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Missing Person Identification and Tracking for Intelligent Video Surveillance

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ABSTRACT: Missing person identification and tracking for intelligent video surveillance systems .Due to some reason the people leave the home or some child or old man's forget the route of home to this missing case entry is updated in police station by using CCTV camera technology compare the each person with the available database and find these people. To improve this system concept system is designed.In this systemdesigned to find the missing people. If the missing person found in the CCTV Video streaming then track the location of missing person.After missing person found in the CCTV Video streaming then send location SMS to relatives of missing person and Police station. So our system can perform the very important role in security and authentication issues. The user performs the main role in the system. Firstly he can register in the system, after the registration he can login to the system. User also adds the missing person details in the system. If missing person found in video then user can send SMS to the police station and also to person'srelatives.Here the admin perform the all administrative role in this system. Admin can add the user, remove the user etc. After getting the user's result admin can view those details.

KEYWORDS: Face Detection, Facial Feature, Video Streaming.

I. INTRODUCTION

One of the most interesting areas of human computer interaction is face detection and tracking. Distinguishing facial features are comparatively low and it is most interesting task to observe these. Detection and tracking face objects from video is a challenging task.Finding a missing person case can be one of the most challenging assignments you will handle in your career. The officer responding to a missing person call is in many cases responding to a situation where the reason for an individual's disappearance is unknown. A face is the best way to detect and recognize a person. No recognition algorithms will work without face detection step. Rate of detection affects the recognition stage. With all these noise is a very difficult task to detect and localize an unknown non-face from still image or video image.Face detection and recognition in surveillance applications is still a challenging task since face images may be affected by changes in the scene, such as pose variation, face expression, or illumination. The main goal to propose this system is to find the missing person with the help of CCTV camera video input and report their location to the police station and also relatives of that specific person. A face recognition technique which is used here to matches the train face image to the original faceimage. Verification algorithm used in this system which is capable of authenticating a person identity by his or her face scan.The proposed approach is simple, efficient, and accurate. This system gives accurate result as compare to existing approach. System play's very important role in authentication and verification related field. That is this gives important result very quickly i.e. finds the missing person soon as compare to traditional methods.

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II. LITERATURE SURVEY

Sr. No	1
Author and Title	AniruddhaDey, "**A Contour based Procedure for Face Detection andTracking from Video** " 3rd Int'I Conf. on Recent Advances in Information Technology I RAIT-20161
Proposed System	In this paper primary goal is to recognize location of faces from video. Moreover, finding face motion leads to be a part of face recognition system. Firstly, face edges are detected using Robert edge detector followed by a set of arithmetic operations between an initial frame and the nearest ones. Thereafter, non-desired edges and noise are removed by Gaussian filtering technique. A logical operation is then performed between the previous two output frames and noiseless face contour frame for detecting edges corresponding to face video. Finally, four corner points i.e. topleft, top-right, bottom-left, bottom-right is computed to draw rectangle around the face and detect face contour of each frame. To track human face from video, scalar and vector distance between four corner points of two consecutive frames are calculated. Displacement of corner points means position and location of face changes in the next frame.
For this paper we referred	Referred following techniques : 1. Face Detection 2. Moving Face Contour Detection 3. Face Tracking
Sr. No	2
Author and Title	Andreas Ess, Bastian Leibe, Konrad Schindler, Luc Van Gool, "**A Mobile Vision System for Robust Multi-Person Tracking** " 978-1-4244-2243-2/08/$25.00 ©2008 IEEE
Proposed System	Propose a way to closely integrate the vision modules for visual odometer, pedestrian detection, depth estimation, and tracking. The integration naturally leads to several cognitive feedback loops between the modules. Among others, we propose a novel feedback connection from the object detector to visual odometrywhich utilizes the semantic knowledge of detection to stabilize localization. Feedback loops always carry the danger that erroneous feedback from one module is amplified and causes the entire system to become instable. We therefore incorporate automatic failure detection and recovery, allowing the system to continue when a module becomes unreliable. The approach is experimentally evaluated on several long and difficult video sequences from busy inner-city locations. Our results show that the proposed integration makes it possible to deliver stable tracking performance in scenes of previously infeasible complexity.
For this paper we referred	Object or multi-person tracking-by-detection with additional depth information.
Sr. No	3
Author and Title	Rolf H. Baxter, Michael J. V. Leach, Sankha S. Mukherjee, and Neil M. Robertson, "**An Adaptive Motion Model for Person Tracking with Instantaneous Head-Pose Features**" IEEE SIGNAL PROCESSING LETTERS, VOL. 22, NO. 5, MAY 2015
Proposed System	It presents novel behavior based tracking of people in low-resolution using instantaneous priors mediated by head-pose. We extend the Kalman Filter to adaptively combine motion information with an instantaneous prior belief about where the person will go based on where they are currently looking. Weapply this new method to pedestrian surveillance, using automatically derived head pose estimates, although the theory is not limited to head-pose priors.
For this paper we referred	Intentional tracker could significantly outperform the standard KF on both videoand synthetic datasets containing sudden changes in behavior.
Sr. No	4

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Author and Title	He Guohui ,Wang Wanying, "**An algorithm for fatigue driving face detection and location** " 2015 8th International Conference on Intelligent Computation Technology and Automation
Proposed System	To detect and locate face region accurately, improve real-time, accuracy, and reliability of face detection in the fatigue driving warning system, according to the theory put forward by Yang, combined with skin color segmentation and edge detection technology, we mixed Gaussian Model and Oval Clustering Model.
For this paper we referred	Understand following face detection techniques : 1. Skin color segmentation 2. Color Gaussian model 3. Face edge feature extraction
Sr. No	5
Author and Title	K. V. Arya, AbhinavAdarsh, "**An Efficient Face Detection and Recognition Method for Surveillance** " 2015 International Conference on Computational Intelligence and Communication Networks
Proposed System	It presented for automatic detection and recognition of human faces for surveillance purpose. The proposed method first detects skin regions in the image using askin color model using YCbCr and HSV color space. Then apply height to width ratio followed by face region identification. Lastly PCA verification algorithm is used to detect face accurately. Train face images are used to generate feature space (face space). Test images are then projected on sub spaces and distances measured tofind out best match from train images. The face space is affine subspace and face images can be represented as weighted sum of these sub spaces.
For this paper we referred	Process of Skin Detection, Segmentation, Face Detection, Texture And Illumination, Recognition
Sr. No	6
Author and Title	PrantiDutta, Dr. Nachamai M, Department of Computer Science, Christ University Bengaluru, India "**Detection of Faces from Video Files withDifferent File Formats** "
Proposed System	This paper evaluates the performance of detection system on single face from stored videos that is stored in different file formats. Stored videos contain raw homemade datasets as well as ready-made datasets. This proposed work concludes detection percentage of face detection system in different video formats. The implementation is done in two phases. The raw homemade dataset is tested on .3gp,.avi,.mov,.mp4 and a ready-made dataset is tested on .wmv, .m4v, .asf, .mpg file formats.
For this paper we referred	Process of face detection from video file, pattern recognition, object recognition, stored video database
Sr. No	7
Author and Title	Lihe Zhang, Huchuan Lu, Dandan Du, and Luning Liu, "**Sparse Hashing** Tracking" IEEE TRANSACTIONS ON IMAGE PROCESSING, VOL. 25, NO. 2, FEBRUARY 2016
Proposed System	Propose a novel tracking framework based on a sparse and discriminative hashing method. Different from the previous work, we treat object tracking as an approximate nearest neighbor searching process in a binary space. Using the hash functions, the target templates and the candidates can be projected into the Hamming space, Facilitating the distance calculation and tracking efficiency. First, we integrate both the inter-class and intra-class information to train multiple hash functions for better classification, while most classifiers in previous tracking methods usually neglect the interclass correlation, which may cause the inaccuracy

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For this paper we referred	Learning Discriminative Hashing Functions Optimization Using ADM Tracking Framework With Learned Hashing Functions
Sr. No	8
Author and Title	Dennis Mitzel, Esther Horbert, Andreas Hess, and Bastian Leibe, "**Multi-person Tracking with Sparse Detection and Continuous segmentation** "
Proposed System	Presents an integrated framework for mobile street-level tracking of multiple persons. In contrast to classic tracking-by-detection approaches, our framework employs an efficient level-set tracker in order to follow individual pedestrians over time. This low-level tracker is initialized and periodically updated by a pedestrian detector and is kept robust through a series of consistency checks. In order to cope with drift and to bridge occlusions, the resulting track let outputs are fed to a high-level multi-hypothesis tracker, which performs longer-term data association. This design has the advantage of simplifying short term data association, resulting in higher-quality tracks that can be maintained. Even in situations where the pedestrian detector does no longer yield good detections.
For this paper we referred	System-level view of end-to-end tracking framework, Level-Set Tracking, Tracking-by-Detection
Sr. No	9
Author and Title	Francesco Comaschi, Sander Stuijk, TwanBasten, HenkCorporaal, "**ROBUST ONLINE FACE TRACKING-BY-DETECTION** "
Proposed System	Propose RFTD (Robust Face Tracking-by-Detection), a system which combines tracking and detection into a single framework to robustly track a face from unconstrained videos. RFTD is based on the idea that adaptive and stable algorithmic components can complement each other in the task of online tracking. An online Structured Output SVM (SO-SVM) is combined with an offline trained face detector to break the self-learning loop typical in tracking. In turn, the face detector is supervised by a Deformable Part Model(DPM) landmark detector to assess the reliability of the face detection output. Extensive evaluation shows that RFTD deliversconsistently good tracking performances across different scenarios, i.e., high mean success rate and lowest standard deviation across benchmark videos.
For this paper we referred	Face tracking, tracking-by-detection, structured output SVM, deformable models
Sr. No	10
Author and Title	Xiaoming Liu and Tsuhan Chen, "**Video-Based Face Recognition Using Adaptive Hidden Markov Models** " Electrical and Computer Engineering, Carnegie Mellon University, Pittsburgh, PA, 15213, U.S.A.
Proposed System	Propose to use adaptive Hidden Markov Models (HMM) to perform video based face recognition. During the training process, the statistics of training video sequences of each subject, and the temporal dynamics, are learned by an HMM. During the recognition process, the temporal characteristics of the test video sequence are analyzed over time by the HMM corresponding to each subject. The likelihood scores provided by the HMMs are compared, and the highest score provides the identity of the test video sequence. Furthermore, with unsupervised learning, each HMM is adapted with the test video sequence, which results in better modeling over time. Based on extensive experiments with various databases, we show that the proposed algorithm provides better performance than using majority voting of image-based recognition results.
For this paper we referred	Temporal HMM for modeling face sequences (Hidden Markov model), How HMM perform video-based face recognition

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III. MATHEMATICAL MODEL

PCA Algorithm mathematical notations and equations:

Steps:

1. Let a face image X(x, y) be a two dimensional m x n array of intensity values.
   An image may also be considering the vector of dimension m n.
   Let the training set of images {X1, X2, X3,…, XN}. The average face of the set is defined by

$$X^{-} = \frac{1}{N}\sum_{i=1}^{N} Xi$$

2. Calculate the Covariance matrix to represent thescatter degree of all feature vectors related to theaveragevector.The Covariance matrix C is defined by

$$C = \frac{1}{N}\sum_{i=1}^{N}(Xi - X^{-})(x_i - x^{-})^T$$

3. The Eigenvectors and corresponding eigenvalues arecomputed by using

CV=**λ**V

Where V is the set of eigenvectors associated with itseigenvalueλ.

4. Sort the eigenvector according to their correspondingeigenvalues from high to low.

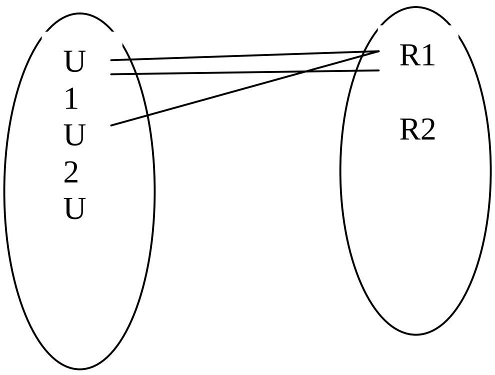
5. Each of the mean centered image project intoeigenspace using

$$W_i = V_i^T (X_i - X^{-})$$

6. In the testing phase each test image should be meanCentered, now project the test image into the sameeigenspace as defined during the training phase.

7. This projected image is now compared with projectedtraining image in eigenspace. Images are comparedwith similarity measures. The training image that isclosest to the test image will be matched as used toidentify.

<u>Mapping</u>



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Many users can obtain one or many result.

Where, U1= First User
U2= Second User
U3=Third User
R1 =Right Result
R2 =Right Result

Set Theory:
S={s, e, X, Y,Φ}
Where,

s = Start of the program.

1. Admin registration
2. Log in (module wise for e.g Admin).
3. Add user.
4. User login.
5. Add missing person details.
6. Select video streaming.
7. Face detection and compare with missing person face.
8. Match found send notification to admin.

e = End of the program.

1. Missing person found or not.
2. If found then send SMS notification to police and missing person relatives.
3. User logout.
4. Admin logout.

X = Input of the program.
Input should be video file.
Y = Output of the program.
Missing person found or not.
X, Y ∈ U
Let U be the Set of System.
U= {Client, V, F, RC, R}
Where, Client, S, M, D are the elements of the set.
Client=Admin, user
V=Video.
F=Face Detection.
RC=Face Recognition.
R=Final Result.

SPACE COMPLEXITY:
The space complexity depends on Presentation and visualization of discovered patterns. More the storage of data more is the space complexity.
TIME COMPLEXITY:
Check No. of patterns or file available in the datasets= n
If (n>1) then retrieving of information can be time consuming.
So the time complexity of this algorithm is O(n^n).

Above mathematical model is NP-Hard
Sometime face detection and face recognition problems are occurs because video quality is low.

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Φ = Failures and Success conditions.
Failures:

- Huge database can lead to more time consumption to get the information.
- Hardware failure.
- Software failure.

Success:
Search the required information from available in Datasets.
User gets result very fast according to their needs.

IV. SYSTEM ARCHITECTURE

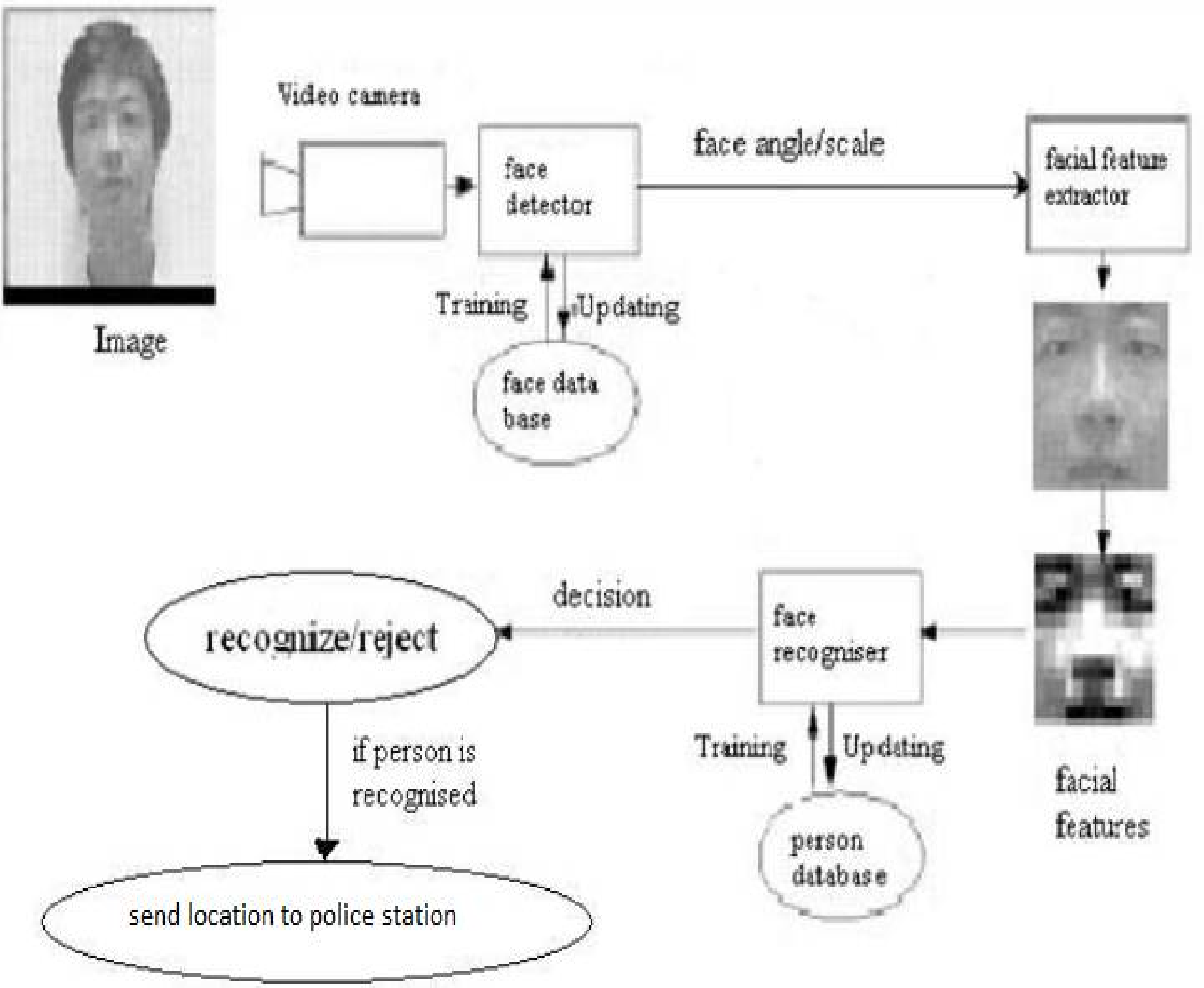

Fig No 01 System Architecture

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Vol. 5, Issue 3, March 2017

V. EXPERIMENTS RESULT

The experiment is performed on 50 non-faces, 100 face and 100 noisy images. The results show that the proposed method gives better results as compared to the existing method. The existing method gives 97 hits while the proposed method gives 98 hits. The existing method gives 3 misses and proposed method gives 2 misses. We have concentrated on single face images. The table illustrates face recognition performance. As a result of this hit ratio of proposed method is more as compared to that of existing method.

Table1: For non-face images

Eigen faces	Hits	Misses	Accuracy (%)
10	10	0	100
20	18	2	90
30	29	1	96.67
40	38	2	95
50	48	2	96

Table 1 is showing that different samples of eigenfaces up to 50 are taken for recognition. From the samples taken, the no. of hits are calculated which gives the number of times the recognition of faces is done. It is clearly shown in the table that the accuracy rate is highest when the no of eigenfaces taken are 30.

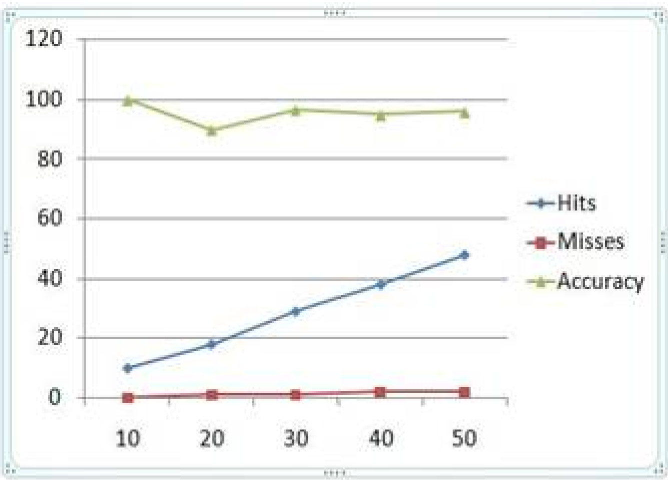

Fig 2: For non-face images

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It is demonstrated in the Figure 1 that the no. of misses are almost close to 0 and no. of hits are correspondingly increasing which makes the accuracy rate close to 90.

Table 2: For face images

Eigen faces	Hits	Misses	Accuracy (%)
10	10	0	100
20	19	1	95
30	28	2	93.33
40	38	2	95
50	49	1	98
60	58	2	96.66
70	68	2	97.14
80	79	1	98.75
90	88	2	97.77
100	98	2	98

Table 2 is showing that 100 samples of eigenfaces are taken for recognition and the noise and disturbance is calculated from the samples which gives the no. of hits when the faces are matched with the input images. It is clearly shown in the table that the accuracy rate is highest when the no of eigenfaces taken are 10.

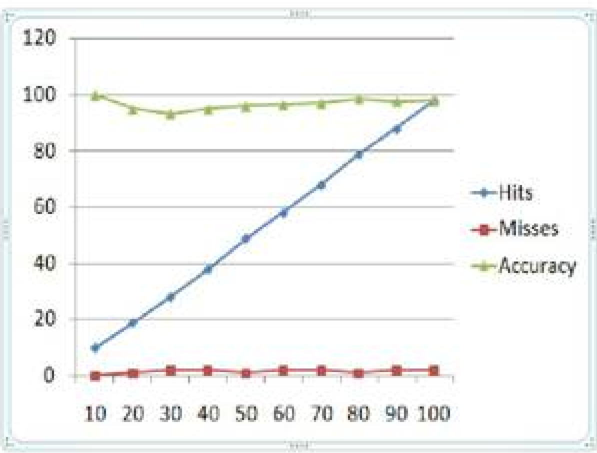

Fig 3: For face images

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It is clearly shown in Figure 2, the accuracy rate is almost close to 100 due to continuous increase in no. of hits and the no. of the faces not detected i.e. misses are close to 0 .

Table 3: For blurred images

Eigenfaces	Hits	Misses	Accuracy (%)
10	10	0	100
20	18	2	90
30	29	1	96.66
40	38	2	95
50	49	1	98
60	58	2	96.66
70	68	2	98.57
80	77	3	96.25
90	86	4	95.55
100	96	4	96

According to table 3, 100 samples of eigenfaces are taken for recognition and the noise is calculated from the samples. The no. of hits can be calculated from the faces recognized with the input sample which gives the number of times the recognition of faces is done. It is clearly shown in the table that the accuracy rate is highest when the no of eigenfaces taken are 10.

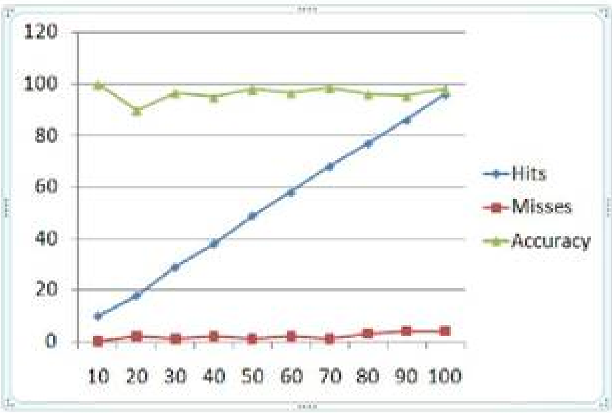

Fig 4: for blurred images

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As illustrated in the figure 3 there is a small rise above 0 in the miss ratio i.e. no. of misses are between 0 to 4 and no. of hits are continuously increasing which makes the accuracy rate close to 100.

Table 4: Existing method vs. proposed method

	Eigen faces	Existing method	Proposed method
Non-Faces	50	97.2	98.8
Faces	100	97.018	98.71
Blurred Faces	100	72.1	98.23

Recognized Output Image:

Fig 5: Test image and equivalent output image

Figure 5 is showing the input test image and the corresponding equivalent image. It is clearly visible from the figure that equivalent image is almost similar to input image.

VI. CONCLUSION

Identification of a person in surveillance area using face information has many applications in real life. The face recognition in the images got from surveillance camera is challenging task due to the presence of multiple faces in the given area. In this paper a method has been proposed where the algorithm has been modified for the detection of the faces, extraction of the feature information and matching the features. The work can further be extended for improving the recognition accuracy as well as time for large face databases.In this system designed to find the missing people. If the missing person found in the CCTV Video streaming then track the location of missing person.After missing person found in the CCTV Video streaming then send location SMS to relatives of missing person and Police station. So our system can perform the very important role in security and authentication issues.

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