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ROTATION INVARIANT FACE RECOGNITION USING RLBP, LPQ AND CONTOURLET TRANSFORM

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ABSTRACT: *Rotation invariant face recognition is an important area of research because of its many real-world applications, especially in creating a more robust recognition system for commercial and government technologies. Their diffusion is mainly supported by governments, forensics and law enforcement agencies with the aim of improving the public security or in general a sense of security; in fact, the biometric identification does not directly improve the security but acts as deterrent to illegal activities. In this work, we also consider illumination variable database. In this first we located face as region of interest. Only LBP and LPQ features have been used for feature extraction. There are variants of LBP features i.e. RLBP (Rotated local binary pattern) etc. which has been proved better. The existed work has been implemented on only those datasets which have face in them. After this LDA has been used to reduce feature set by taking negative log-likelihood from each Contour let-WLD, RLBP and LPQ descripted image histograms. After this KNN has been used for classification purposes. The experimental results show excellent accuracy rates in overall testing of input data.*

KEYWORDS: LBP,RLBP, CONTOURLET, KNN.

I. INTRODUCTION

Face detection [1] is one of the fundamental techniques which enable human-computer interaction in a natural way. It is a very complicated topic which involves face alignment, face modeling, face relighting, face recognition, face verification/authentication, head pose tracking, facial expression tracking/recognition, gender/age recognition and so on. Face detection is also a core research topic in human-computer interaction areas. Only when the face is accurately detected, the computers can truly understand people's thoughts and intentions. For human beings, they can easily detect people's human faces without hesitation. But for computers, face detection is a very complicated process which involved many aspects.

As the number of areas monitored by security cameras has grown, only automated tools such as face recognition can identify which images contain faces, which is essential to cut down on the number of images which must be considered by either human or computer-based face identification tasks. Beyond security tasks, face recognition is important for other applications, such as user identification for preventing voter fraud or unlocking computers, or even for digital cameras for knowing which areas should be kept in focus. Overall, although face recognition is a difficult task, it is necessary for many day-today tasks.

Face recognition methods typically confronts many real-world challenges, including the pose (out-of-plane rotation); the presence or absence of structural components like beards, mustaches, glasses; and the face appearance that is directly affected by a person's facial expression. Occlusion is also an obstacle in face recognition, as faces may be partially occluded by other objects. Imaging conditions, lighting, and resolution are also in the list of possible difficulties a face recognition system has to attenuate and if possible eliminate. Orientation (in-plane rotation) is a new and important challenge in face recognition, which occurs when the face appearance may vary for different rotations about the camera's optical axis. Most of face recognition methods suffer if input images are rotated, and new domains and applications demand face recognition to be more robust. Everyday pictures do not always show faces in an upright position in front of the camera, and thus different applications may need to recognize people from any picture and not just a typical picture face posture. A person could lie on bed so the face is rotated with a tilt of 90°, or could be hanging from a back stretcher having the whole body upside down.

2. LITERATURE SURVEY

Gonzalez-Diaz et al. (2014) [2] proposed a probabilistic generative model that concurrently tackles the problems of image retrieval and region-of-interest (ROI) segmentation. Specifically, the proposed model takes into account several properties of the matching process between two objects in different images, namely: objects undergoing a Geometric transformation, typical spatial location of the region of interest, and visual similarity. In this manner, their approach improves the reliability of detected true matches between any pair of images. Furthermore, by taking advantage of the

links to the ROI provided by the true matches, the proposed method is able to perform a suitable ROI segmentation.

DassVenkat M. et al. (2014) [3] presented a new approach called image retrieval system based on IGA. Content based image retrieval is a challenging method of capturing relevant images from a large storage space. Although this area has been explored for decades, no technique has achieved the accuracy of human visual perception in distinguishing images. Whatever, the size and content of the image database is, a human being can easily recognize images of same category. In this work, representing and retrieving the image properties of colour, texture and edge are used using interactive genetic algorithm (IGA) for better approximation with user interaction. CBIR is still a developing science. As image compression, digital image processing, and image feature extraction techniques become more developed, CBIR maintains a steady pace of development in the research field.

Paone et al. (2014)[4]used an experimental data set comprised of 17486 images from 126 pairs of identical twins (252 subjects) collected on the same day and 6864 images from 120 pairs of identical twins (240 subjects) with images taken a year later to measure the performance on seven different face recognition algorithms. According to it, Facial recognition algorithms should be able to operate even when similar looking individuals are encountered, or even in the extreme case of identical twins. Performance was reported for variations in illumination, expression, gender, and age for both the same day and cross-year image sets. Regardless of the conditions of image acquisition, distinguishing identical twins are significantly harder than distinguishing subjects who are not identical twins for all algorithms.

Devi et al. (2015)[5]present a novel efficient and robust methodology for quick face recognition by using Rule based Local Binary Pattern (RLBP). The face image is said to be divided into a number of 3x3 regions, called as micro patterns, indicating the structure of the grey level pixels within a neighbourhood to describe the spatial context of represented as rule number to evaluate the membership degree of the central pixel to the others within a neighbourhood. A Local face distributor for each of the 3x3 neighbourhood, called LBP descriptor, is obtained by applying Rules from which the RLBP feature distributions are extracted. Use of contributes to more than a single bin in the distribution of LBP values in the feature vector.

3. PRESENT WORK

System module

The system module of the proposed system is shown in Figure 4.1. The input image is first read into workspace and next a set of features are extracted from each image by converting image into blocks of size 8*8.

- **Local binary patterns for texture evaluation**

The local binary pattern is a powerful gray level invariant texture primitive. The histogram of the binary patterns computed over a region is used for texture description [6]. The operator describes each pixel by the relative gray levels of its neighboring pixels. If the gray level of the neighboring pixel is higher or equal, the value is set to one, otherwise to zero.

- **Rotated Local Binary Pattern (RLBP)**

The problem of variations to rotations in LBP arises due to the fixed arrangement of weights. As the weights are aligned in a circular manner, the effect of image rotations can be countered by rotating the weights by the same angle while computing the descriptor. Since the angle of the rotation cannot be known, we propose an adaptive arrangement of weights based on the locally computed reference direction. The reference direction should be such that if an image undergoes a rotation, it should also undergo a rotation by the same angle. In our experiments, we have tested different choices of the reference direction, such as the gradient, weighted difference between the pixels, etc. The best results were obtained with what we call, the Dominant Direction. The Dominant Direction is defined as the index of the neighbouring pixel whose difference from the central pixel is maximum.

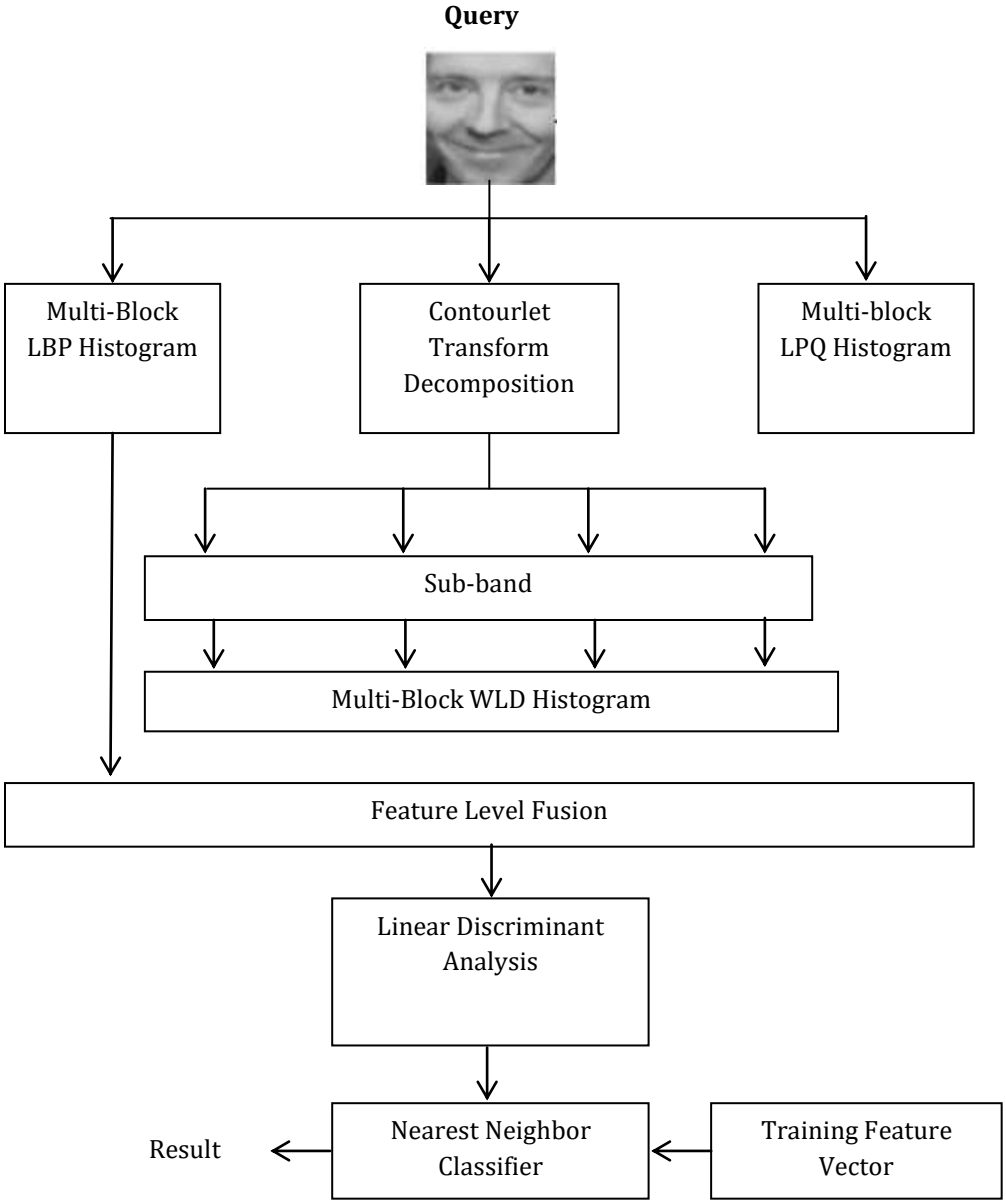

Fig-1: System Module

- **Local phase quantization**

LPQ is another widespread histogram-based feature extractor from the family of local texture descriptors, which performs the assessment of phase in a local window at the pixel position [7]. Local phase analysis in frequency domain leads to a detailed illumination insensitive texture description of face images. LPQ is also insensitive against image degradation, blur effect, which happens usually in real world applications, such as video surveillance, which is caused by out of focus of camera or object motion. LPQ is a common illumination and blur insensitive feature extractor.

4. RESULTS AND DISCUSSION

The software implementation of the project has been done using MATLAB.MATLAB stands for MATRIX LABORATORY, software developed by Math works in USA. First of all it is used in military area. For this proposed thesis work, image

processing toolbox commands and Image Acquisition commands has been used.

In this section results are discussed at different levels of the algorithm. A stepwise description for each step followed has been described below:

Fig-2: Input image

1) RLBP feature extraction

RLBP is one of the most successful local feature extractors, which extracts texture features of the image by comparing each pixel with its neighbor's in a small neighbourhood.

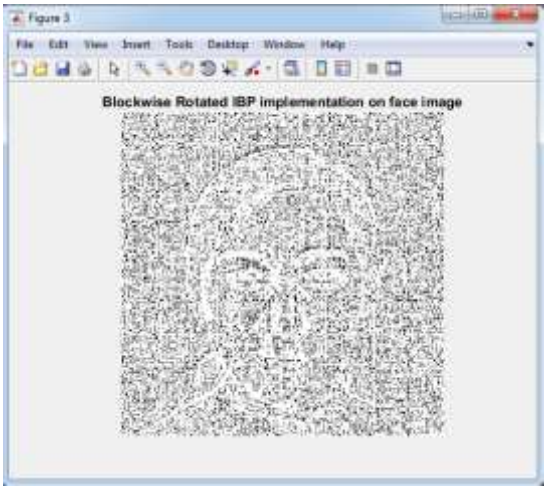

Fig-3: RLBP implementation of face image

1) LPQ feature extraction

LPQ is another widespread histogram-based feature extractor from the family of local texture descriptors, which performs the assessment of phase in a local window at the pixel position. Local phase analysis in frequency domain leads to a detailed illumination insensitive texture description of face images. LPQ is also insensitive against image degradation, blur effect, which happens usually in real world applications, such as video surveillance, which is caused by out of focus of camera or object motion.

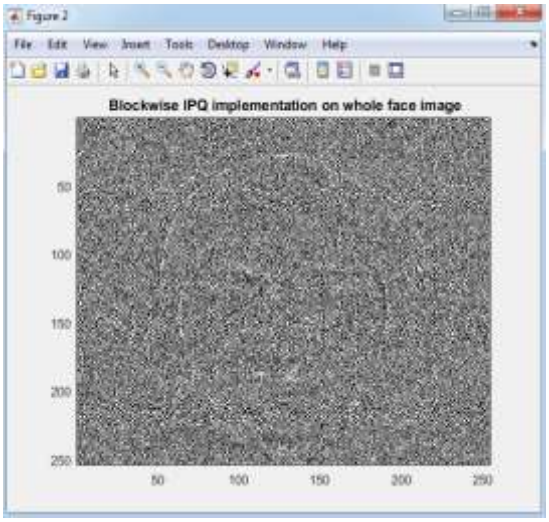

Fig-4: LPQ implementation of face image

2) Weber local descriptors of the coefficients of contour let transform

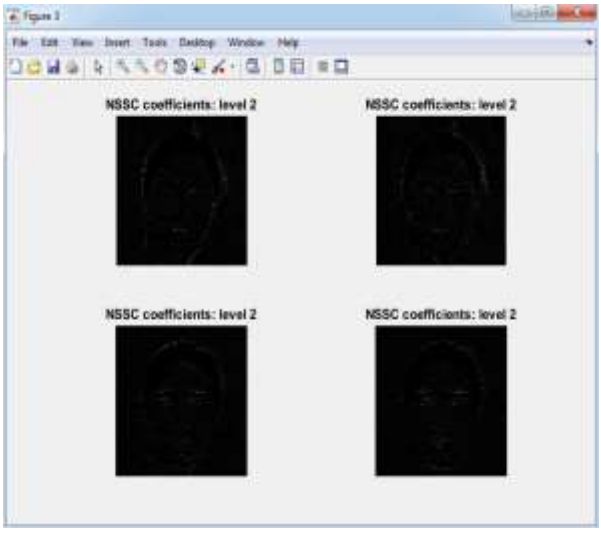

Fig-5: Second level coefficients of contour let transform

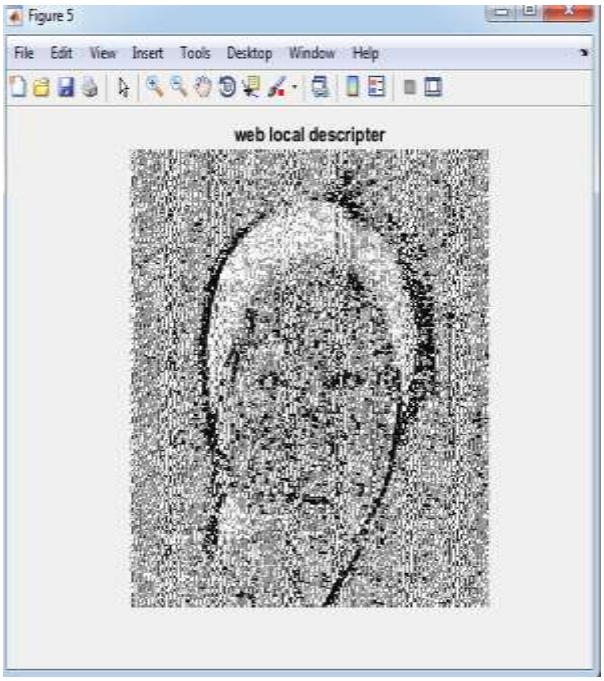

Fig-6: web local descriptors at sub-band one

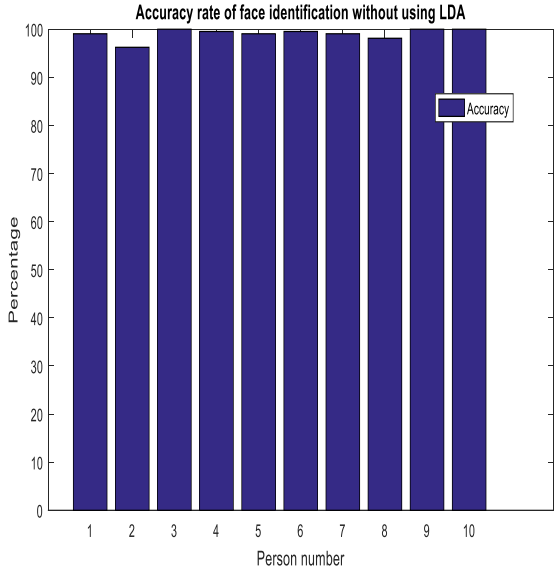

Fig-7: Accuracy rate of face recognition without using LDA Approximate overall Classifier Accuracy without using LDA is 99.06%

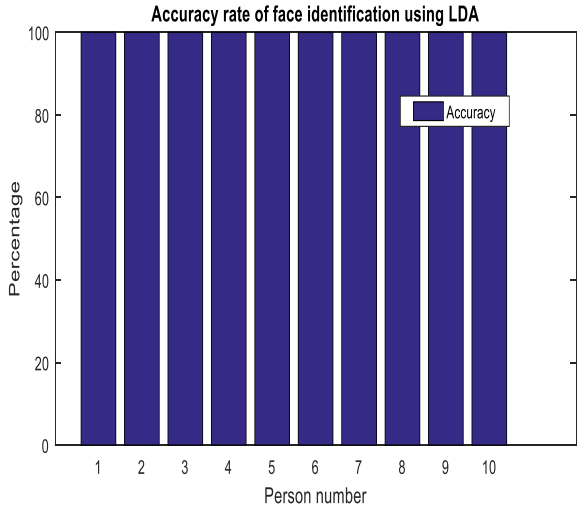

Fig-8: Accuracy rate of face recognition using LDA Approximate overall Classifier Accuracy using LDA is 100%

5. CONCLUSION

Face is a complex multidimensional structure and needs a good computing technique for recognition. Various face expression recognition techniques include Local Binary Pattern(LBP), Principal Component Analysis (PCA), Local Discriminate Analysis(LDA), Linear programming. Basic technique used for face expression recognition is local binary pattern. Local binary pattern uses the concept of threshold with the neighbouring pixels. A number of variants of LBP exist like Rotation in-variant LBP, improved LBP, Advanced LBP, Modified LBP, Extended LBP, Multi-scale LBP, Multi-block LBP, Hamming LBP etc. Similarly LPQ is based on quantizing the Fourier transform phase in local neighbourhoods. The phase can be shown to be a blur invariant property under certain commonly fulfilled conditions. In face image analysis, histograms of LPQ labels computed within local regions are used as a face descriptor similarly to the widely used Local Binary Pattern (LBP) methodology for face image description. In ourwork we haveused Contour let-WLD, RLBP and LPQ feature extraction techniques. LDA has been usedto reduce the space of discussed feature extractor. After this, the classifier named as k-NN is used to classify the face images in Jaffe dataset. Experimental results shows that the approximate overall Classifier Accuracy without using LDA is 99.06%.and approximate overall Classifier Accuracy using LDA is 100%

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