SECURITY SYSTEM USING VIOLA JONES FACE DETECTION ALGORITHM

Praful Pathare.[1], Gurjit Singh Saini[2], Prof. R. S. Meshram[3]

[1] *Mr. Praful Pathare BE student, Electronics and Telecommunication Department, Konkan Gyanpeeth College of Engineering, Maharashtra, India*
[2] *Mr. Gurjit Singh Saini BE student, Electronics and Telecommunication Department, Konkan Gyanpeeth College of Engineering, Maharashtra, India*
[3] *Prof. R. S. Meshram Professor, Electronics and Telecommunication Department, Konkan Gyanpeeth College of Engineering, Maharashtra, India*

ABSTRACT

The paper is comprised mainly of three subsystems: namely face detection, face recognition and automatic door access control. Face detection is the process of detecting the region of face in an image. The face is detected by using the viola jones method and face recognition is implemented by using the Principal Component Analysis (PCA). Face Recognition based on PCA is generally referred to as the use of Eigen faces. If a face is recognized, it is known, else it is unknown. The door will open automatically for the person whose face is in the database due to the command of the microcontroller. On the other hand, alarm will ring for the unknown person. Since PCA reduces the dimensions of face images without losing important features, facial images for many persons can be stored in the database. Although many training images are used, computational efficiency cannot be decreased significantly. Therefore, face recognition using PCA can be more useful for door security system than other face recognition schemes. Face detection algorithms focus on the detection of frontal human faces. It is analogous to image detection in which the image of a person is matched bit by bit. Image matches with the image stores in database. Any facial feature changes in the database will invalidate the matching process.

Keyword: - *Face recognition, Viola Jones Algorithm, Security system.*
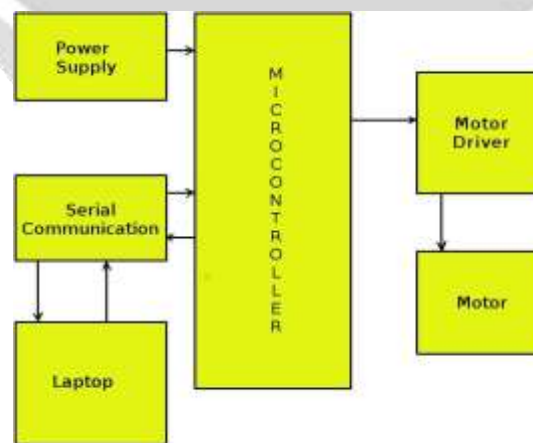
1. METHODOLOGY

Fig-1.1: Block diagram of face recognition system

The automatic personal identification is access control which become popular by using biometrics data instead of using cards, passwords or pattern. Most of the biometrics data have to be collected by using special hardware such as fingerprint scanner, palm print scanner, DNA analyser. The advantage of this system is that face recognition does not require to be touched with any hardware. The performance of the entire face recognition system is influenced by the reliability of the face detection. By using face detection, it can identify only the facial part of an image regardless of the background of this image. There are three more basic and efficient methods. The first method is the magnetic lock connected with a keypad, which requires a password for the magnetic lock to open. The main disadvantages of password system is if the personal identification number is somehow forgotten the system could not be accessed. The second method is used more for businesses, where it requires a card which works on frequency radio. While traditional security systems are reliant on passwords, personal identification numbers (PINs) or smart cards, you can achieve a high level of accuracy with biometrics systems. Face recognition can get high security.

The face detection has received important consideration. In few areas the face detection gain extraordinary position due to various reasons such as verification of identities, large range of commercial and law enforcement available for feasible technologies. Face detection is one of many applications in digital image. processing. It is concerned with the automatic identification of an individual in a digital image. Face detection is used to identifying and locating the human face irrespective of its size, position and situations. Face detection is an easy task for human brain but it is a very difficult task for computer system [1]. To detect the face easily and accurately computer system needs some training factors so that the computer system can easily identify whether it is face or non-face. For detecting the face some thresholds values are sets based on these value a system can detect the human face. If the image specifies the desired threshold value then the image is a face otherwise it is a non-face. Face detection algorithms are divided into two parts: (i) feature based (ii) learning based. The feature based algorithms are based on the statement that the face is detected based on some simple features, independent of light, face variation and posture. The learning based algorithm usage an amount of training models, benefit from statistical models and machine learning algorithms [2].

1.1 Haar Features

The first step of the Viola-Jones face detection algorithm is to turn the input image into a new image representation called an integral image that allows a very fast feature evaluation. The used features are reminiscent of Haar basis functions. The Viola-Jones method analyses a 24*24 sub-window using features consisting of two or more rectangles. Each feature results in a single value which is calculated by subtracting the sum of the white rectangle(s) from the sum of the black rectangle(s). The different types of features are shown in fig-1.2.

Fig-1.2: Different Haar Features

1.2 Classifier

The first step of the Viola-Jones face detection algorithm is to turn the input image into a new image representation called an integral image that allows a very fast feature evaluation. The used features are reminiscent of Haar basis functions. The Viola-Jones method analyses a 24*24 sub-window using features consisting of two or more rectangles. Each feature results in a single value which is calculated by subtracting the sum of the white rectangle(s) from the sum of the black rectangle(s). The different types of features are shown in fig-1.3
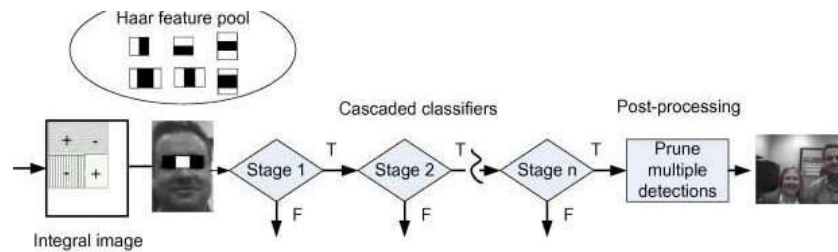
Fig-1.3 Classifier

To extract the relevant features of facial images, Principal Component Analysis (PCA) method is used. Face Recognition based on PCA is generally referred to as the use of eigen faces. Eigen faces are Principal Components of the distribution of faces, or equivalently, the eigen vectors of the covariance matrix of the set of the training images, where an image with N by N pixels is considered as a point in N 2D space.

2. FACE RECOGNITION

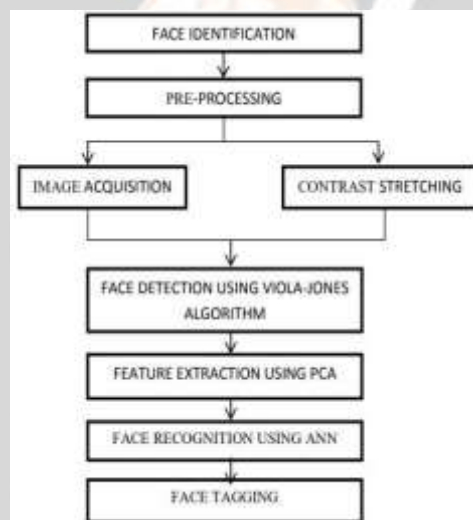The basic flowchart of face recognition process is shown in the fig. 2.1

Fig-2.1: Flowchart

The next step in the process is to identify the detected face using Artificial Neural Network. An Artificial neural network can be compared to a human brain system. The concept of Artificial Neural Network is to make the computer think like human brain. Neural network system has building blocks called as neurons and all the neurons are connected by a path to carry electric current referred to as synapses. An Artificial Neural Network has inputs, outputs and hidden cells shown in fig. 2-2.
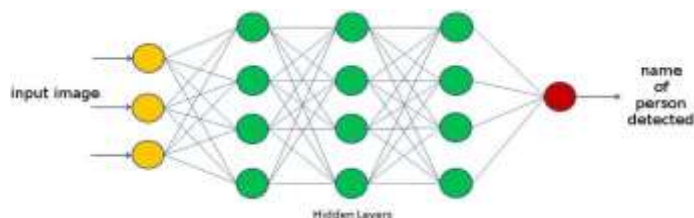

Fig-2.2: Deep neural network

The Neural Network finds the connection weights between the input, output and hidden cells through back propagation technique The Neural Networks learn through the back propagation technique and determine the connection weights between the inputs, outputs and hidden cells and the desired output is calculated. The back propagation uses the formula that has weights, inputs, outputs, error and learning rate to minimize the error.

3. CONCLUSIONS AND FUTURE SCOPE

Viola Jones algorithm for face detection is comparatively more enhanced than any other methods fpr face detection out there. It is state-of-art in object detection. It has faster training as compared to others. The features sought by the detection framework universally involve the sums of image pixels within rectangular areas. As such, they bear some resemblance to Haar basis functions, which have been used previously in the image-based object detection. However, since the features used by Viola and Jones all rely on more than one rectangular area, they are generally more complex situations. The cascade structure allows vast (irrelevant) regions of the image to be discarded with minimum effort, focusing heavier computation on the most promising regions. To my knowledge, no other object detection algorithm has the ability to speed up computation this way. Viola-Jones framework is still popular and state-of-the-art. One can plug in any feature descriptor into the Viola-Jones framework or use any form of AdaBoost but the approach remains the same.

4. REFERENCES

[1] Anil K. Jain, "Face Recognition: Some Challenges in Forensics", IEEE International Conference On Automatic Face and Gesture Recognition, 726-733, 2011.
[2] Gary B. Huang, Manu Ramesh, Tamara Berg, Erik Learned-Miller, Labeled Faces in the Wild: A Database for Studying Face Recognition in Unconstrained Environments, University of Massachusetts, Amherst, Technical Report 07-49, October 2007.
[3] Craw, I., Ellis, H., and Lishman, J.R. (1987). Automatic extraction of face features. Pattern Recognition Letters, 5:183-187.
[4] Bakshi, U. and Singhal, R., 2014. A survey on face detection methods and feature extraction techniques of face recognition. International Journal of Emerging Trends & Technology in Computer Science (IJETTCS), 3(3), pp.233-237.
[5] Maria De Marsico, Michele Nappi, Daniel Riccio and Harry Wechsler, " Robust Face Recognition for Uncontrolled Pose and Illumination Changes" IEEE Transaction on Systems, Man and Cybernetics, vol.43,No.1,Jan 2013.
[6] Jyothi S Nayak and Indramma M, "Efficient Face Recognition with Compensation for Aging Variations", IEEE International Conference on Advanced Computing, pp 1-5, Dec2012.
[7] Varsha Gupta and Dipesh Sharma, " A study of various Face Detection Methods", International Journal of Advanced Research in computer and communication Engineering, Vol 3, Issue 5, May 2014.
[8] Siddarth Ravi, Dattatreya P and Sadique Nayeem, " Face recognition using PCA and LDA: Analysis and comparison", IEEE International Conference on Advances in Recent Technology in communication and Computing, pp 6-16, Sep 2013.
[9] Juwei Lu, K .N. Plataniotis and A.N. Ventesanopouios, " Face recognition using LDA-based algorithms", IEEE Transactions on Neural Networks, pp 195-200, Vol 14, Jan 2003.
[10] Zhen Lei, Shengcai Liao and Stan Z. Li, " Efficient feature selection for LDA and its application to face recognition", IEEE International Conference On Pattern Recognition, pp 1136-1139, Nov 2012.
[11] Paul Viola, Michael J. Jones, Robust Real-Time Face Detection, International Journal of Cumputer Vision 57(2), 2004.
[12] Henry A. Rowley, Shumeet Baluja, Takeo Kanade, Neural Network-Based Face Detection, IEEE Transactions on Pattern Analysis and Machine Intelligence, Volume 20, Issue 1, Jan 1998. Digital Object Identifier 10.1109/34.655647.