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Smart Reconnaisance and Apprise System using Raspberry PI

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Abstract: ***In day today life, the security of our belonging is becoming more important. The modern surveillance is integrated with many automation technologies. In this modern world, crime has become ultra modern tool. At this point of time a lot of incident occurs like robbery, stealing unwanted entrance happens, threatening abruptly. So the security does matters in this daily life. This paper presents the monitoring and controlling of surveillance system enhanced with WI-FI (IEEE 802.11) technology. This system consists of webcam, Raspberry PI (BCM2837).In this system, webcam is used to detect the motions or to trace out the intruders and also detect fire. In case of any human movement or fire accident occurs, the webcam will capture live data in the surroundings and transmit it to authorized user through WI-FI(IEEE 802.11). Simultaneously, the buzzer alerts the nearby neighbors. The system also consist of sprayer, sprays the chloroform liquid on the intruders.***
Keywords: surveillance, WI-FI, Raspberry PI.

I. INTRODUCTION

Face detection and recognition has been used for the purposes of surveillance, security, human computer interaction, etc. Different methods of face detection are Viola Jones Face Detection Algorithm, Principle component analysis, Haar classifier [1-2], Local Binary Pattern, AdaBoost Algorithm. In this Paper, Haar classifier extracted from Viola Jones algorithm is used for to detect face. Various models of face detections and face is used mostly for the purposes of criminal detection and recognition. Some face recognition methods analyze the geometric features of facial images, such as location and distance between nose, eyes and mouth [7, 8], which are not so effective because of the light illumination and expressions in face. To prevent this, a holistic image is created to obtain all features from face. Thus Viola Jones developed Haar classifier, which is a real time face detection algorithm [9]. A Facial recognition is an application to identify or recognize a person from an image source or video source by comparing it with a pre-defined library. For facial recognition we are using various algorithms like Fisherface algorithm, the hidden Markov model, the multi linear subspace learning using tensor representation, and the neuronal motivated dynamic link matching.

II. PROPOSED METHOD

A. Face Detection

Face Detection is done using Haar Classifier Algorithm. Object Detection using Haar feature-based cascade classifiers. It is a machine learning based approach where a cascade function is trained from a lot of positive images (images of faces) and negative images (images without faces) to train the classifier. Then we need to extract features from it. For this, haar features [16,17].For each feature calculation, they introduced the integral images. It simplifies calculation of sum of pixels. But among all these features we calculated, most of them are irrelevant. selection of 160000+ features is achieved by Adaboost. For this process there will be errors or misclassifications. We select the features with minimum error rate. The process is continued until required accuracy is achieved. It is said that even 200 features provide detection with 95% accuracy. Rather than applying all the 6000 features on a window, combine the features into various stages of classifiers and apply one-by-one. The window which passes all stages is a face
Fig. 1 contains five Haar patterns. The position and size of a pattern can change if its black and white rectangles have the same dimension and border, and each of them keep their relative positions for suppose, 4 look up tables of an integral image as:
Sum= I(C) + I(A) – I(B) – I(D) →(1)

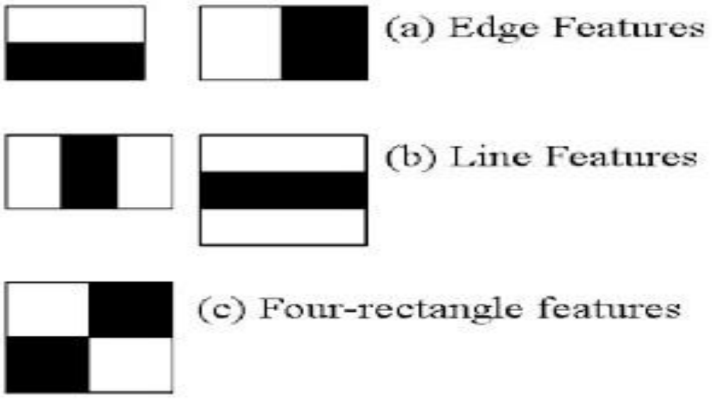

Fig 1.Haar classifier patterns

Thus a preprocessed database is made using haar classifier algorithm and stored. For modifying the pixels of the image without changing its color, we are using geometric transformation. For geometric transformation, we are first of all changing the rgb image into gray for enhancing its contrast and are saving the old points in a pointer. The subject is in motion, therefore morphing of the new and old image is performed for modifying the pixels of the images and then again we will convert our gray image into RGB image.

1) Forward mapping

$x=x(s, t) \rightarrow (2)$

$y=y(s, t) \rightarrow (3)$

Such that equations (2) and (3) can be represented as,

$\mathbf{x}=x(\mathbf{s}) \rightarrow (4)$

2) Inverse mapping

$s=s(x, y) \rightarrow (5)$

$t=t(x, y)' \rightarrow (6)$

such that equation (5) and (6) can be represented as,

$\mathbf{s}=s(\mathbf{x}) \rightarrow (7)$

let f(s, t) or f(s) represent the old image and h(x, y) or h(x) represent the new image.

$h(x, y)=f(s(x, y), t(x, y))$ or $\mathbf{h}(x)=f(s(\mathbf{x})) \rightarrow (8)$

$f(s, t)=g(x(s, t),y(s, t))'$ or $\mathbf{f}(s)=g(x(\mathbf{s})) \rightarrow (9)$

III. FACE RECOGNITION

For face recognition we are using fisherface algorithm. One way to represent the input data is by finding a subspace which represents most of the data variance. This can be obtained with the use of Principal Components Analysis (PCA). PCA yields a set of eigenfaces. These Eigen faces are the eigenvectors associated to the largest Eigen values of the covariance matrix of the training data. For this find a subspace that maps the sample vectors of the same class in a single spot of the feature representation and those of different classes as far apart from each other as possible. LDA is used to find the subspace representation of a set of face images, the resulting basis vectors defining that space are known as Fisherfaces[18,19].

A. K-Fold Cross Validation

To determine the error of "face recognition algorithm", I have made an data base by capturing images of people over long time and now I am training module and test set from these images. Somehow I have managed to put all reactions like happy or sad, the results I got from this evaluation is really unfortunate split of my data. Such splits are prevented by cross-validation, as we build k (non-overlapping) training and test datasets from the (shuffled) original dataset. So what's a fold then? It's best explained with an example.

For a dataset S with 3 classes {c0,c1,c2} each having 4 observations {o0,o1,o2,o3}, a 4-fold cross validation produces the following four folds F

(F1)

o0 o1 o2 o3
c0 | A B B B |
c1 | A B B B |
c2 | A B B B |
A = {D[c0][o0], D[c1][o0], D[c2][o0]}
B = D\A
(F2)
o0 o1 o2 o3
c0 | B A B B |
c1 | B A B B |
c2 | B A B B |
A = {D[c0][o1], D[c1][o1], D[c2][o1]}
B = D\A
(F3)
o0 o1 o2 o3
c0 | B B A B |
c1 | B B A B |
c2 | B B A B |
A = {D[c0][o2], D[c1][o2], D[c2][o2]}
B = D\A
(F4)
o0 o1 o2 o3
c0 | B B B A |
c1 | B B B A |
c2 | B B B A |
A = {D[c0][o3], D[c1][o3], D[c2][o3]}
B = D\A
From these folds the accuracy and the standard deviation can be calculated.

B. Fisherfaces

The preprocessed data sets obtained from k-fold cross validation is used to compare the real time images obtained from camera. To compare these images we use fisherfaces algorithm.[3,6]

For this process we first import the module, then read the dataset. Now create the model default parameters. And then perform a Leave-One-Out Cross-Validation. It provides an accuracy of 96.36. Performing 10 runs of a 5-fold cross validation. Although the standard deviation is slightly higher for the Fisherfaces, with 96.80%+-1.63% it outperforms the Eigenfaces method. You can also see that the faces were reduced to only 14 components (equals number of subjects – 1).Now import the visual module and plot the faces. The Fisherfaces are a bit harder to understand, because they identify regions of a face that separate faces best from each other. None of them seems to encode particular light settings,and not as obvious as in the Eigenfaces method. I could only guess which component describes which features. What is lost in the Fisherfaces method is the ability to reconstruct faces. Atlast we plot it. As a result we'll get back a picture similar to the below figure

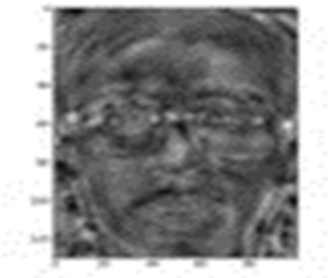

Fig. 2

III. EXPERIMENTAL RESULTS

The snapshot of the proposed system is shown in Figure 3,4,5,6.

Fig.3 Preprocessed dataset

Fig.4 Preprocessed datasets of hierarchial similarity

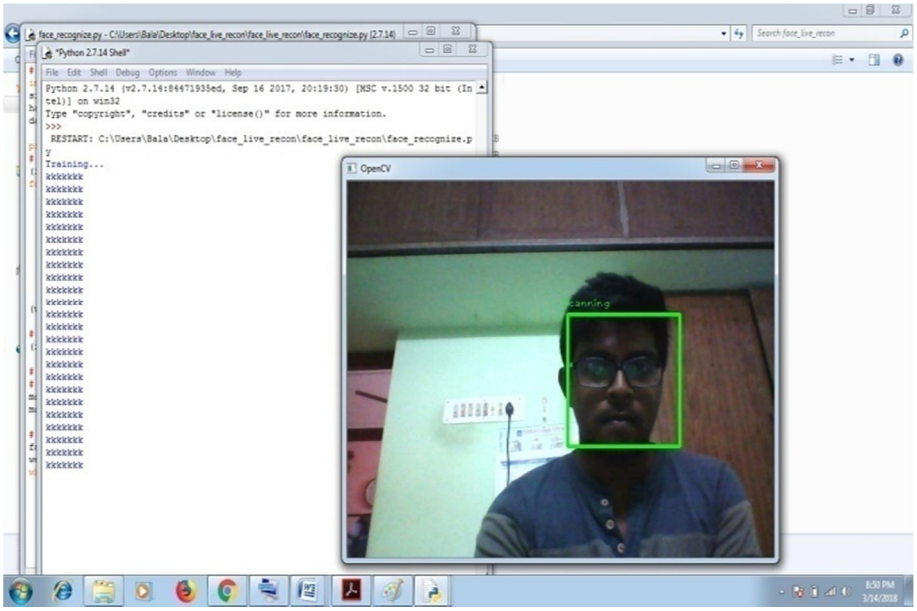

Fig. 5 Recognizing the face

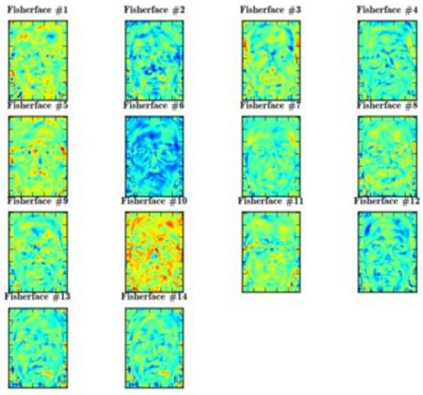

Fig. 6 Fisherfaces

IV. CONCLUSION

The proposed approach may represent a very useful method for smart surveillance system. To the best of our knowledge compared with existing method of recognition like hidden markov model this method is much fast. However the results should be taken with care since the reported studies use different image set. It can be used for identifying persons from database and it can also be used as an automatic attendance system. Future work can allow further improvement by recognizing various other substances in the images like fire detection.

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