ADVANCED FACE RECOGNITION BASED ON LBPH ALGORITHM

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DECLARATION

We hereby, declare that the work presented in this Thesis is the outcome of the investigation performed by us under the supervision of **Mr. Sabbir Ahmed Sibli**, Lecturer, Department of Computer Science & Engineering, Fareast International University. We also declare that no part of this Thesis and thereof has been or is being submitted elsewhere for the award of any degree or diploma.

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ABSTRACT

In recent years computer-based face recognition is an advanced and reliable approach that is being certainly exploited for many access control scenarios. It is one of the simplest ways to separate the identity of each other in the face. Human facial recognition defines a personal identification or authentication system that uses one's personal characteristics to verify his/her identity. Basically, the process of face recognition is based on two stages; one is face detection and another one is face recognition. Facial detection refers to a computer technique that has several applications to identify human faces in digital images. Facial recognition is usually worked by using 'prefect' data of full-frontal facial images. Although, in reality, there are enough situations where full frontal faces may not be available, the imperfect faces come from the CCTV cameras to introduce the case in point. Hence, using partial facial data as probes is still largely an unexplored area of research of the problem of computer-based face recognition. In this paper, we research the question that covers the idea of face recognition by using partial facial information. Two types of methods are being used to advanced detection technology such as Eigenfaces and Fisherfaces. The Eigenfaces method is based on face level space reduction for face detection and uses Principle Component Analysis (PCA) to extract facial features. We develop our project by applying significant experiments to test the performance of machine learning using the Haar cascade classifier. We have analyzed this classifier algorithm by dividing into four steps. In this paper, we apply to Haar feature selection, Creating an integral image, Adaboost training, Cascading Classifiers for complete the detection step. We have used the Local Binary Patterns Histograms (LBPH) algorithm to complete the facial recognition system for human safety of this project with face detection. Some parameters are used in LBPH and we obtain a training dataset by applying the training algorithm. We get complete our computational part by applying the LBPH operation and extracting the histograms. We use different kinds of law to find the difference between two histograms like Euclidian distance, chi-square, etc. For developing "face recognition based on LBPH algorithm" we use open-Source platform namely OpenCV based on python language.

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CHAPTER 1
INTRODUCTION

1.1 Introduction:

In machine learning approach defines a neural network that has successfully been applied to analyzing visual imagery. It has several applications in facial recognition and video analysis, recommender systems, and natural language processing. Here we demonstrate face detection and recognition for people by image processing. Face recognition is growing a multidisciplinary research area and it has spacious applications in the ground of security, identification, and verification of a person in the image. Face detection and recognition define biometric software application which is able for incomparable identification and verification of a person by comparing and analyzing patterns depend on a person's facial configuration. Facial recognition compares the information with a database of known faces to find the match. We have focused on known/unknown people to identify and verify them from a source that provides digital images.

1.2 Motivation:

Facial recognition technology is being used in many sectors like as payment, improve security, criminal identification, advertising, healthcare etc. We want to use facial detection and recognition in private system to decrease anonymous entrance. Our proposed system is capable to detect that kind of peoples who want to unauthorized entry and take them under punishment so that they can't do again.

As for the purpose, we are extremely motivated to establish a system that detects and recognizes people faces to reduce unauthorized entry.

1.3 Objectives:

Our main concern is about detecting and recognized known faces and allows them to enter and avoid unauthorized entrance to private places like offices or any other organizations. so that we can ensure the safety of the places and people.

We are attempting to construct a fast and efficient face recognition system that detects faces of people very quickly in disordered backgrounds. We want to minimize the effects of unwanted real time environment by using Hear-Cascade classifier.

At one time the face detection is done; our following intent is to train our system with useful images. By using Local Binary Patterns for each image a feature vector is to be computed. With this feature vector we desire to label the target images using Support Vector Machine (SVM) classification.

Through our proposed method we want to reduce road accidents caused by illegal moving of people.

By adopting this proposal we can raise public awareness about traffic system and also increase consciousness of road crossing.

By the establishment of our project we want to take suspicious people under punishment.

Moreover, our main concern is to achieve a sound traffic control system and save the valuable lives of people.

1.4 Expected Outcomes:

Facial recognition is quickly adopted around the world. Nowadays for various security purposes facial recognition is used widely. Its popularity comes from the vast areas of potential applications. Some aspects come from our projects are given below.

The system can be applied at busy places like traffic signals, airports, railway station for detecting people faces, when our system detect any suspicious faces it would be make an internal alarm or signal.

The system will increase the privacy and safety of private places and peoples. Moreover, it will reduce unwanted occurrences and crimes.
Alongside, it helps to teach people about awareness and manners to get entrance everywhere.

1.5 Report Layout:

Chapter1: Introduction

We explain about introduction, motivation, objectives, expected outcomes and also report layout of our project in this chapter.

Chapter 2: Background Study

Background part of our proposed method is discussed in chapter 2. We also explain literature review, related works, argumentation of the problems and claims about our project in this portion.

Chapter 3: Methodology

In this chapter we include overall procedures that we have used to build this proposed system. Methods are explained here step by step.

Chapter 4: Design Specification

In this section we have discussed about the graphical interface and display to the users.

Chapter 5: Implementation and Testing

Our empirical results are shown along with the performance analysis that is achieved by the proposed system. We have also covered results summary in this chapter.

Chapter 6: Conclusions and Future plans

In this part of the report we have discussed about conclusion and future aims of our proposed system for detect face of people.

CHAPTER 2

BACKGROUND STUDY

2.1 Introduction

Recognition based on face detection is a web based application where we have developed the system by using Open CV and python language. It enables to detect and recognize people's faces for identifying and verifying them and also it is used for many different issues.

Some human facial features like mouth, nose, ear and eyes in a frontal image are called the face recognition system. For developing our system Open CV is used for face detection. An open source computer vision library namely Open CV is an open source platform that everyone can freely use the library. Open CV is built by using of C++ and its basic interface is in C++ but there are capturing Python, Java and MATLAB. Open CV, generally, may provide three methods for face recognition like as Eigen faces, Local binary pattern histograms (LBPH), Fisher faces.

Face recognition process is categorized into two steps which are face detection and face recognition. Its main concern is to raise awareness of the device of what a face looks like. Face detection generally holds some rules like position of nose, space between eyes, mouth and others. We collect and note information about the face position and size from an image or video stream. Some particular issues are faced by the process of face detection. During imaging for incommodious situation create a problem to differentiate foreground from the background. We use a larger and better training samples for the resolution of this problem. This proposed method based on the use of RGB camera without complex information and cannot distinguish a real face from a face printed on paper. In this cause, in this process, an ordinary camera cannot testify a real face. Face recognition process can be done by following the face detection steps. Face recognition is very convenient and simple to perform than iris or fingerprint recognition.

This paper deals with the detection of face by using Hear classifier and describes the accuracy gained by Local binary Patterns Histograms face recognition algorithm. The cascade classifier is learned with images of faces and images without faces. If Hear-like features are found after scanning an image with the classifier then the image is said to be found.

A method for face recognition is using Local Binary Patterns Histograms which focuses on the statement of the texture features and reflects the details of the characteristics exhibited by the face.

In our proposed method when a people will come in front of our used camera then it detects his/her face and compare it with image database which is trained by our system. When any match can be found then it send the facial details of pedestrians into server.

2.2 Literature Review

Ilias Maglogiannis et al. [1] developed face detection and recognition of natural human emotion using Markov random fields to build an integrated system for emotion detection. Three modules were consisted for the method and they used color images. For image segmentation and skin detection they used Markov random fields that implemented the skin detection. They were considered colored images of human faces as the training set. They used HLV color space of the specified eye and mouth region for the detection and extraction of eye and mouth. They used edge detection and measured the gradient of eyes and mouths regions. Their proposed method consists of two main parts. Face localization for finding face candidates detect skin regions that possibly hold a human face. Their proposed method had a segmentation technique that transformed images from RGB to YCbCr color space. Their skin detection algorithm was emerged on statistical image processing model through the use of Bayesian estimation. A Markov random field and MRF image segmentation was used by them. Whereas a MRF is a non-casual model, they used MRF for skin detection. Skin detection rate 96.24%, Face detection (eyes and mouth) was 84.97% and emotion detection and recognition was 96.68% they gained by experimenting their proposed method.

Tomas Markciniak et al. [2] implemented the influence of low resolution of images on reliability of face detection and recognition to experiment authenticity of the real time system, face detection and recognition from low resolution images. They used many programs for face detection and the face annotation interface. Basically they obtained face detection by three stages as the reduction of impact of interfering and noise reduction, discernment of fields with sublime feasibility where a face can be placed, then confirmation of the formerly selected areas is performed and finally the

face is detected and marked. For face detection several common approaches were used. Face location emerged on the color of human skin was considered as the first approach. They used mathematical morphology operation in the selected region of interest where further features could be isolated, which indicated that the presence of a face in the image. By using geometric models at this step they found face location founded on comparing the location of the elected pattern of the test face with processed picture. Then they used Haar-like features for face detection. It was build depend on the target detector which is proposed by Paul Viola and Michael J. Jones and then upgraded by Rainer Lienhart and Jochen Maydut. They detected both eyes and separately left and right eye by using four classifiers in their program. They explained the cause of resolution on both the face detection stage and identification. They achieved results by using in CCTV image analysis.

H. Zhi, S. Lui et al. [3] had proposed face recognition based on genetic algorithm to raise information security. They focused on identity identification to ensure the security in the areas of finance, national security and justice and so on. They extracted the main components of genetic algorithms like coding mechanism, fitness function, genetic operators and control parameters. The possible solutions of the problems would have coded into individual chromosomes when they applied genetic algorithm. They gained the fitness function of individuals from an initial selection group, the individuals satisfying the termination conditions could be output.

Shonal Chaudhry et al. [4] Chandra proposed a face detection and recognition method in an unconstrained environment for mobile visual assistive system. They had noticed that the main material is the intelligent systems module. They developed their proposal by using CNNs or cascade classifiers based on the performance. They employed with cloud based support system for computing the features in periods of learning the selected smart system. In order to ensure security and reliability, by using specific data transfer protocols were transformed into the mobile device. They discovered the visual assistive system which implemented for low end mobile devices that feature input camera. In day light condition, the highest performance gained by the detection module by using CNNs was 94.64% but lower performance in other lighting condition. Similarly, they obtained maximum performance of 80% by the recognition module when they used CNNs which face images had poor lighting.

Alireza Tofighi et al. [5] had proposed a method to improve the performance of face detection and recognition systems. Basically their proposed method consists of two main parts. Firstly, they detected faces and then recognize the detected faces. They used Gaussian skin color model combined with AdaBoost algorithm for skin color segmentation in detection step. AdaBoost algorithm is fast and also more accurate. To improve the face detection performance they used a series of morphological operators. They divided their tasks into four steps to complete face recognition part. They used Gabor features extraction, dimension reduction using PCA, feature selection using LDA, and SVM based classification. They used both PCA and LDA together for improving the capability of LDA. They used a face database for a few sample images and also they examined the system with face databases. In different lighting condition they tested the system and they gained results that show the system is robust enough to detect faces.

2.3 Comparative studies

Facial images are concerned for face recognition. Multiple algorithms have been established to resolve the face identification problem. We can identify one of the earliest work was that Savvides et al. In their proposed method they experimented on several facial areas to build quantifiers with discriminative capability. For feature extraction depend on gray scale pictures the method of kernel correlation filters was utilized to decrease image degree. Because of the separation between different facial features they used Support Vector Machines (SVM). In their experiment, they tested only three basic fields of face are eyes, nose and mouth. They gained experimental result and suggested that the eye side has a sublime authentication degree by comparing to the mouth and other areas.

In an analogous way He et al. [6] discovered a method named the Dynamic feature Matching (DFM) for partial face recognition. They proposed a method emerged on Fully Convolutional Networks (FCN) with sparse representations. They used FCN to substance features among many pictures which have the ability to show more discriminative features. They proposed VGG face model for transferring features to FCN. Their proposed method gained good classification accuracy.

Besides, various robust face recognition methods had been proposed due to assign the aims for face recognition due to face imprisonment in miscellaneous scenarios. In [7], Long et al. developed subclass pooling for classification (SCP) to solve the double imprisonment problem. They used bounded data in a training set. In their proposed system they used a fuzzy max-pooling method and they also used the average pooling schemes. They gained a better result that shows a remarkable margin of performance of their system.

Nowadays, Lahasan et al. [8] proposed a framework called as the Optimized Symmetric Partial Face graph (OSPE) for facial identification within various situations. In their proposed method they used some cues that consists obdurate face, facial manipulation, and variation of flaming. They introduced partial facial data by which they gained results of their experiment that shows some progresses in face recognition rates.

In addition, Daun et al. [9] discovered a system named Topology Preserving Graph Matching (TPGM), in order to improve the recognition method by using incomplete images of faces. They developed the process founded on the Geometric graphs, to present faces and gallery faces. They minimized geometric and textural cost of function by using TPGM. They used four face databases to gain the expected outcome of their proposed method. They achieved better performance on facial recognition from those databases; it also proved that their invention omitted other state of the art approaches at the time.

Likewise, Cai et al. [10] proposed a facial variation modeling system forsparse representation for face recognition. They developed their proposed method depend on a single sample face. They notified the facial transmission towards different neutral, front of faces from diverse facial angle view. They performed face recognition for single image face recognition problem and showed that basic improvements can be achieved.

Another volume of face recognition tasks which is in this part was developed by Li et al. [11]. They developed their method to recognize human faces in frontal views with different illumination, disguise and occlusion. They developed a new technology to recognize human face which essences a dynamic subspace from pictures and they gained the peculiar areas for each matter. They represented a property of discriminative element for those areas. They used the K-

nearest neighbor algorithm (K-NN) [12], because of giving identification protocol to categorize faces images. Both public databases ORL and Extended Yale B were used where they applied their proposed method. They also used partial facial laws for recognition human face images and results described that their recognition rates was better.

At present, Peng et al. [13] proposed a method named Locality Constrained Collaborative Representation (LCCR) to improve elimination of representative pictures. They applied LCCR that have five distance measures with different databases. In their proposed technique three basic facial features have been used such as right eye, nose, and mouth with whisker by distinguishing the main pictures. Their experimental results indicated that they gained a high recognition rates from the right eye, mouth and whisker by working with LCCR and City Block Distance measures.

Nevertheless, in recent years the performance of proposed methods declines remarkably when dealing with acute occlusions in a face. Several previous discussions indicate that in facial recognition, closeness appears to be a key recognition factor. The rate of closeness of image changes when the target face image is partial occluded, with expressions and with the age of the subject.

2.4 Challenges

Our project “People detection based on face recognition” is very challenging work for us. In our system we have to detect people’s faces and recognize them as well as show all the saved data about them which is very challenging for us. To recognize a person in a proper way we need to train his/her image perfectly which is more challenging for us.

Requirement

Creating a dataset by saving captured images was trained firstly to recognize a match of face. Showing persons proper information which is detected is so challenging that we had needed the proper face features for detecting. Server controlling which contains a lot of information was much challenging for us.

Time Scheduling

Time scheduling refers a set of techniques used to develop and offer schedules that says when the whole work will be done. Our main concern was about time scheduling to complete this project in the meantime. If the experiment was not prepared on time it will be a big trouble for us. We divided our working time and project work among us to complete whole projects.

Cost reducing

Every decision in project development affects cost so it was another challenging task to reduce cost and increase our profits.

Increasing Communication

During the time of developing our project we had faced many questions. For achieving solution we communicated with supervisor and co supervisor. In this case, increasing communication, it was little challenging for us.

Skills for the projects

Required skills to complete our whole project work were taken properly.

CHAPTER 3

METHODOLOGY

3.1 Introduction:

In previous chapter we discussed about the related works of face detection and recognition system. We have also explained about some difference types of procedure that were used in pervious. In this chapter we will discuss about our procedure that we have used to develop this system. When we study about related works of our system then we came to know about some difference algorithm which can be used for developing face detection and recognition system. After that study we decided to select a specific algorithm. We have used Haar cascade classifier for detecting face and Local Binary Patterns histogram (LBPH) algorithm for recognizing the face. We will discuss briefly about our used algorithms in the net part of this chapter.

3.2 Methodology:

In our system we have to detect faces and recognize them. So when people come in front of the camera then it detects his/her face's portion and compares it with image database. If detected image and database image match, then his/her details will pass into server. For creating database we have to train those images along with this system. For completing whole system we need to cover following steps:

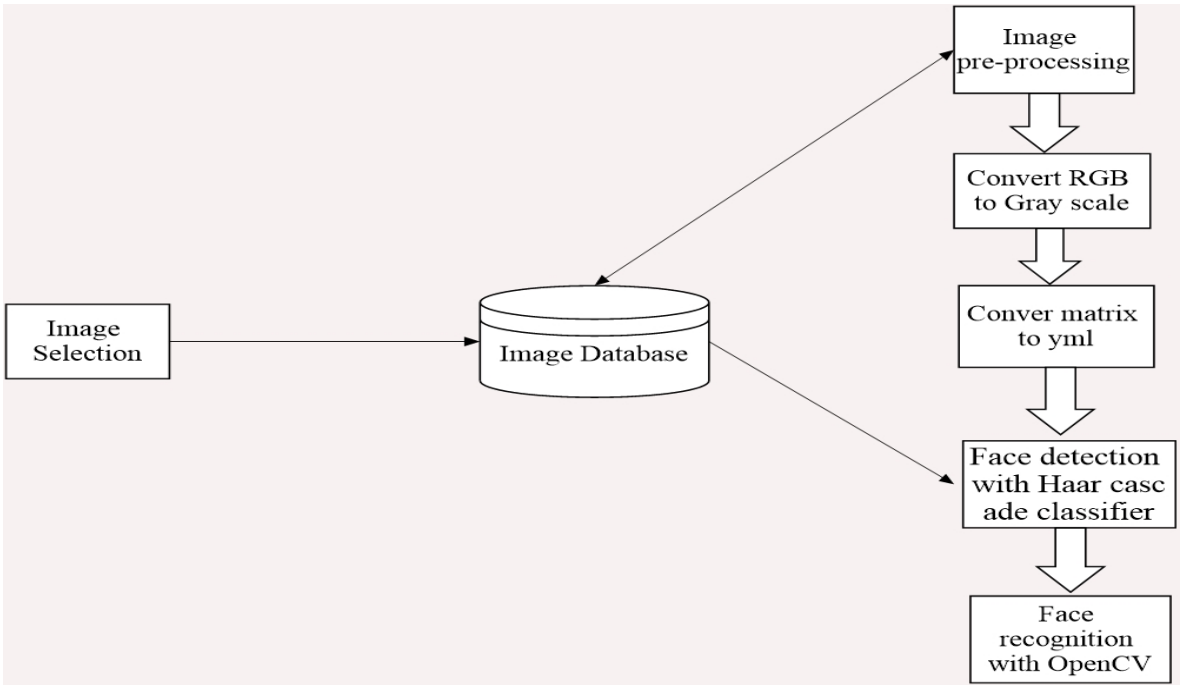

Figure 3.1: Structure of face detection and recognition using openCV

Our whole system worked with 4 main Steps which are given bellow.

A. Face Detection

B. Train stored data

C. Face recognition with Local Binary Patterns Histograms (LBPH) algorithm

D. Data passes in server.

A. Face Detection: The objective of face detection means find the faces from a person's full image or from videos. The faces are detected by the using of Haar cascade classifier. Haar cascade algorithm has 4 steps:

1. Haar features selection
2. Creating integral image
3. Adaboost training
4. Cascading Classifiers

Detecting face this algorithm needs a lot of positives and negative images .Positive image which is with face and negative image which is without face. These images are needed to train the

Classifier. Haar feature works with adjacent rectangular region at a specific location in windows. It calculates the sum pixel intensity of every territory and finds the verities among these sums.

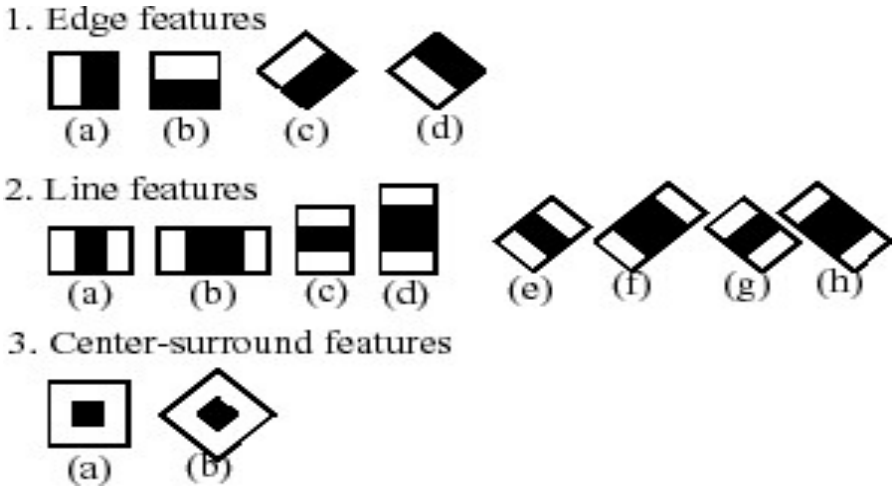

Figure 3.2: Cascade Classifier [14]

For making this system super-fast internal images are used. There can be thousands of features. For this reason Adaboost is used to find best feature and classifier is trained by Adaboost to use them.

The cascade classifier has a collection of stages and every stage is full of weak learners. Weak learner which is also simple classifier and it's called decision stumps. A technique called boosting that is used to train every stage. Boosting takes weighted average of decision which is made by weak learners. It has ability to train most accurate classifier. Every stage of the classifier labels the territory is the present position of sliding windows. It may positive or negative. If positive then object was found .if negative then object was not found. When label is negative, the classification of the region is complete. Then detector passes windows to the net position. Otherwise the classifier passes the territory to the net stage. The stages discard negative sample as soon as possible. A set of positive and negative images are needed to train cascade classifier. Mathematical equation of haar cascade classifier can be written as:

Sum = I(C) +I (A)-I (B)-I (D)

Here A, B, C, D is parts of the integral image I.

B: Train stored images: This is one of the most important parts. It is very essential to create a database of images in".yml" files which are trained by the machine. Comparing with the trained data a face will be recognized.

C: Face recognize with using LBPH: Now see Local binary patterns histograms algorithm steps:

1. Parameter: Local binary patterns histograms algorithm takes four parameter which are:

A. Radius: For building the circular local binary patterns the radius is used. The radius around the central pixel is represented by it. Normally its value is 0.

B: Neighbor: Sample point is essential to build circular local binary patterns. Its value is normally 8.

C. Grid X: Some amount of cells in horizontal direction. If more cells then more finer grid and the resulting feature is higher dimensional. It value is also 8.

D. Grid Y: Some amount of cells in vertical direction. More cells, finer grid and resulting feature is higher dimensional .Most of the times it is set to 8.

2. Training Algorithm: At first we need to train the algorithm. We need to use dataset which is used for recognize. Also there is another thing needed which ID for each image. Same person's images must have same ID.

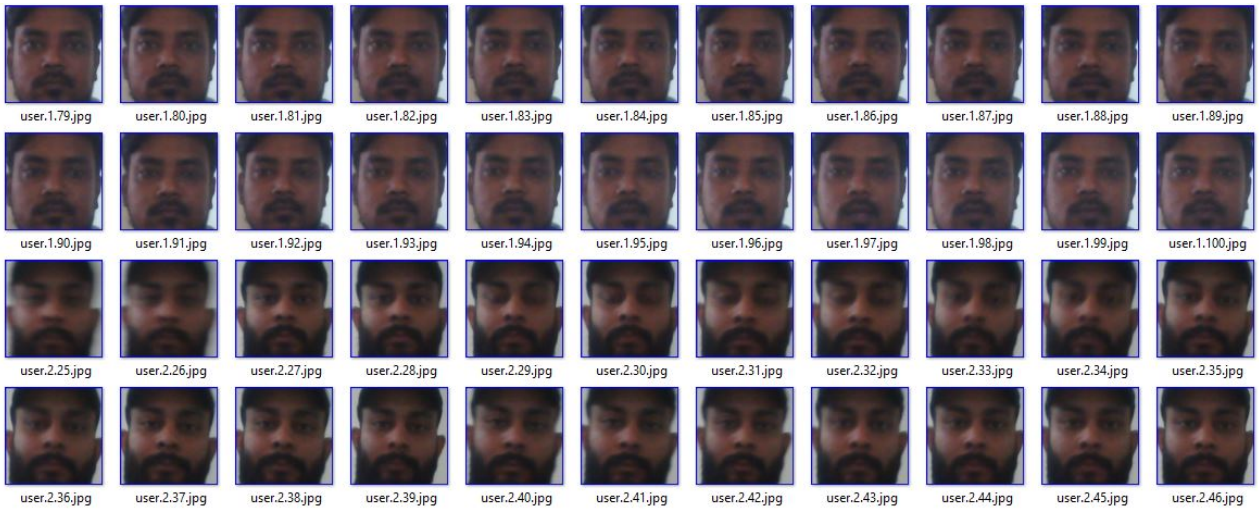

Figure 3.3: Training dataset

3. Applying LBP operation: This is a computational step. Creating intermediate image is the first computational step which describes the original image in another way with using facial characteristics that is better. This algorithm uses the idea of sliding windows with using Radius and Neighbor.

If we describe step by step then it will more understandable. So let's break it into some steps:

- This algorithm breaks an image as some grid and also matrix .Each of this grid and matrix is 3x3 pixels.
- Take middle value of the matrix and use it as threshold.
- For each of 8 neighbor of threshold, set a new binary value.
- Put 1 for equal or greater than threshold and 0 for smaller than threshold.
- At present Matrix is full with just binary number.
- Concatenate value of matrix line by line for every position
- Convert binary value into decimal and put it as the central value of matrix.
- Now get a new image of original image with better representation of characteristics.

4. Extracting the histograms: By using Grid X and grid Y it breaks into grid .each histogram have only 256 positions. It represents intensity of each pixel. Then concatenate every histogram for creating new and large histogram. The characteristics of original image are represented by final histogram.

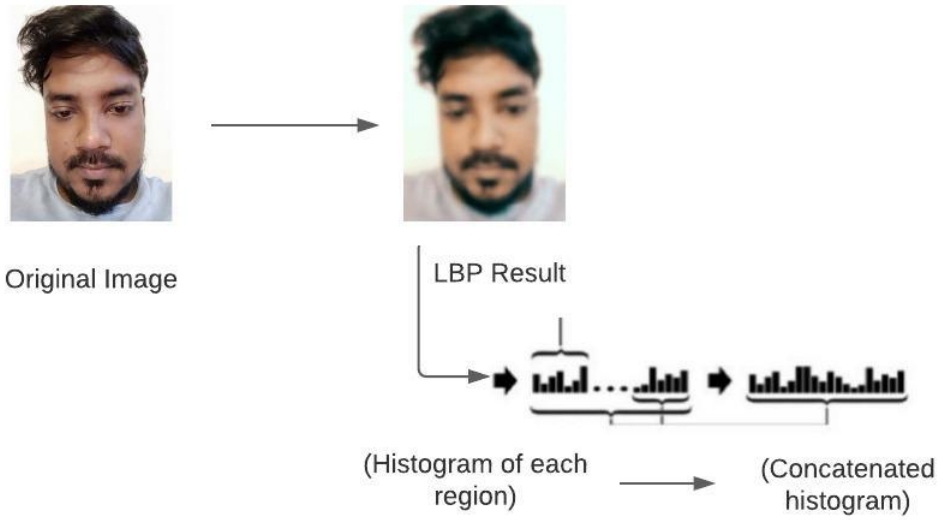

Figure 3.4: Extract histogram from original image

5. Performing and recognition:

In this step, algorithm has been trained. Every histogram is created for representing each image from database. If we give new image again as an input, we perform the steps again and create new histogram for representing database image. So for finding the matching image we need to compare two histograms. Then it returns an image with the nearest histogram. We may use different kinds of law to find the difference between two histogram like as Euclidian distance, chi-square etc. Here we can use Euclidian distance to measure distance between two histogram. The output of the algorithm is Id from the image with the nearest histogram and return measured distance. Measured distance can be used as Confidence measurement. Here lower confidence means distances between two histograms are closer. So, lower confidence is better than higher confidence. Now we can use threshold value. Face recognition will fully successful if confidence is lower than threshold.

D. Data passes on server:

We have to collect some detail about a people and put it in database with the reference of user ID which is unique. When system recognizes a person then it goes to database and find out the detail about that recognized person. Here we have created a web app using Django framework. This is one the most popular framework of python.

3.3 Proposed Model:

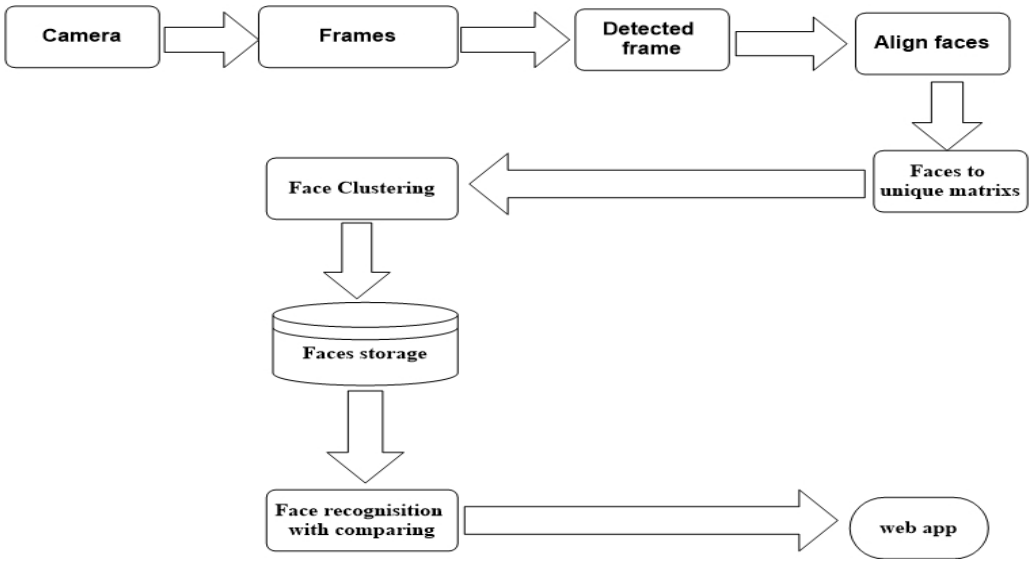

Figure 3.5: proposed model of whole system

Description:

In our system, Data is passed according to fig [5]. Camera detects face from video capture and covert face image into matrix. Then it does face clustering and store faces on database. Then it recognizes face with comparing. When match occur, then it passes data about the recognized person on server.

CHAPTER 4

DESIGN SPECIFICATION AND RESULT

4.1 Front-end design:

The Admin will put specific user id for each user to train his/her image. This user id needs to accurate identification of user. Don't put same user id for more than one user. Admin also take100 images of one user for training and all images will be putted under one user id.

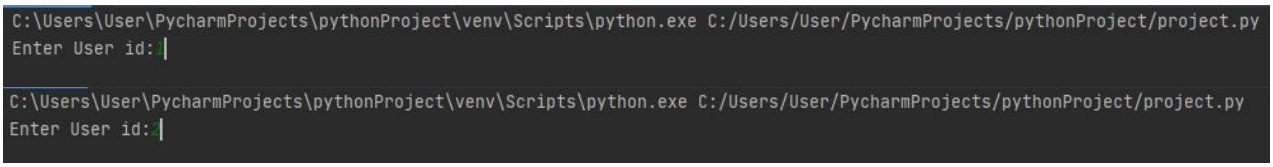

Figure 4.1: front-end design

4.2 Back-end design:

Table 4.1: Design of database

User ID	Name
1	Mahadi
2	Osheem
3	Tithi
4	Bakee
5	Jhon
6	Tomy

When our system detect faces for training admin has to give unique ID and name to store data about detected person. And In our database it is stored like as table.1.

4.3 Experimental result:

The experiment was executed by using Pycharm on windows 10 operating system. SQLite3 is used for data storing. In figure.7 two images of faces which are different in expression that are detected successfully.

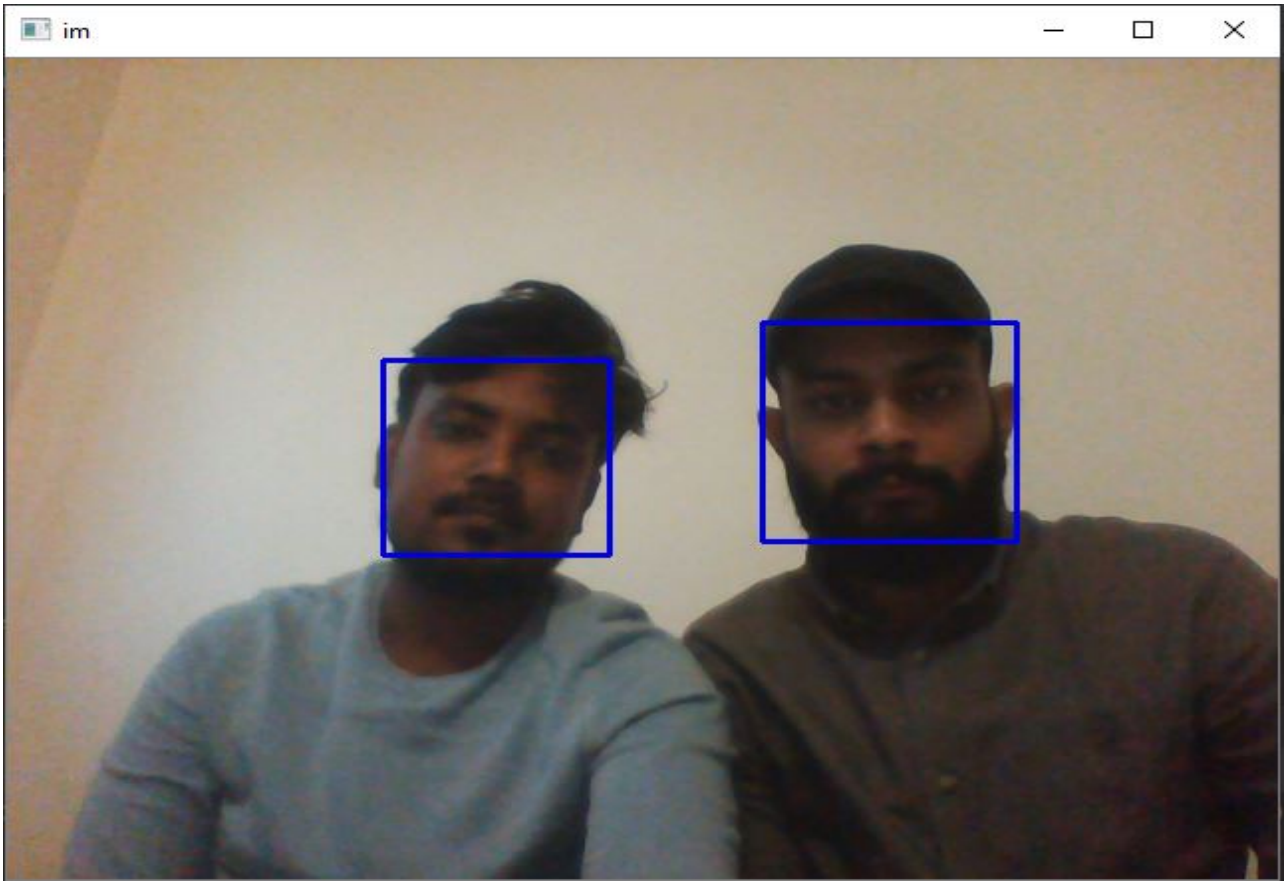

Figure 4.2: Detection of multiple faces

The process of detection is executed by using video recording. In the next step detected area of image is cropped and stored in database as dataset with a unique user ID. In figure.8 is shown the image dataset.

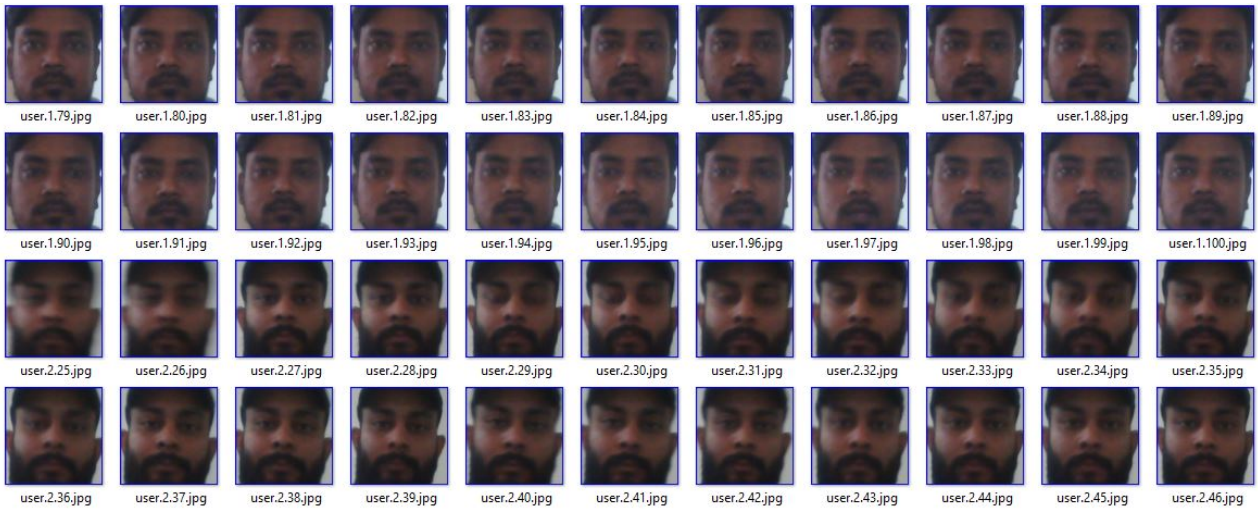

Figure 4.3: Image dataset

The next part is to recognize face. For recognition is compare two histogram and return closest histogram with the user ID. Then system brings the Name from database that is stored in database with unique user ID.

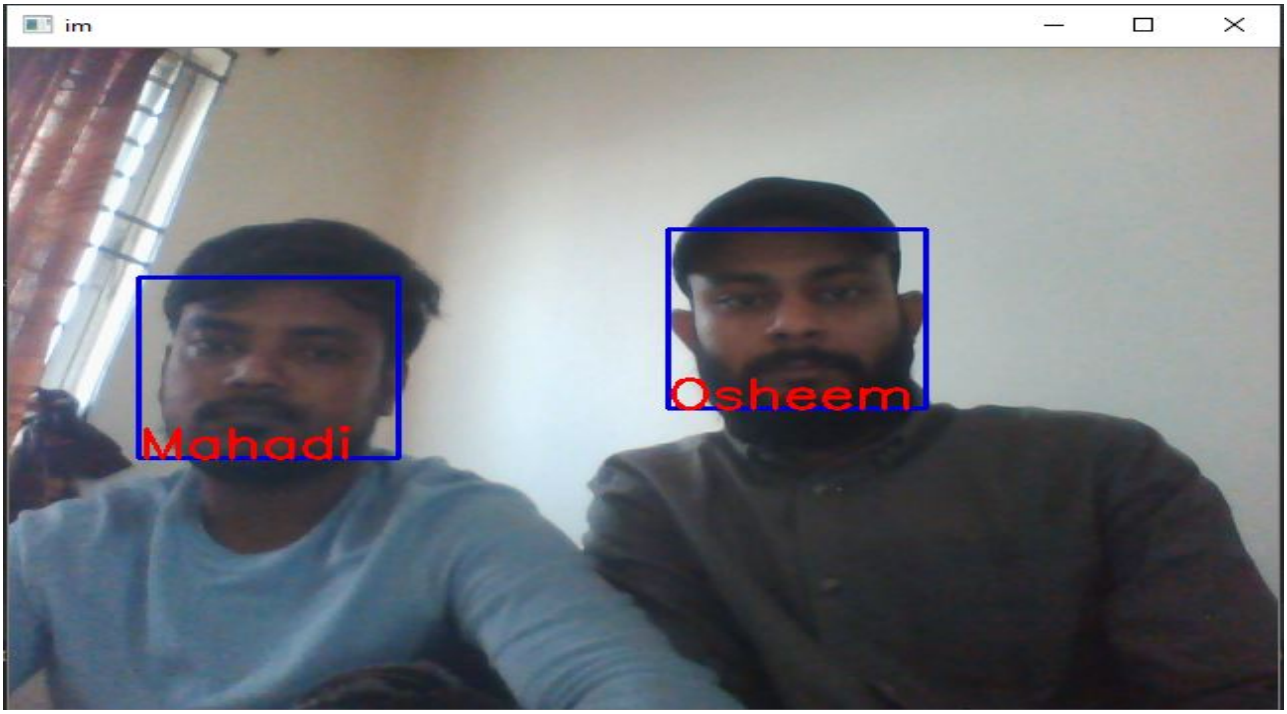

Figure 4.4: Recognition of multiple faces

4.4 Implementation Requirement:

When we started to implement this project, it was very new to us. That was hard to cover up this challenge. For implementing some cameras need for detection and recognition and need a computer to implement the code. We need to set those cameras under the same Wi-Fi network. Besides it requires some soft skills.

a. Python
b. OpenCv
c. Django framework
d. HTML
e. CSS
f. SQlite3

The database handling should be careful so that database is not being heavy for data redundancy.

CHAPTER 5

IMPLEMENTATION AND TESTING

5.1 User Registration with face detection

For face recognition, at first we have to register user with detecting his/her face using camera. By putting unique user ID an image is separated from another image.

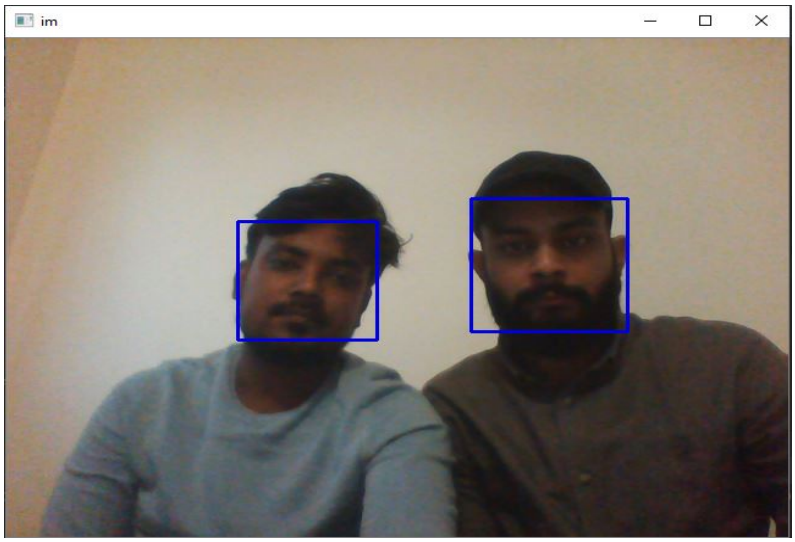

Figure 5.1: Registration using face detection

5.2 Implementation of database

Database contains a set of images and person name of each image along with user id. Database will be dynamic in future.

Table.5.1: Simple database of stored data

User ID	Name
1	Mahadi
2	Osheem
3	Tithi
4	Bakee

5.3 Training data

Trainer create .yml file. This file contains all the matrix of each image. These matrixes are used for comparing images.

```
%YAML:1.0
---
opencv_lbphfaces:
   threshold: 1.7976931348623157e+308
   radius: 1
   neighbors: 8
   grid_x: 8
   grid_y: 8
   histograms:
      - !!opencv-matrix
         rows: 1
         cols: 16384
         dt: f
         data: [ 5.78512363e-02, 2.27272715e-02, 0., 4.13223123e-03,
             1.03305783e-02, 0., 6.19834661e-03, 1.23966932e-02, 0., 0.,
             0., 0., 6.19834661e-03, 0., 1.23966932e-02, 1.03305783e-02,
             2.06611566e-02, 1.23966932e-02, 0., 8.26446246e-03,
             6.19834661e-03, 2.06611562e-03, 0., 6.19834661e-03,
             8.26446246e-03, 6.19834661e-03, 0., 0., 2.06611566e-02,
             4.13223123e-03, 3.09917349e-02, 2.47933865e-02, 0., 0., 0.,
             0., 0., 0., 0., 0., 0., 0., 0., 0., 0., 0.,
             2.06611562e-03, 1.23966932e-02, 6.19834661e-03, 0., 0., 0.,
             0., 0., 0., 0., 0., 0., 0., 8.26446246e-03, 2.06611562e-03,
             4.13223123e-03, 8.26446246e-03, 1.23966932e-02,
             2.06611562e-03, 0., 0., 6.19834661e-03, 0., 0.,
             2.06611562e-03, 0., 0., 0., 0., 0., 0., 0., 2.06611562e-03,
             8.26446246e-03, 0., 0., 0., 0., 0., 0., 0., 0., 0., 0., 0.,
             4.13223123e-03, 0., 0., 2.06611562e-03, 6.19834661e-03,
             4.13223123e-03, 0., 0., 0., 0., 0., 4.13223123e-03, 0., 0.,
             0., 0., 0., 0., 0., 4.13223123e-03, 1.65289249e-02,
             4.13223123e-03, 0., 0., 0., 0., 4.13223123e-03, 0.,
             1.23966932e-02, 0., 0., 0., 1.03305783e-02, 0.,
```

Figure 5.2: Matrix of dataset in YML file

5.4 Testing implementation:

The testing part is so excellent experience for us. In this part, we take 150 pictures of each person with many facial expressions for finding the weakness of our system. But our system gives us a very brilliant result. It can detect multiple faces in one frame and can successfully recognize multiple faces in one frame. It can –

a. Detect faces
b. Recognize faces
c. Give Detail of a person who is recognized
d. Add new user with putting new user ID.

5.5 Acceptance Test

This test case is better than other related software which can detect and recognize faces.

5.6 Test result and report

All the tested value was positive. We need to focus on graphical interface our system.

5.7 System testing

The beta testing result was very supportive. End users will understand the system easily and acknowledge will be positive.

CHAPTER 6

CONCLUSION AND FUTURE PLAN

6.1 Discussion and Conclusion

Human face recognition has significant uses in law enforcement and justice solutions by getting one step ahead of the ever-advancing criminals in the world. Facial detection and recognition system includes software solution for global law enforcement agencies to provide human safety. Facial recognition system has sufficient use for proper detection of terrorists and protects criminal attack in Homeland Defense. Proper use of this system can be seen in an airport and other transportation terminal security. A facial recognition system can improve the effectiveness of immigration and customs personnel. The financial service areas have great concern about the security system. Human face detection and recognition system increase security in the financial service sectors.

We develop facial recognition based on face detection for people. Our main aim is to detect and recognize people who are responsible for unauthorized entrance to private places. We are eager to develop a fast and efficient face recognition system that detects faces of people very quickly in the unauthorized entrance to private places. We can reduce bank robbery; militancy caused by the illegal moving of people by using our proposed method as well as our aim is to increase public awareness, human safety, and law enforcement by adopting our proposal.

6.2 Future scope

Some of the work we have finished but we have a future plan to develop this system is more reliable, understandable and user friendly. To achieve the goal we have to do some work that's are-

a. Develop a beautiful graphical user interface
b. Work more with database.
c. Create authentication to use.
d. Build dynamic web application.

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