



# An Automated Intelligent Surveillance System for Suspicious Person Detection in Public Places

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**Abstract—** In recent days video surveillance systems are widely used for monitoring private and public environment. Robbery, crimes, fights and antisocial behavior problems are common problem in our day to day life. This paper presents an effective method for detecting suspicious person in the recorded videos using face recognition technology to prevent the crimes in the society. Motion detection algorithm is used to detect the unwanted intruder present in the video. In the first stage the input video is converted into image frames. In the next step Viola Jones algorithm is used to extract the face regions from the extracted frames. The statistical features are extracted from face regions and compared with stored features in the database. In the next stage K-nearest neighbor classifier is used to take decision about the processed video. The method used in this paper is simple to identify the suspicious person in the recorded video

**Keywords-** Viola Jones, K-nearest Neighbor (KNN), Feature extraction

## I. INTRODUCTION

In recent days, government organization, private organization, and schools are moving towards video surveillance to enhance the people security. Video surveillance acted as an important system to ensure security at airports, banks and many other places [1]. Human face and human behavioral pattern play an important role in person identification. Visual

information is a key source for such identifications. Surveillance videos provide such visual information which can be viewed as live videos, or it can be played back for future references. The recent trend of 'automation' has its impact even in the field of video analytics. Video analytics can be used for a wide variety of applications like motion detection, human activity prediction, person identification, abnormal activity recognition, vehicle counting, people counting at crowded places, etc. In this domain, the two factors which are used for person identification are technically termed as face recognition. Among these techniques, face recognition is more versatile for automated person identification through surveillance videos. Background elimination method is widely used for moving object detection in case of fixed cameras. Video surveillance systems are used in people tracking, traffic monitoring and semantic annotation videos. Anomaly detection technique is widely used for person detection and scene analysis in a video data. It analyzes the scene that has complex correlated activities of multiple objects [2]. In the review papers [3][4][6] follows a common pipeline based framework. In these papers the moving objects in the video data are detected first and then the moving objects are classified and tracked for a certain number of frames. Based on the analysis of the frames normal behaviour and abnormal behaviour of the objects are recognized. In the paper [7][8][9][10] KNN classifier is used for classification purpose. This classifier is very simple and the computational complexity of the



algorithm is also less. The accuracy obtained by this classifier is also high in the review paper. So KNN classifier is preferred in this work for classifying the suspicious person. In Paper [11][12][13] efficient contour and shape extraction techniques are used for image shape extraction. In this paper edge extraction method are used for shape analysis. Motion recognition with face recognition is very useful in many applications such as verification of a person, identification of a person and detecting presence or absence of a person at a specific place and time. In addition, estimation are used to devise a system that can identify and recognize suspicious behavior among pupil in an crowd area. [5] proposed a system in which the cross-diamond search algorithm employs two diamond search patterns (a large and small) and a halfway-stop technique. It finds small motion vectors with fewer search points than the DS algorithm while maintaining similar or even better search quality.

## II. PROPOSED METHOD

### A. Proposed Method

The block diagram of the proposed method is shown in the below figure 1.

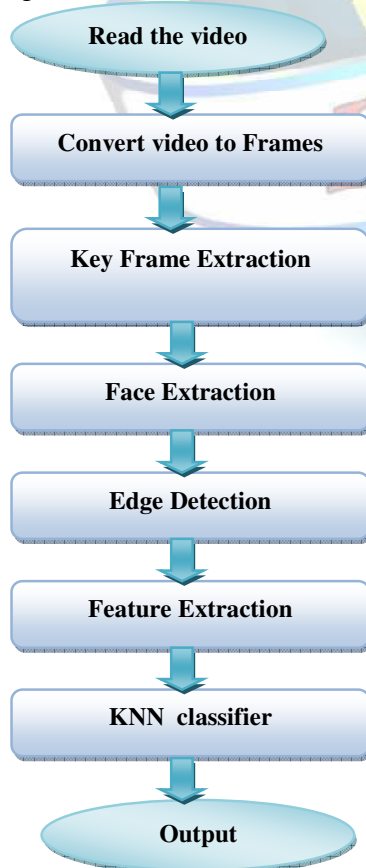


Fig1. Proposed Method

In this method the input video signal recorded from the environment is converted into frames. The frames are converted into gray scale images. The gray scale images are easy to process in computer vision techniques which helps to reduce the complexity of the system.

The converted frame images are classified into two groups. Some set of frames are considered as key frame which has more information. The less information frames are discarded for further processing. The key frames consist of face images in the recorded video. In the next step viola jones algorithm is used to extract the individual face images from the video frames. Edge detection algorithm is used to find the edge details of the object. Statistical features are extracted from the edge detected image. Then the extracted features are used in K-nearest neighbor (KNN) classifier. The KNN classifier is used to classify whether the extracted person in the video is suspicious or non suspicious person.

### B. Viola jones Algorithm

In this work viola jones algorithm is used for extracting individual faces from the video frames. This algorithm detects face of the person from group of images. This algorithm is the first detection framework to provide competitive object detection rates in real time. Some of the characteristics of this algorithms are robust, and real time. Some of the advantages of viola jones algorithm is efficient feature selection, scale and location invariant detector. Haar features approach introduced by Viola et Jones can be used for face recognition. The strength of this methodology is the low false/positive rate i.e. probability of identifying non-hand regions as hand regions is low. Hence it has a very high accuracy while detecting faces, it needs to be coupled with a classification algorithm like AdaBoost to give the best performance and hence has an extra overhead attached with it.

### C. Edge Detection

In Image processing edge detection techniques are widely used to find the discontinuities in images. Edge detection determines the sharp change in the brightness of the image and organizes a cured line segments. In this work canny edge detection algorithm is used to extract the object edge present in the image. The



Canny edge operator uses a multistage algorithm to detect a wide range of edges in images. The major steps for canny edge detection is given below

- 1) Gaussian filter is used to filter out the noise present in the image
- 2) Find the edge strength by determining the gradient of the image
- 3) Determine the edge direction from the gradient.
- 4) Relate the edge direction and trace the edge of the image.

The Gaussian mask values used in canny edge detection is shown in the figure

2	4	5	4	2
4	9	12	9	4
5	12	15	12	5
4	9	12	9	4
2	4	5	4	2

Fig2 Gaussian Mask

#### C. Feature Extraction

The purpose of feature extraction is to reduce the original data by measuring certain features that distinguish one input pattern from another. In this work various features are extracted from the edge detected face region. The extracted features are Area of the object region, major axis and minor axis of the object region, perimeter and Eccentricity of the object region

#### D.K-NEAREST NEIGHBOUR ALGORITHM

K-Nearest Neighbour (KNN) Classifier is widely used for data classification. In KNN algorithm there is no need for training phase. The classifier Algorithm is based on distance matching between the training features and the testing features.

##### Algorithm

- a) Compute the distance between the testing image feature and each feature in the training set of the image.
- b) Find the summation value of the distance matrix.
- c) Sort the distance in decreasing numerical order and the pick the first 'k' elements.
- d) The output class is computed by considering the maximum class value among the k neighbor values.

### III. RESULTS AND DISCUSSION

This work uses the sample videos obtained from the internet for classifying the suspicious person. The input video signal is converted into frames. The sample frames obtained from the database Video is shown in Figure1 3



Figure 3. Reference frame with face images

The viola jones algorithm is used to identify the individual faces from the frames. The output obtained using viola jones algorithm is shown in the figure4 .

Face Identification output using Viola Jones



Figure4. Face identification using Viola Jones

In the next step canny edge detection algorithm is used to extract the edge details of the individual face images. The individual face and edge extracted output is shown in the figure 5.



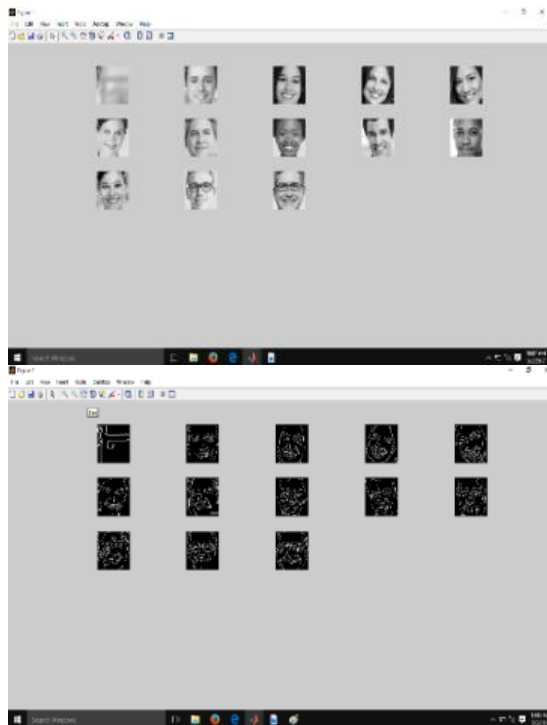


Figure 5 Edge detected output image

In the next step statistical features are extracted and stored in the database. In the database normal person and suspicious person features are stored. These features are used by KNN classifier for decision making purpose. The sample extracted features are shown in below table.

Table 1: Sample features

per son	Area	Major Axis	Minor Axis	Perimeter	Eccentricity
1	73	45.9806	14.6869	125.946	0.9476
2	26	24.9629	4.1872	44.75	0.9858
3	27	17.1831	6.8737	48.364	0.9165
4	16	8.0107	5.8252	15.432	0.6864
5	6	6.9311	1.875	11.14	0.9627
6	12	11.1966	3.4437	22.718	0.9515
7	48	53.8638	2.58	90.822	0.9989
8	19	18.5822	2.8193	33.627	0.9884
9	22	21.7909	3.1786	36.124	0.9893
10	4	4.6188	1.1547	5.88	0.9682
11	9	7.3937	1.819	11.438	0.9693
12	45	23.1177	8.2668	78.004	0.9339
13	1	1.1547	1.1547	0	0

The recognized person using KNN algorithm is shown in the below figure 5



#### IV.CONCLUSIION

In this paper an efficient method for identifying the suspicious person from the recorded video is presented. The input video is converted into frames and viola jones algorithm is used to extract the face from the videos. Then canny edge detection technique is used to obtain the edge points in the detected image. The features are extracted from images and classification is performed



using KNN Classifier. The accuracy and<sup>[1]</sup> computation speed of this method is better than other techniques. This Work can be utilized in society prevent from unwanted crimes.

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