ISSN: 0975-8585

Research Journal of Pharmaceutical, Biological and Chemical Sciences

Face Recognition for Home Security System.

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ABSTRACT

For human and computer interaction (HCI) the first stage is to recognize. Biometrics is a computer technology where the identification of human is based on biological characteristics. The facial recognition is a part of biometrics can be achieved by strong data set. This paper proposes the identification of face. The face is captured and is stored as password. This data set is now used to authenticate the person. This implementation is done for home security system. This paper aims in bringing home security by where the module is fixed at the door step. The face is stored in the database. The authentication of face is done. When the dataset matches the sensor gets activated by the automation system to open the door. When the data set is not matched then the captured face by the camera is sent as a message to the authenticated person's mobile phone.
Keywords: Gray scale conversion; PCA; Eigen vectors.

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ISSN: 0975-8585

INTRODUCTION

This project is mainly developed for the security purpose at home. The concept of principles of component analysis and independent component analysis are being used. This is a database where the various facial expressions of the authenticated person is given. The comparator module is used to compare the captured image of the person with the facial expressions of the authenticator. If the dataset matches then sensor is turned on for the door automation system. The message is sent to the mobile phone through the mobile app. If the dataset does not match then the captured image is sent to the authenticated person's mobile phone. To make feasible more rigorous, quantitative measurement of facial expression in diverse applications in facial expression and computerized image processing, automated methods of facial expression analysis are developed. To precede at first the pre image processing should be done. Then face recognition is done using Eigen values eliminating the unwanted data for recognition. Face recognition has the defect that it should eliminate small changes in face that is like temporary scars, facial hairs etc.

Image processing and Face Recognition

Before the image is processed the image needs to be preprocessed. The preprocessed image has the nethermost level of perception. The input and the output of the image are called concentrated images. The image apprehended by the sensor is iconic images and are the original images captured by the sensor with the intensity image. It is usually put in a matrix of function values. It increases

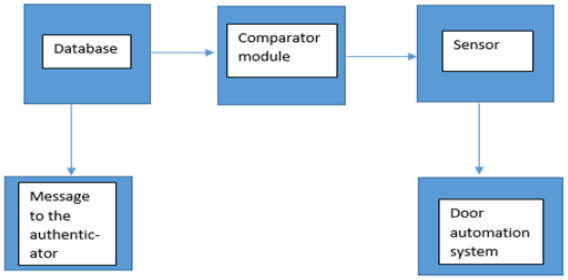

Fig. 1.Overall architecture

GRAY SCALE CONVERSION

The original image contains about 1crore and seventy lakhs colors (since the input image has 2 power 24 bit colors). This original 24 bit image will be converted into gray scale image. The gray scale image contains 2 power 16bit (65536) colors. This color conversion is performed by using the pixel values of the original image.

Fig. 2.Conversion of Gray Scale Image

FACE DETECTION AND RECOGNITION

Face detection is a computer technology that determines the locations and sizes of human faces in capricious (digital) images. It detects facial features and ignores anything else, such as buildings, trees and bodies. Face detection is used in biometrics, often as a part of (or together with) a facial recognition system. It is also used in video surveillance, human computer interface and spitting image database management. Some current digital cameras use face detection for auto focus.

ISSN: 0975-8585

Fig.3.Focusing on head from the whole background

PRINCIPLE COMPONENT ANALYSIS

PCA is method used for treating the dataset, it reduces the dimensions from multidimensional to lower dimension by analysis. When it is now technical, PCA can be transformed in the form of linear that can transform the data. The new coordinate system is created or identified such that the greatest variance will be any projection of the data comes to lie on the first coordinate (called the first principal component), the second greatest variance on the second coordinate, and the third greatest variance on the third coordinate and so on. PCA can be used for dimensionality drop in a dataset while retaining those characteristics of the dataset that endow most to its variance, by keeping lower-order principal components and ignoring higher-order ones. Such low-order components often contain the "most important" aspects of the data. But this is not necessarily the case, depending on the application.

PCA is a useful numerical technique that has found application in fields such as face recognition and image compression, and is a common technique for finding designs or patterns in data of high dimension. It is a way of identifying patterns in data and expressing the data in such a way as to highlight their similarities and differences. Since patterns in data can be hard to find in data of high dimension, where the luxury of graphical representation is not available, PCA is a powerful tool for analyzing data. The other main advantage of PCA is that once you have found these patterns in the data, and you compress the data, i.e. by reducing the number of dimensions, without much loss of information. This technique is also used in image compression.

Step 1: Get some data

Here we need to take some sets of data. For explanation purpose let's take data set which has only got 2 dimensions

Step 2: Subtract the mean

For PCA to work properly, you have to subtract the mean from each of the data dimensions. The mean subtracted is the average across each dimension. So, all the values have (the mean of the values of all the data points) subtracted, and all the values have subtracted from them. This produces a data set whose mean is zero

TABLE I . NORMAL DATA

Normal Data		**Data Adjusted**	
X	**Y**	**X**	**Y**
2.5	2.4	-69	-40
0.5	0.7	-1.31	-1.21
2.2	2	0	0.2
1.9	2.2	-0.3	0
3.1	3	1.2	1
3.3	2.7	0.4	0.7
2	1.6	10	31
1	1.1	-81	-83
1.5	1.6	-0.31	-0.33
1.1	0.9	-0.71	-1.01

ISSN: 0975-8585

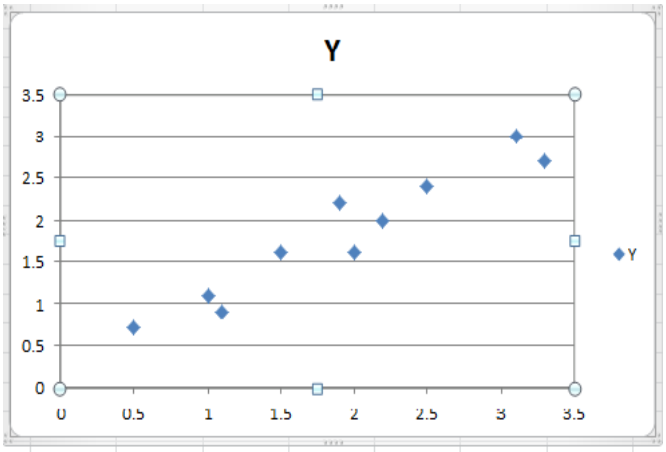

Fig. 4.PCA example data, original data on the left, data with the means subtracted on the right, and a plot of the data

EIGEN VALUES

Face Images are projected into a feature space ("Face Space") that best encodes the variation among known face images. The face space is defined by the "Eigen faces", which are the eigenvectors of the set of faces. As mentioned, one of the goals that the feature extraction routine wishes to achieve is to increase the efficiency. One simple way to achieve this goal is using alternative orthonormal bases other than the natural bases.

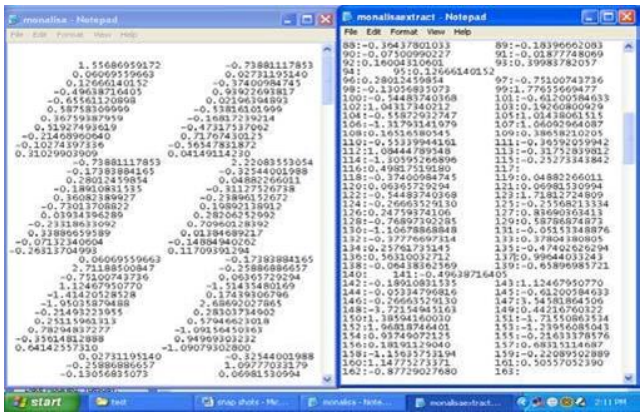

Fig. 5.Calculating Eigen vectors and Eigen values

FACE EXPRESSION RECOGNITION

Facial expression communicates information about emotions, regulates interpersonal behavior and person perception, indexes physiologic functioning, and is essential to evaluating preverbal infants. Current human-observer methods of facial expression analysis are labor intensive and difficult to standardize across laboratories and over time. These factors force private detective to use less specific systems whose convergent validity is often unknown. To make practicable more arduous, reckonable measurement of facial expression in diverse applications, our interdisciplinary research group, with knowledge in facial expression and computerized image processing, is developing automated methods of facial expression analysis. Expression implies a disclosure about the characteristics of a person, a message about something internal to the expresser. In the context of the face and nonverbal communication, expression usually suggests a change of a graphic pattern over time, but as a static painting can express a mood or capture a sentiment, so too the face can express relatively static characteristics.

Emotions in Man and Animals, Charles Darwin wrote that repulsion refers to something revolting. Fear is an emotional response to impending danger that is tied to anxiety. Most fear is usually connected to throbbing

ISSN: 0975-8585

(i.e., some fear heights because if they fall, when they land, they will be in great pain). Behavioral theorists that dread is one of several very basic emotions (e.g., joy and anger). Fear is a survival mechanism, and usually occurs in response to a specific negative stimulus. Surprise pronunciation is a brief emotional state that is the result of experiencing an unexpected event. Surprise can have any valence, that is, they can be neutral, pleasant, or unpleasant. Accordingly, some would not categorize surprise in itself as an emotion. In everyday language depression refers to any downturn in mood, which may be relatively transitory and perhaps due to something trivial. In the field of psychiatry, the word depression can also have this meaning but more specifically refers to a mental illness when it has reached a severity and duration to warrant a diagnosis. Happiness is an emotion in which one experiences feelings ranging from contentment and satisfaction to bliss and intense joy.

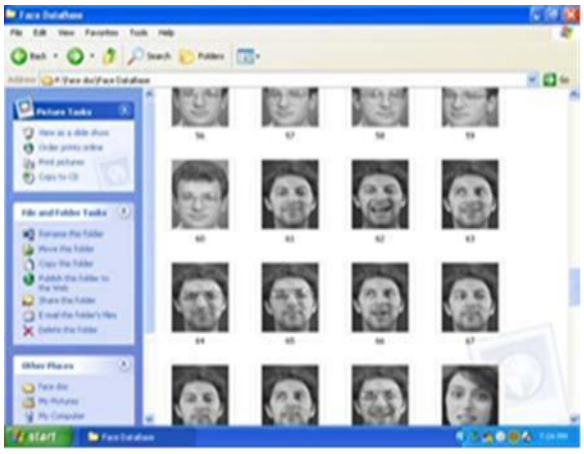

Fig. 6.Database of detecting various facial expression

Fig.7. Data base for different edge images

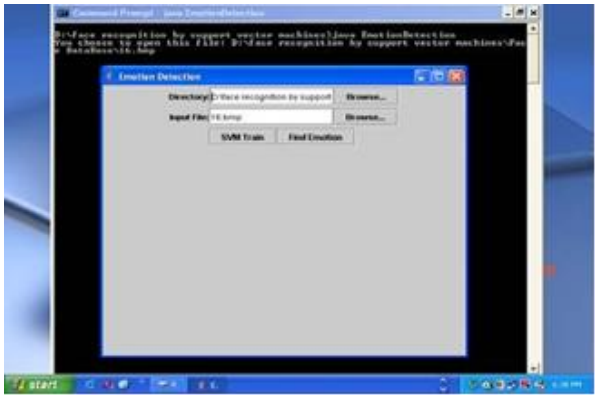

Fig.8.Output screen after authentication

ISSN: 0975-8585

WORKING MODEL

1) Stepper Motor: The Stepper motor is the DC motor which is has no brushes. Its work is to divide a full rotation into number of equal steps. Stepper motors have multiple toothed electromagnets arranged around a central gear-shaped piece of iron. The electromagnets are invigorated by an external control circuit such as microcontroller. This motor is used for to switch the webcam so that all outlooks of the room can be monitored.

2) Webcam: For keeping eye in the home, the camera is used. Web camera will capture all the outlooks of the home as it will rotate in 360˚. The webcam is fitted on stepper motor. The captured views will display on users remote workstation when he will enter the IP.

3) Electromagnet: The electromagnets are used in the latches. The electromagnet has north and south poll. When the latch is close, the electromagnet poll will get attracted to each other and when the circuitry moves, the doors automatically get opened.

Fig.9.Home Screen of Home security app

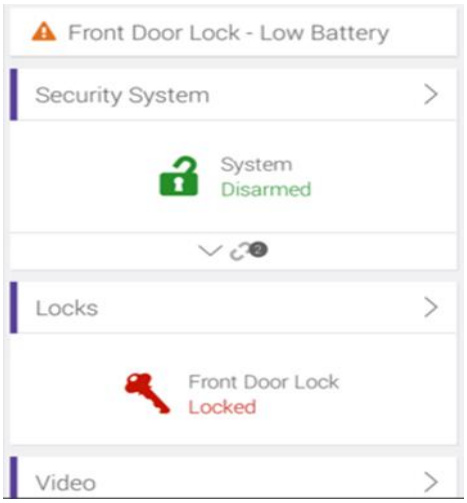

Fig.10.Status Screen of security status of Home security app

ISSN: 0975-8585

Fig.11.Settings Screen of Home security app

CONCLUSION

The basic vision of the home security system is to provide a convenient and a secure system to the user, which would aid the high degree of mobility and control, people aim to achieve nowadays. The system can be made efficient by modularizing each and every component of the system hence ensuring that it can be integrated with a varied range of devices.

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