Different Approaches of Face Recognition

Michelle Araujo E Viegas
Electronics and Telecommunication
Don Bosco College of Engineering
Margao, Goa

Richard Simoes
Electronics and Telecommunication
Don Bosco College of Engineering
Margao, Goa

Nikisha Thanekar
Electronics and Telecommunication
Don Bosco College of Engineering
Margao, Goa

Saptak Banerjee
Electronics and Telecommunication
Don Bosco College of Engineering
Margao, Goa

Rahul Dicholkar
Electronics and Telecommunication
Don Bosco College of Engineering
Margao, Goa

Abstract— **In the field of image analysis computer vision face recognition presents a challenging problem. It has becoming difficult to secure information. Areas where security system is crucial are ATM, banks, university, offices, airports etc. using digital image a person can be recognized. The face of a person should be detected automatically. Face of person should be recognized regardless of physical parameters such as ageing, lighting, transformation, illumination etc. the paper is divided into holistic matching approach, feature based matching approach and hybrid approach.**

I. INTRODUCTION

Face is the easiest method to identify a person.due to numerous practical application in law enforcement, security control, information security, smart cards and surveillance systems face recognition is leading in under great research. Passwords and pins may be forgotten and are difficult to remember. Cards, tokens or keys may be stolen, duplicated or corrupted. Human face cannot be forgotten, misplaced, or stolen. The factors which are necessary to develop a useful and applicable face recognition system are

- The accuracy to identify correct person should be high.
- From detection to recognition, the speed of the system should be fast.
- The image should be recognised regardless of physical factors such as lighting, illumination, ageing etc.

II. DIFFERENT APPROACHES OF FACE RECOGNITION

Face recognition has attract researches in different backgrounds such as face recognition, face pattern, neural networks, computer vision, computer graphics and psychology. It is challenging method, but yet it is interesting. Some of the face recognition methods are

1. Holistic matching
2. Feature-based matching
3. Hybrid matching

1. *Holistic matching methods*

In this method entire face is used as a raw input to a recognition system. The holistic matching method can br classified into linear and non-linear projection methods. Linear projection appearance-based method includes principal component analysis (PCA), independent component analysis(ICA), linear discriminate analysis(LDA) and linear regression classifier(LRC). Non linear projection appearance-based method includes kernel principal component analysis, kernel linear discriminate analysis, and locally linear embedding. In non linear approach the input image is mapped into higher dimensional space in which the face is simplified and linear. Hence traditional methods are applied. In principal component analysis a number of images are taken using grey levels. Each image is mapped to a long vector of grey levels. Several views of each person are collected in the database during training. During recognition a vector corresponding to an unknown face is compared with all vectors in the database. The vector image in the database which is closest to the unknown face is declared as a recognised face. The dimensionality of each vector will be very large. The grey levels are also too sensitive to noise and lighting conditions. A possible solution to these problems are reducing the dimensionality of a space by finding principal component(eigen vectors) to space the face and only a few significant eigen vectors can be used to represent a face thus reducing the dimensionality. In the first case a training set of size nxn is created. After creating training set, each image is converted into vectors. The next step involves is normalisation of vector. Normalisation means finding common features among various images i.e so that each image is left behind with its unique feature. If τ is the normal face vactor vector ψ is the average face vector than the normalised face vector is given by

$$\Phi = \tau - \psi$$

The next step involves calculating eigen values for which covariance matrix is measured

$$C = AA^T \quad \text{where } A = \Phi_1 + \Phi_2 + \Phi_3 + \dots \Phi_n$$
$$A = N \times M$$

where N are the number of rows and M is the number of columns. To recognise an image each k eigen vector is assigned weights. The distance between the input weight vector and all the weight vectors of the training set is compared. If this distance is less than threshold value than the unknown person is not matched but if it is above than the face is matched.

A. Feature based method

In this method the eyes, nose, mouth are located and features are extracted which are feed to the structural classifier. In feature based method face restoration is a big challenge. Due to large variations the system is unable to retrieve features. The extraction methods can be distinguished into

- General methods based on eyes ears and nose
- Feature-template based method
- Structural matching methods (geometrical Constraints on the features)

In digital image processing and computer vision local binary pattern histogram approach is used to recognise a features of a face. This approach was first demonstrated in the year 1990. In texture classification LBP method is found very influential. The detection performance can be regularly and precisely be improved by combining the LBP and Histogram descriptor. Each pixel of an image is assigned an operator. For an 3*3 pixel, a threshold value is set in which all the neighbouring values are compared to the central value and if the value is greater than the central value than it is represented as one, else zero. Local regions are formed and texture descriptor is extracted from these regions. These features are concatenated to farm global description of the face. Spatially enhanced histogram is formed from these global patterns. To measure the distance spatial enhanced histogram is used. To measure the distance weighted chi square is used. To create a LBP feature vector the window is divided into cells and each pixel value in the cell is compared with neighbouring pixel value. If the pixel value of the central cell is less than its neighbouring cells value than it encoded as zero. If the pixel value of the central cell is greater than its neighbouring cells value than it encoded as one.
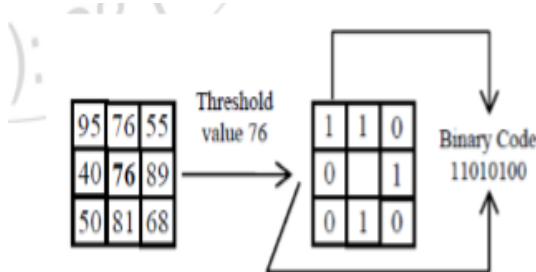
B. Hybrid method

It is a combination of holistic method and feature based matching method. In this method 3-D images are used. This allows the system to note the curves of eyes, nose, cheeks etc. full face can be constructed as the depth and axis of measurement gives a lot of information about the face.this method involves detection of the face either by scanning or by photograph taken in real time. The location, angle and size of the head is positioned. Each curve is measured and a template is made and the region outside the eye, inside the eye, region of the nose is focused. This template is than converted into code. This code is stored in the database and than later compared with input image for recognition.

ACKNOWLEDGMENT

REFERENCES

[1] https://www.ijert.org/research/different-approaches-to-face-recognition-IJERTV4IS090102.pdfI. S. Jacobs and C. P. Bean, "Fine particles, thin films and exchange anisotropy," in Magnetism, vol. III, G. T. Rado and H. Suhl, Eds. New York: Academic, 1963, pp. 271–350.

[2] https://pdfs.semanticscholar.org/4948/c1791412cf13b770d922399c625527b51a6f.pdfR. Nicole, "Title of paper with only first word capitalized," J. Name Stand. Abbrev., in press.

[3] https://www.academia.edu/16472594/FACE_RECOGNITION_TECHNIQUES_AND_APPROACHES_A_SURVEYM. Young, The Technical Writer's Handbook. Mill Valley, CA: University Science, 1989.

[4] https://www.sciencedirect.com/topics/computer-science/face-recognition-approach

[5] http://www.handysolution.com/science/Face_rec12.pdf

[6] http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.47.3791&rep=rep1&type=pdf

[7] https://en.wikipedia.org/wiki/Eigenface

[8] Digital image rocessing-gonzalez (textbook)

[9] https://youtu.be/jQOZrXZTXcw

[10] https://youtu.be/_lY74pXWlS8

[11] https://youtu.be/SaEmG4wcFfg

[12] https://youtu.be/Agtd-NE4we8