appearance based face representation and recognition", IEEE Trans. Pattern Anal. Mach. Intell. 26 (1) (2004) 131–137.

[5]. J. Ye, "Generalized low rank approximation of matrices, in: International Conference on Machine Learning, pp. 2004, pp. 887–894.

[6]. J. Liu, S. Chen, "Non-iterative generalized low rank approximation of matrices",Pattern Recognition Lett. 27 (9) (2006) 1002–1008.

[7]. P. Belhumeur, J. Hespanha, D.J. Kriegman, "Eigenfaces vs. Fisherfaces: recognition using class specific linear projection, IEEE Trans. Pattern Anal. Mach. Intell. 19 (7) (1997) 711–720.

[8]. Z. Hong," Algebraic feature extraction of image for recognition", Pattern Recognition 211-219 (1991)

[9]. Y. Cheng, K. Liu, J. Yang, Y. Zhuang, N. Gu, "Human face recognition method based on the statistical model of small sample size", Intelligent Robots and Computer Vision X: Algorithms and Techniques, 85–95 (1991).

[10]. H. Othman, T. Aboulnasr, "A separable low complexity 2D HMM with application to face recognition" IEEE Trans. Pattern. Anal. Machie Intell., **25**(10): 1229-1238 (2003).

[11]. K. Lee, Y. Chung, H. Byun, "SVM based face verification with feature set of small size", Electronic letters, **38**(15): 787-789 (2002).

[12]. H. Cevikalp,M.Neamtu,M.Wilkes, A. Barkana, " Discriminative common vectors for face recognition" , IEEE Trans. Pattern Anal. Machie. Intel. **27**(1): 4-13 (2005).