Efficient Face Recognition Algorithm And Background Subtraction Application

Arihant Bhandari[1], Pranik N. lalwani[2], Prakash chandra[3], Pallavi N[4]
[4]Assistant Professor
[1, 2, 3, 4] Atria Institute Of Technology

Abstract- *Various face acknowledgment strategies have been formulated and connected in the course of recent long stretches of innovative advancement. Fields like security and reconnaissance have broadly utilized face acknowledgment throughout the years as individuals are extremely worried as to recognizing and getting lawbreakers or individuals with mal aims. Getting them without having the capacity to speedily perceive and their appearances has been a noteworthy issue. An individual's facial highlights are dynamic and have variable appearances, which makes it an issue to be extremely exact and quick in distinguishing proof of an individual. Not just this, security get to controls through face recognizers makes it very troublesome for programmers and wafers to utilize an individual's personality or information. The essential goal of this paper subsequently is to comprehend a few previous face discovery and acknowledgment and build up an innovation such which can help get offenders expeditiously and just as shield individuals' security and personality from programmers. Numerous facial databases have been considered in order to separate them in states of changes in stances, enlightenments and feelings. Different conditions to block ID of countenances are examined later. The paper portrays traffic control and street security issues and their answers utilizing picture preparing calculations. We have built up a calculation to recognize ceased vehicles amid traffic reconnaissance. Our calculation depends on foundation estimation in picture groupings*

Keywords- Face recognition, Live video feed, Face detection, SVD, PCA, Fisherface, Biometrics,traffic surveillance; video analysis; background subtraction;

I. INTRODUCTION

For as long as quite a while, face acknowledgment in biometrics, design acknowledgment, and security observation offices has assumed a urgent job.

In this day and age, it is incredibly extreme and hard to verify an individual's way of life just as assets from hoodlums and fakes. The wrongdoings found in the updates on each other day where there is Mastercard extortion, hacking of PCs and essential information and security dangers looked by organizations or government offices are expanding quickly. The fundamental explanation behind the disappointment and these security breaks is that the verification is done on premise of not our biometric personality [1] but rather based on codes or passwords created by us or machines like our character cards, PINS and so forth. This innovation based on perceived or checked on premise of their physiological highlights like retina, penmanship, thumb impressions.

This paper essentially centers around how we can have better and progressively proficient observation and security affirmation as and when required by associations or government organizations to initially expand their verification system to stay away from wrongdoings and besides it will help get hoodlums and cheats.

This paper depicts the answer for traffic control framework– halted vehicle identification. In the event that a vehicle stops out and about, it might be an obstacle for traffic and represent a genuine risk. In this case, a convenient recognition of such circumstance permits to caution other street clients and illuminate the crisis benefits in time.

Segment 2 of this paper presents fisherface, PCA (Principle segment examination) and SVD (single esteem deterioration)- based calculation and tells how highlight extraction is finished by projections and how these calculations fill in all in all .Section 3 of this paper contains writing review of two papers read and comprehended which were additionally utilized for premise in this exploration.. Segment 4 gives productive calculation and segment 5 gives utilization of foundation subtraction calculation .Section 6 of this paper demonstrates the outcomes and execution with dataset precedents which were utilized. Area 7 gives the end and future extent of this paper.

II. FACE RECOGNITION USING THEORY OF OPTIMAL LINEAR PROJECTION

Principal component analysis method for most expressive features, combined with fisherface for most discriminating features[2] will be used to get face recognition to be optimized

and most efficient. Face recognition by PCA was first used by Turk and Pentland[3].

The PCA method is basically vector representations shown by the following formula:

$$y = A^T x \quad (1)$$

The above equation represents feature vector y as projection of vector x on domain A.

PCA algorithm is based on using eigenvectors [3]. We hence don't need to design classifiers for these models as Euclidean distance can be used to recognize faces because the generated vectors are not correlated to each other.

The **fisherface**[4] method is based on the ratio of the similarity in the faces of two or more people for the basis of comparison. The procedure of this algorithm is as follows:

Given that the total number of images of each of the people is K and number of people are C and total number of images are N the existing number of eigenfaces [3][9] is equal to N-1 obtained by the PCA method. The determinant hence obtained S_w and S_b are as follows:

$$Sw=\sum_{i=1}^{c}\sum_{j=1}^{k}(y_j - M_i)(y_j - M_i)^T \quad (2)$$

$$Sb =\sum_{i=1}^{c}(M_i - M)(M_i - M)^T \quad (3)$$

Here it is observed that the value of"M_i = mean vector of the ith class & M = mean vector of all the classes. c-1 D feature vectors are hence obtained by projection of the vectors of PCA model on the Fisherface matrix. The faces are then recognized using predetermined feature vectors [2]."

SVD-based face recognition is a method according to which, a singular value decomposition for projection and recognition is used. It is basically 2D-PCA [5][6] algorithm. The left and right singular vectors compose the matrix which then store the face features.

III. LITERATURE SURVEY

In this section, existing researches and papers on different face recognition techniques have been analyzed.

Chou-Hao Hsu and Chaur-Chin Chen [13] worked upon "SVD-Based Projection for Face Recognition" and the paper proposed a system requiring less memory than any other approaches and also the tested database was ORL of 40 subjects and it achieved a total 97.5% recognition rate. Shang-Hung Lin [12] wrote on "An introduction to face recognition technologies" which gives a basic overview to several existing algorithms like eigenfaces, fisherface, neural networks and so on. As well as, it explains the generic framework for the system and how the face recognizer faces several problems like camera positioning, illuminations etc, they are also well elaborated in this paper.

Faizan Ahmad et al [14] wrote a paper on "Image-based Face Detection and Recognition". Evaluation of several face detection and recognition algorithms was done through this paper. Image based face detection and recognition with better accuracy was the solution provided and 5 datasets were trained and tested to evaluate for the same based on different poses,

illumination, races and emotions. It was a step towards video based face detection and recognition. The highest recognition rate in their evaluation was obtained by Gabor algorithm and
the value was 92.35%.

IV. EFFICIENT ALGORITHM

A novel model is proposed so as to improve precision and accuracy of recognition. There are several conditions which obstruct obtaining efficient face recognition like illumination, translation, angle of the photo, rotation, hairstyle, spectacles, makeup, background, distortion etc. These are the complications which mainly need to be tackled. It has been tried to solve it to the best possible limit.

The steps followed in the algorithm are explained in a simplified manner as follows and shown in the flow chart below:

Step 1:
Two dataset models will be trained for recognition purposes, first using fisherface[10] to extract features and using the k-nearest neighbor [7][8]method to use as classifier. The second one will be trained using the SVD- based technique.

Step 2:
A subset will be obtained of the predicted subjects from the resulting sets of the two trained models.

Step 3:
If the subset obtained contains more than one unique label,
Then rank all the labels according to the minimum distance and choose the label with lowest rank.

Step 4:

The final resulting face recognized is hence obtained and the output is given as desired.

V. APPLICATION:STOPPED VEHICLE DETECTIONALGORITHM

Stopped vehicle detection algorithm is based on background subtraction technique [16]. Algorithm work can be divided into the initialization stage and the stage of stopped object detection.

Initialization stage is initial background estimation. For this purpose, an averaging filter is applied: the average value of brightness for a given number of frames is determined in each pixel of the image [17]. Thus, the initial background estimation is done by accumulating the information about the pixel brightness for a sufficiently long period of time.

When detection algorithm is based on background subtraction, one of the tasks is to update the background estimation. To do so, our algorithm uses an exponential filter [18]. With background estimation done, object detection can be carried out by analyzing the module of the difference between the current image and the background.

Our approach is based on a current background estimation BG_N and a queue of background estimations for various short time intervals BG_i (i= 0..N–1). Then we subtract the earliest background estimation from the current background estimation for stopped object detection.

Thus, the stopped object detection stage comprises
the following steps.
x Processing of binary image B_D.
x Information accumulation in matrix S about the duration of assigning each pixel to the object.
x Getting matrix B_S by binarizing matrix S.
x Objects marking and parameterization.
x Update of background estimations

Next step is binary image B_D postprocessing in order to connect small segments. To do so, morphological operations of opening and closing are applied. It is also possible to use a predetermined mask for zeroing pixel values in the image B_D in areas not belonging to the roadway.

Matrix S is created in order to account for the temporary detection threshold. It stores for each pixel the number of frames in which this pixel is classified as belonging to a stopped object. Update of the matrix S is performed for each frame and based on the information in the image B_D.

Binary image B_S is the result of the matrix S thresholding.

The threshold is set according to required detection time. Finally, marking and parametrization of selected objects is performed basing on image B_S. During the procedure, each object is assigned with a unique number, coordinates and area are calculated. Too small objects are rejected.

To update the current background estimation BG_N, the exponential filter input is supplied with current image I_N. As a result, BG_N will accumulate information about stopped objects.

Update of earlier background estimations BG_i (i= 0..N–1) is based on the mask, which is binary image B_D. For pixels that belong to stopped objects, the brightness value is averaged over all background estimations BG_i (i= 0..N–1). After a predetermined short period of time, background estimation queue shifts, the earliest estimation is rejected (BG_0 = BG_1, …, BGN–1 = BGN).

Figure 1. Detection of 3 stopped vehicles.

VI. RESULTS AND ANALYSIS

The work was performed on a computer with specifications as follows: Intel Pentium core i5 processor with 1.7-2.4 GHz clock and 4GB RAM memory. The software has been written in python. The AT&T Face database was used to obtain images
(ORL images)[11].

The dataset which we used were 10 different images each of 40 test persons. The images have been captured in different illuminations, emotions such as crying, frowning etc, various physiological details like moustache beard and spectacles (all issues as discussed in earlier sections).

Work was done with images of size 128 x 128[11] from original size of 320 x 243 for a total of 4 face recognition algorithms. The ORL database which was used and the dataset trained were obtained from a paper on human face identification cited [15]. To tackle the background problem, a dark homogeneous background was used behind the faces. The persons were made to stand in upright, frontal position (with slight pose changes).

The following results were obtained for Stopped Vehicle Detection.

TABLE I. RESULTS OF STOPPED VEHICLE DETECTION

Test video	Results		
	TP	*FN*	*FP*
1	4	0	0
2	3	0	0
3	4	0	0
4	2	0	0
5	2	0	0
6	1	0	1
7	1	0	0
8	1	0	0
9	1	0	0
10	3	0	0
11	22	0	1

VII. CONCLUSION AND FUTURE SCOPE

In conclusion, in this paper the combination of the PCA model along with fisherface method and SVD projections has been used to gain results for better and higher efficiency and accuracy. The efficiency is indeed improved and recognition rates are increased but still there is still need and scope for better creations of training sets and the way changes in the face affects the efficiency.

It is realized that Face recognition is highly challenging but also a very crucial technique. Face recognition technique is non intrusive which gives it an upper edge over all biometric technologies existing, that was also the main reason for choosing this topic.

In the paper we described one of the tasks of traffic surveillance – stopped vehicle detection. We introduced an algorithm to process video sequences from optical sensor performing traffic surveillance. The algorithm is based on background subtraction and designed to detect and localize stopped vehicles.

It is a hope and an endeavor that this paper helps increase and creates more options and better opportunities in face recognizing techniques and through this it is also encouraged that others do the same and make this technology the best at our disposal.

VIII. ACKNOWLEDGMENT

The work has been done in the university and home. I would like to thank Mrs. Pallavi N for his guidance and support. He encouraged me to write this research paper. I am also grateful to my family for putting up with us.

REFERENCES

[1] R. Chellapa and S. Sirohey, "Human and Machine Recognition of Faces: A Survey," Proceedings of the IEEE. Vol. 83, no. 5, May 1995.
[2] D. L. Swets, and J. Weng, "Using Discriminant Eigenfeatures for Image Retrieval," IEEE Trans. on Pattern Analysis and Machine Intelligence, vol. 18, no. 8, pp. 831-836, August 1996.
[3] M. Turk and A. Pentland, "Eigenfaces for recognition," J. Cognitive Neuroscience,vol. 3, 71-86., 1991.
[4] J Lu, K. N. Plataniotis, A. N. Venetsanopoulos, Face recognition using LDA-based algorithms, “IEEE Neural Networks Transaction”, 2003.
[5] M. Li and B. Yuan, ”2D-LDA: A statistical linear discriminant analysis for image matrix”, Pattern Recognition Letters, vol. 26, pp.527- 532, 2005.
[6] J. Yang and D. Zhang, A.F. Frangi, and J.Y. Yang, ”Twodimensional PCA: a new approach to appearance-based face representation and recognition”, IEEE Trans. on Pattern Analysis and Machine Intelligence, vol. 26, no. 1, pp.131- 137, 2004.
[7] M. Kirby and L. Sirovich, “Application of the KarhunenLo´eve procedure for the characteriza-tion of human faces,” IEEE Trans. Pattern Analysis and Machine Intelligence, vol. 12, no. 1, pp. 103–108, Jan. 1990.
[8] A.M. Martinez and A.C. Kak, “PCA versus LDA,” IEEE Trans. Pattern Analysis and Machine Intelligence, vol. 23, no. 2, pp. 228–233, Feb. 2001.
[9] A. P. Pentland and M. A. Turk, "Face Recognition Using Eigenfaces," in Proc. the International Conference on Pattern Recognition, pp. 586-591, 1994.
[10] P. N. Belhumeur, J. P. Hespanha, and D. J. Kriegman, "Eigenfaces vs. Fisherfaces: recognition using class specific linear projection," IEEE Trans. on Pattern Analysis and Machine Intelligence, vol. 19, no. 7, pp. 71 1-720, July 1997
[11] Hyung-Ji Lee, Wan-Su Lee, and Jae-No Chung: “Face Recognition using Fisherface algorithm and elastic graph matching” ,IEEE Image Processing 2001, proceedings 2001, international conference.
[12] Shang hung Lin-PhD: “An introduction to face recognition technologies”, IC media corporation.
[13] Chou-Hao Hsu and Chaur-Chin Chen: “SVD-Based

[14] Projection for Face Recognition" , IEEE EIT 2007 Proceedings. [14] Faizan Ahmad, Aaima Najam and Zeeshan Ahmed:
"Image-based Face Detection and Recognition", IJCSI International Journal of Computer Science Issues, Vol. 9, Issue 6, No 1, November 2012.

[15] F. Samaria and A. Harter : "Parameterisation of a stochastic model for human face identification", 2nd IEEE Workshop on Applications of Computer Vision December,1994.

[16] Y. Benezeth, B. Emile, H. Laurent, and C. Rosenberger, "Review and evaluation of commonly-implemented background subtraction algorithms," International Conference on Pattern Recognition, pp. 1–4, December 2008.

[17] M. Piccardi, "Background subtraction techniques: a review," Proc. of IEEE International Conference on Systems, Man and Cybernetics, pp. 3099–3104, 2004.

[18] J. Heikkila, O. Silven, "A real-time system for monitoring of cyclists and pedestrians," 2nd IEEE Workshop on Visual Surveillance, pp. 74– 81, 1999.