PARTIAL FACE RECOGNITION

[1]Ishani Mishra, [2]Krishna Priya S, [3]Kashmitha D
[1]Senior Asst.Professor, [2]Student, [3]Student
[1]Department of Electronics and Communication,
[1]New Horizon of Engineering, Bengaluru, India

Abstract : Face recognition is the method of verifying whether the input image is similar to the available database. Partial face recognition is a technique which helps to recognize the core features of a face image which appears in most of the real world applications. Partial faces appear in unconstrained image capture environments such as images captured using mobile phones and surveillance cameras. In this paper, a method is discussed in which face recognition will be based on initial pre-processing of an image and obtaining the local features. Further, matching the feature vectors that contain the local features which are extracted using the Gabor ternary pattern is done. The similarity between the probe image and database is extracted based on Euclidean distance. Thus similarity between partial faces and holistic faces can be obtained using this method.

Index Terms: **Gabor Ternary Pattern, Euclidean distance, Feature vector.**

I. INTRODUCTION

A facial recognition system is a technology capable of identifying or verifying a person from a digital image or a video. Facial recognition is mostly used for security purposes, though there is increasing interest in other areas of use.
There are certain drawbacks associated with facial recognition. Facial recognition can only identify people when the conditions such as lighting are favorable. The application could be less reliable in case of insufficient light or if the face is partially obscured. Another disadvantage is that facial recognition is less effective when facial expressions are varied.
The face recognition has achieved great success in controlled environment but has failed in uncontrolled and real time application and hence the partial face problem occurred in order to differentiate it from holistic faces. It is important to recognize an arbitrary facial patch or occluded face sample to enhance the intelligence of such recognition systems. Here we address the problem of partial face recognition and propose a method of partial face recognition using Gabor ternary pattern and Euclidean distance measure.

II. PARTIAL FACE RECOGNITION ALGORITHM:

This algorithm requires the image to be pre-processed to remove any noise if present in the image. After pre-processing is done the features is extracted using the Gabor ternary pattern and the feature vectors are compared using the Euclidean distance formula.

III. IMPLEMENTATION OF THE ABOVE ALGORITHM:

A test image and database images are given as input to the proposed system. These images are pre-processed and further the local features are extracted using the Gabor ternary pattern. Further the image is divided into grids and histogram of each grid is obtained. These histograms are concatenated to form a feature vector. The feature vectors are compared using the Euclidean distance formula and the minimum Euclidean value indicates the recognized image.

3.1. FLOW CHART OF THE ALGORITHM

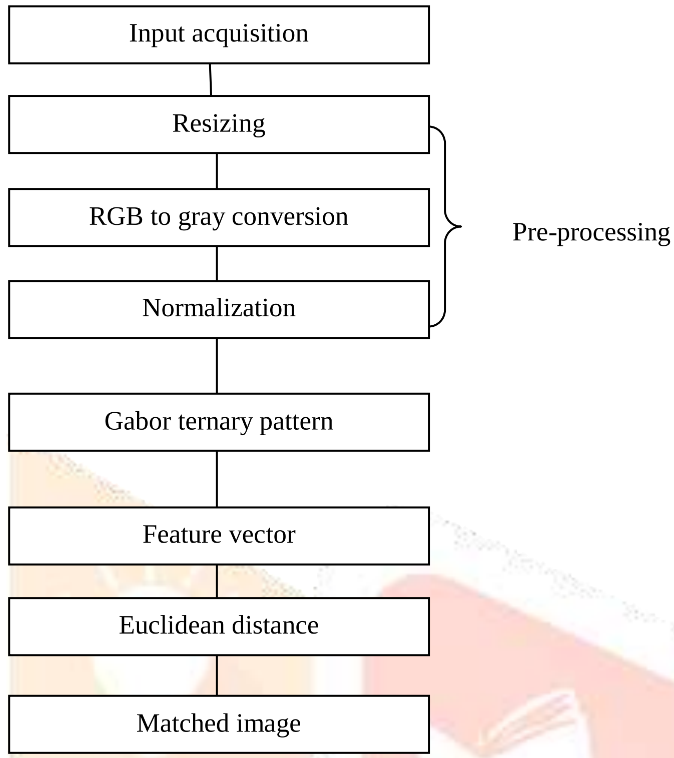


Image acquisition:

The input image is acquired and given for further pre-processing steps.

Pre-processing:

The images are pre-processed to remove any noise or disturbance present in the image. In this method three pre-processing steps are used they are:

1) Image resizing:

Image resizing is a process of reducing the size of the image without losing its visual content. The image is resized to a standard size of 60*60.

2) RGB to gray conversion:

It is the process of converting a three dimensional image into one dimensional image. This process is used because the color images are complex to process.

3) Normalization:

Image normalization is used in order to eliminate the noise and other disturbances present in the image. This process is used to change the pixel intensity values.

Gabor ternary pattern:

The feature extraction is used to represent the important features of an image in the form of a compact feature vector. There are many feature extraction methods such as PCA, SIFT and so on. In this method Gabor ternary pattern method is used since it is applicable for both holistic and partial faces. After the image is normalized to a fixed size, a local descriptor is constructed. The first step is to apply the Gabor filter. The Gabor filters are used because they provide good perception of local image structures and they are robust to illumination variations. The Gabor kernels are defined as

$$\Psi_{\mu,\nu(x,y)}=\|K_{\mu,\nu}\|^2/\sigma^2 * \exp(\|k_{\mu,\nu}\|^2\|z\|^2/2\sigma^2)[\exp(iK^T\mu,\nu Z)-\exp(-\sigma^2/2] \quad (1)$$

where μ and ν define the orientation and scale of the Gabor kernels, respectively, $z=(x,y)^T$, and the wave vector $K_{\mu,\nu}$ is defined as

$$k_{\mu,\nu}=(kv\cos\varphi\mu,\ kv\sin\varphi\mu)^T,\ with\ kv = kmax/fv, kmax = \pi/2, f=\sqrt{2},\ and$$

$$\varphi\mu = \pi\mu/8 \quad (2)$$

Since a relatively small region size (60*60 pixels) is used, we use Gabor kernels at a single scale (ν =0) and four orientations (μ ∈{ 0,2,4,6},corresponding to 0◦, 45◦, 90◦, and 135◦) with σ =1 are used. Only the odd Gabor kernels are used which are sensitive to edges and their locations. These four response images emphasize edges in four different orientations (0◦, 45◦, 90◦, and 135◦).
For each pixel (x,y) in the normalized keypoint region, there are four Gabor filter responses as follows

$$fi(x,y)=Gi(x,y)*I(x,y),\ i=0,1,2,3 \quad (3)$$

where Gi = imag(ψ2i,0) is the i^{th} odd Gabor kernel and ∗ is the convolution operator. The responses of the four filters are combined as a ternary pattern

$$GTPt(x,y)= 3i\,[(fi(x,y) < -t)+2(fi(x,y) > t)] \quad (4)$$

where t is a small positive threshold (a value of 0.03 is used in our experiment). This local descriptor is called the Gabor Ternary Pattern (GTP). It encodes local structures from the responses of odd Gabor filters in four different orientations. The local ternary pattern provides a discriminative encoding of the four Gabor filters and these encodings are insensitive to image noise, illumination variation because the quantization range is tolerant to these corruptions.
Further, the 60 × 60 region is divided into 6× 6 = 36 sub grid cells, each of size 10 × 10 pixels.

Feature vector:

A histogram of GTPs is calculated in each grid cell, and all histograms are concatenated to form an n-dimensional vector of numerical features that represent an image called the feature vector. It is a vector that contains information describing an image's important characteristics. The features can be gradient magnitude, color, grayscale intensity, edges etc.

Euclidean distance:

Distance metrics is often useful in image processing to be able to calculate the distance between two pixels in an image, but this is not as straightforward as it seems. The presence of the pixel grid makes the distance metrics possible which often give different answers to each other for the distance between the same pair of points. There are three most important methods used, they are Euclidean distance, City block distance and Chessboard distance. Of all the three distance metrics mentioned above the Euclidean distance takes a bit more time but is more accurate. Hence this distance metric is chosen for this method.
The Euclidean distance is the distance between any two points in Euclidean space. The two points P and Q in two dimensional Euclidean spaces and P with the coordinates (p1, p2), Q with the coordinates (q1, q2). The line segment with the endpoints P and Q will form the hypotenuse of a right angled triangle. The distance between two points p and q is defined as the square root of the sum of the squares of the differences between the corresponding coordinates of the points. The two-dimensional Euclidean geometry, the Euclidean distance between two points is given by,

$$d(p,q)=\sqrt{(q1-p1)^2+(q2-p2)^2} \quad (5)$$

IV.SIMULATION RESULTS:

A test image is fed as the input to the system and some pre-processing steps are performed on the image to remove noise from the image. The local features of the image are extracted using the Gabor ternary pattern and are represented in the form of feature vector. The database images also undergo the same steps mentioned above and the features of database are also represented in the form of feature vectors. The similarities between the test feature vector and database feature vector is measured using Euclidean distance and the minimum Euclidean value is the matched image. We have used MATLAB R2017a for all the simulations.

Image acquisition:

Initially the image is acquired and given as the input for further pre-processing steps. Either a holistic or partial face can be given as test image.

Image pre-processing:

There are three pre-processing steps in order to remove noise. They are:

1) Image resizing:

2) RGB to gray conversion:

3) Normalization:

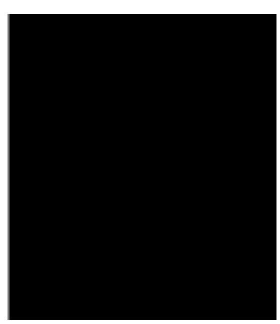
Feature extraction:

Used to extract the important features from the image.

0^0 GABOR KERNEL

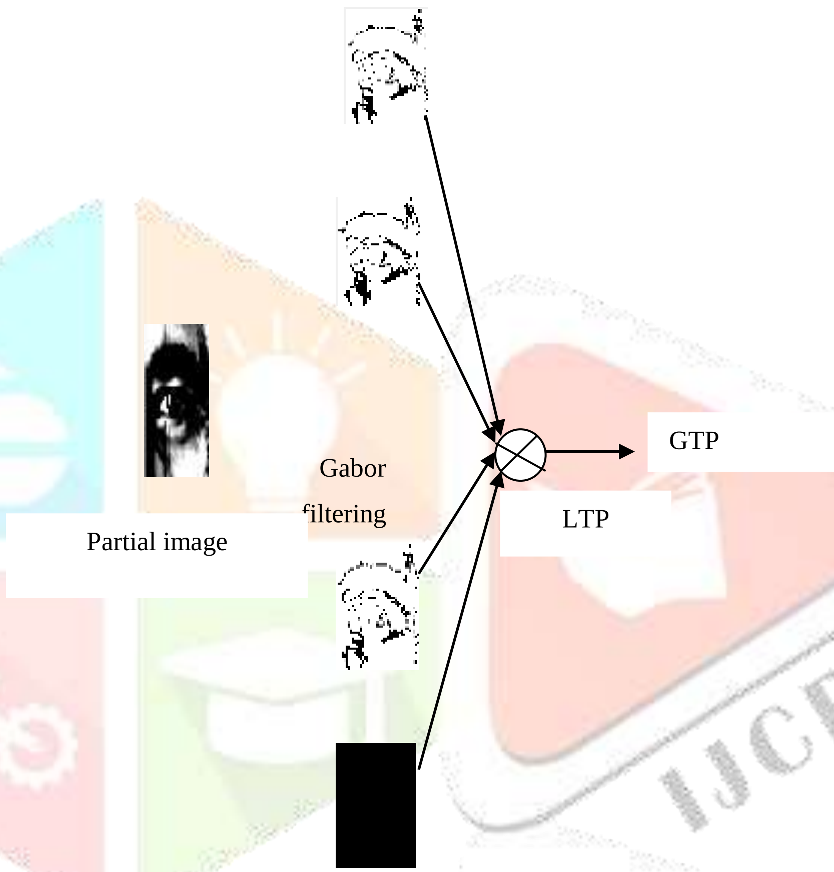
45^0 Gabor kernel

90^0 Gabor kernel



135^0 Gabor kernel

Complete GTP



Gabor ternary pattern

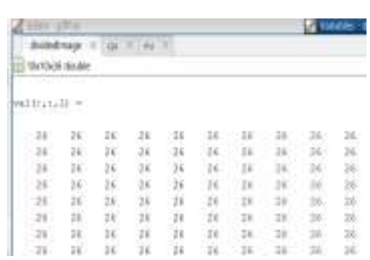
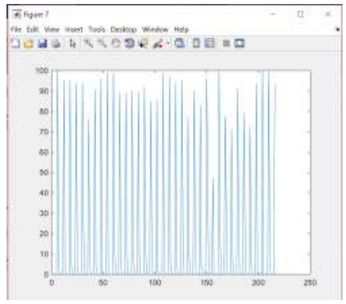
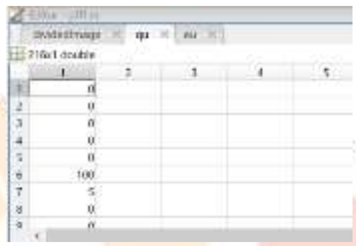


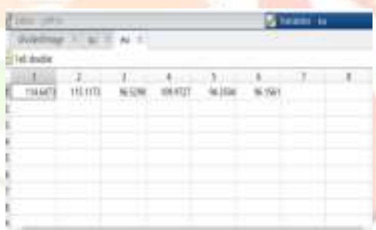
Image divided into subgrids



Concatenated Histogram



Feature vector



Euclidean distance values

Matched image

V.**CONCLUSION**:

This method of partial face recognition is used to recognize the human faces which are holistic and partial faces as well. It is used to recognize a test image from the database of images using the Gabor ternary pattern and Euclidean distance measure. The minimum Euclidean value is used to indicate the matched image. In this method the test image should be an image of the same person which is in the database of images. This method can be improved by using other distance metrics which give even more accurate results due to age variations and face alignment.

REFERENCES:

[1] Shengcai Liao, Anil K. Jain, Fellow, IEEE and Stan Z. Li, Fellow, IEEE, “A Partial face recognition: an alignment free approach” IEEE-2011.

[2] Aher pravin D and Galande H G, ”Euclidean based partial face recognition”, IJERT ,Vol.6 Issue 07,July 2017.

[3] Renliang Weng, Jiwen Lu, Senior Member, IEEE, and Yap-Peng Tan, Senior Member, IEEE, “Robust point set matching for partial face recognition” IEEE, Vol.25,no.3,2016.

[4] Ismahane Cheheb, Noor Al-Maadeed, Somaya Al-Madeed, Ahmed Bouridane, Richard Jiang, “Randomn sampling for patch based face recognition”,IEEE-2017.

[5] Yingcheng Su, Yujiu Yang, Zhenhua Guo, Weiguo Yang, “Face recognition with occlusion” , IEEE-2016.

[6] Z. Li, J. Imai, and M. Kaneko, “Robust face recognition using block-based bag of words,” in the 20th International Conference Pattern recognition, Aug 2010.

[7] W.Sylvia Lily Jebrani, T.Kamalaharidharini, “PNN-SIFT: An enhanced face recognition and classification system in image processing”, IEEE-2017

[8] G.Hua,M.H.Yang,E.Learned-Miller, Y.Ma.M.Turk, D.J.Kriejman and T.S.Huang , “Introduction to the special section on real-world face recognition”,IEEE Transaction on pattern analysis and machine intelligence, Vol.33, No.10, pp.1921-1924, 2011.