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FACE RECOGNITION FOR SURVEILLANCE USING MATLAB

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Abstract: Facial recognition is a technology that can match a human face from a digital image or video, against a database of stored faces. Without using additional biometrics, the targeted person can be identified and verified using only their face. Despite being a simple task, it is thought to be the most complex and difficult for computer vision. The clear detection, tracking, and recognition of a face utilising image processing will be demonstrated in this work. Face recognition is utilised in several biometric, security, and surveillance applications. In this project, Viola-Jones and PCA algorithms are implemented using MATLAB. Through serial data communication live updates is given to control room.

Keyword: Viola-Jones, PCA, Serial data communication, MATLAB, Wi-Fi, Live update.

I. INTRODUCTION

In the recent years, face recognition systems have gained interest and applications due to face's rich features which offer a strong biometric cue to recognize individuals. It has become a very active area of research mainly due to increasing security demands and its potential, commercial and law enforcements. Compared to other types of biometric recognition, facial recognition is considered the most natural form of matching, because that is how humans can actually determine how one person can differentiate from another: by comparing facial features. Although commonalities exist between faces, they vary considerably in terms of age, skin, colour and gender. The problem further complicated by differing image qualities, facial expressions, facial furniture, background and illumination conditions. Viola-Jones face detection method is used to distinguish face from non-face objects in an image or a video. Feature extraction and dimension reduction method will be applied after face detection. Principal Component Analysis (PCA) method is widely used in pattern recognition. MATLAB programming develops a computer vision system in the real time for face detection and tracking using camera as image acquisition hardware. Different number of training and testing images is used to evaluate the system performance. The advantage of using MATLAB is because of its image processing algorithm development environment, it's built-in functions such as image acquisition toolbox and its compatibility with hardware such as camera, Arduino and many more.

II. METHODOLOGY

Database: The database is a well-organized group of photos of the targeted person that is electronically accessible and preserved. While large databases are housed on computer clusters or cloud storage, small databases can be stored on a file system.

Face Detection: The face of the targeted person is captured using Viola Jones face detection algorithm. Face detection and identification from a picture comprising one or more people faces is made possible by computer vision and it can recognize specific faces. Image pre-processing is the steps taken to format images before they are used by model training. This includes resizing, colour formatting and normalization. Image pre-processing decreases model training time. Instead of processing the entire image, a common practice is to find objects of interest in the image. Then, the face detector can operate on a bounding box already defined. This prevents the detector from processing the entire image, improving accuracy.

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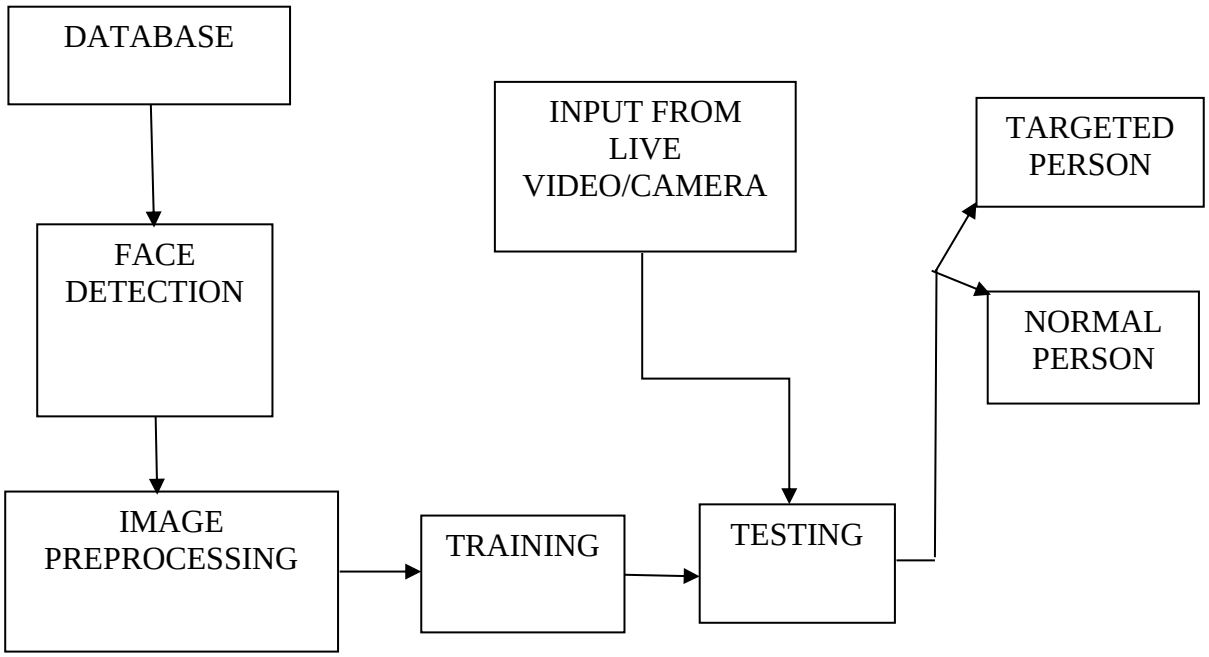

Figure 1: Block diagram of face recognition.

Training the Model

(i) **Support Vector Machines:** SVMs is a highly effective approach for general-purpose pattern recognition. A SVM naturally discovers the hyper plane that maximises the distance from either class to the hyper plane while separating the highest feasible fraction of points from the same class on the same side given a set of points belonging to two classes. Recently, the use of SVMs in computer vision problems has been suggested. In order to discriminate between the two classes of faces and non faces, train an SVM for face detection.

(ii) **Principle Component Analysis:** A quantitatively rigorous approach for attaining simplification is principal component analysis. Principal components, a new collection of variables produced by the approach, are created. The original variables are combined linearly to form each major component. This algorithm is basically used for learning of training face images because before starting to face detection and recognition we have to require a set of Eigen values and Eigen vector of trained images.

PCA aids in data interpretation, although it doesn't always identify the key patterns. High-dimensional data can be made simpler through the use of principal component analysis (PCA), while still preserving trends and patterns. It accomplishes this by condensing the data into fewer dimensions that serve as feature summaries.

Testing

A feature descriptor called HOG, or Histogram of Oriented Gradients, is frequently employed to extract features from image data. It is commonly used for object detection in computer vision tasks. Based on the output of SVM classifier and Principal Component Analysis of the image in the database, The Query image i.e., the input from live video is compared to with the HOG features. Confusion Matrix gives the accuracy of the image inputs given. Based on this accuracy, the model shows the results, if the targeted person is present in the live videos or not.

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III. FLOWCHART

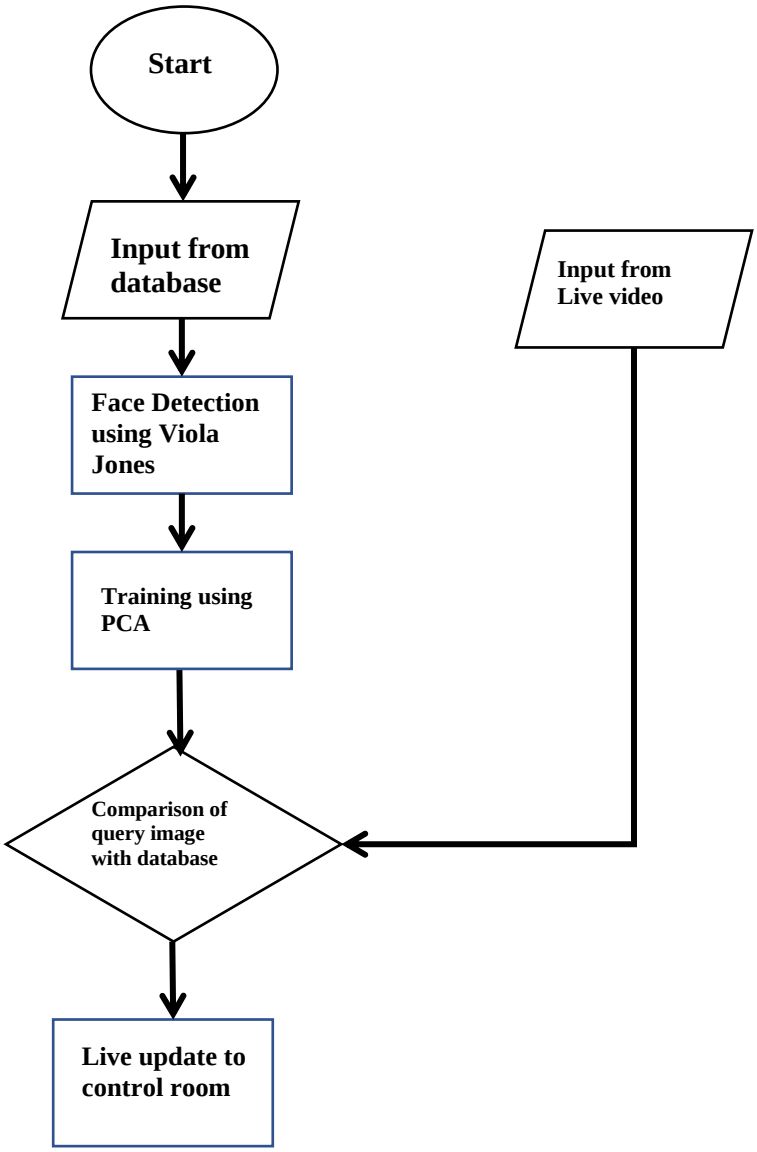

Figure 2: Flow chart of Face Detection and Recognition.

The first step of this proposed system is that the input image will be uploaded to the database. In large scale applications, image will be uploaded to a cloud server where each control can have access to the database. The system analyses a large number of incredibly small sub regions of an image (this technique only works on grayscale images) and makes an attempt to recognise a face by looking for specific qualities in each sub region. Numerous locations and scales must be verified because it is possible for an image to contain multiple faces of various sizes. Jones and Viola used hear-like strategies. ADABOOST: Nearly 160,000 features are present in the 24 by 24 detector window, however only the selected subset of these elements is crucial for face identification. In order to find the top features among the 160,000 features, we employ the AdaBoost method. Each Hear like feature in the Viola-Jones method represents a weak learner. AdaBoost evaluates the performance of each classifier that you feed it with in. Due to the similarity of faces, it is difficult to distinguish or recognise distinct people. In this research, we focus on the face recognition problem and demonstrate that SVMlearned discrimination functions can outperform the popular conventional Eigen face technique in terms of recognition accuracy. The given image is converted into grey scale images because it is easier for computation. The converted grey scale image is scaled to particular size because the input images that we collect are of different sizes. Therefore, we develop a training set where we have for different conditions. We have images of different sizes, illuminations, expressions etc. for face recognition. Based on SVM classification and Principal component analysis, a

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knowledge base is created. It contains all the features of image in the database. In MATLAB and Simulink, Image Acquisition Toolbox offers functions and building blocks for integrating cameras. Using this, the query images from live videos are obtained.

IV. RESULT ANALYSIS

Figure 3: Result showing Matched face, i.e., the targeted person is found.

Figure 4: Result showing unmatched face, the program shows error when the images don't match.

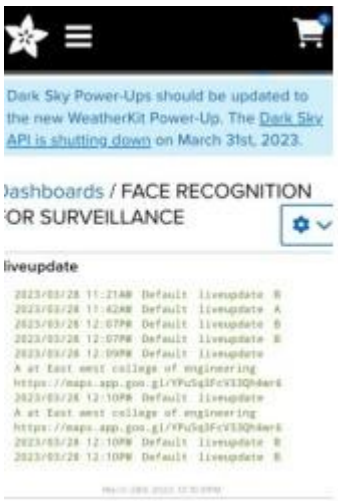

Figure 5: Live updates shown using Adafruit.

The Results and Discussion section of Face Recognition for Surveillance Using MATLAB project is a crucial aspect of the research process, as it provides a detailed evaluation of the system's accuracy and efficiency. This section includes data, such as the number of input images provided for training and their quality, percentage of accuracy by confusion matrix, the time taken to detect the person and to give live updates.

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V. CONCLUSION

Face Recognition for Surveillance Using MATLAB Project: The entire programme is implemented in MATLAB using Digital Image Processing. Using this model, a culprit, terrorist, or a wanted and missing person can be found. This model can be implemented in crowded places where a person cannot be assigned to monitor the crowd and verify each and every person. This project can help search for the targeted person even from a distance with the aid of high resolution and robust cameras or image enhancement algorithms.

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