FACE RECOGNITION

A PROJECT REPORT

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BONAFIDE CERTIFICATE

Certified that this project report titled "**Face Recognition**" is the bonafide work of "**Ansh Nagar** (21BCE10704), **Harshit Dhundale** (21BCE11454), **Prakhar Saxena** (21BCE11360), **Moinuddin** (21BCE11595), **Aatif Khan** (21BCE11290)" who carried out the project work under my supervision. Certified further that to the best of my knowledge the work reported here does not form part of any other project / research work on the basis of which a degree or award was conferred on an earlier occasion on this or any other candidate.

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The Project Exhibition I Examination is held on _____

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First and foremost, I would like to thank the Lord Almighty for His presence and immense blessings throughout the project work. I wish to express my heartfelt gratitude to Dr. Preetam Suman, Head of the Department, School of Computer Science and Engineering for much of his valuable support and encouragement in carrying out this work. I would like to thank my internal guide Mr. Gopal Singh Tandel, for continually guiding and actively participating in my project, giving valuable suggestions to complete the project work. I would like to thank all the technical and teaching staff of the School of Computer Science and Engineering, who extended directly or indirectly all support. Last, but not the least, I am deeply indebted to my parents who have been the greatest support while I worked day and night for the project to make it a success.

ABSTRACT

The face is one of the easiest ways to distinguish the individual identity of each other. Face recognition is a personal identification system that uses personal characteristics of a person to identify the person's identity. Human face recognition procedure basically consists of two phases, namely face detection, where this process takes place very rapidly in humans, except under conditions where the object is located at a short distance away, the next is the introduction, which recognize a face as individuals. Stage is then replicated and developed as a model for facial image recognition (face recognition) is one of the much-studied biometrics technology and developed by experts. There are two kinds of methods that are currently popular in developed face recognition pattern namely, Eigenface method and Fisher-face method. Facial image recognition Eigenface method is based on the reduction of face dimensional space using Principal Component Analysis (PCA) for facial features. The main purpose of the use of PCA on face recognition using Eigen faces was formed (face space) by finding the eigenvector corresponding to the largest eigenvalue of the face image. The area of this project face detection system with face recognition is Image processing.

Keywords: face detection, Eigen face, Principal Component Analysis

I. Introduction

1.1 Introduction

Face recognition involves separating image windows into two classes; one containing faces (tarning the background (clutter)). It is difficult because although commonalities exist between faces, they can vary considerably in terms of age, skin color and facial expression. The problem is further complicated by differing lighting conditions, image qualities and geometries, as well as the possibility of partial occlusion and disguise. An ideal face detector would therefore be able to detect the presence of any face under any set of lighting conditions, upon any background. The face detection task can be broken down into two steps. The first step is a classification task that takes some arbitrary image as input and outputs a binary value of yes or no, indicating whether there are any faces present in the image. The second step is the face localization task that aims to take an image as input and output the location of any face or faces within that image as some bounding box with (x, y, width, height).

1.2 Motivation To Work

Today protection and surveillance structures are of fundamental importance in high- danger regions like military, groups and so forth. In a surveillance gadget, face popularity is a vital step for higher and accurate surveillance. The complexity includes in it are high measurement subspace, a selection of expressions, lighting fixtures, length etc. Motivates to develop a new and higher set of rules which genuinely decorate the safety of such systems. The necessity for private identification within the fields of personal and comfortable structures made face popularity one of the foremost fields of different biometric technologies. The importance of face reputation rises from the reality that a face popularity device does now not require the cooperation of the man or woman even as the other structures want such cooperation. Face recognition algorithms attempt to remedy the hassle of each verification and identification. When verification is on call for, the face recognition machine is given a face photograph and it's miles given a

claimed identification. The system is anticipated to both reject or take delivery of the declare. On the other hand, inside the identity problem, the device is trained by a few images of regarded individuals and given a take a look at the image. It comes to a decision which character the check photo belongs to him.

1.3 Problem Statement

The Problem statement of Face Recognition for Real-Time Applications are given below:

- To do face recognition in real time.
- Enhance the Speed i.e. frames/sec.
- Do recognition on high Camera resolution.

The purpose of this report is to follow up on a 10-week project on face detection and recognition and give insight on how feasible it is to use a face recognition attendance system in a university environment.

1.4 Objective of the work

1. Trying to find a face within a large database of faces. In this approach the system returns a possible list of faces from the database. The most useful applications contain crowd surveillance, video content indexing, personal identification (example: driver's license), mug shots matching, etc.

2. Real time face recognition: Here, face recognition is used to identify a person on the spot and grant access to a building or a compound, thus avoiding security hassles. In this case the face is compared against multiple training samples of a person.

1.5 Summary

The automated vision systems implemented in this did not even approach the performance, nor were they as robust as a human's innate face recognition system. However, they give an insight into what the future may hold in computer vision.

II. Literature Review

2.1 Introduction

The local binary pattern is a simple however very capable texture operator which labels the pixels of an image by thresholding the neighbourhood of each pixel and take the result as a binary number. The LBP method can be seen as a unifying approach to the traditionally divergent statistical and structural models of texture analysis.

LBP is used to threshold all pixels in a definite neighbourhood based on the value of the central pixel of that neighbourhood and calculate a new value for the central pixel. So, when the central pixel is ruined by noise than the comparison between this noised pixel and its neighbours will not be the same as it was with the without noise pixel and its centre pixels. Also, according to LBP strategy, if we want to produce inferior, we have to assign values '0'Tand '1' to the pixels. The pixels with greater value than central pixels are assigned the value '0' and those with smaller than the values of central pixels are assigned the value'1'. The system may find a pixel which has value a value less than the central pixel value but a little bit and those which has a value significantly less than the value of the central pixel. But according to LBP theory both of these pixels will be assigned a value '0' which is not desirable.

2.2 Literature Survey

Shepherd et al. (1981): Ranking of significance of facial features: Hair, face outline, eyes, and mouth (not necessarily in this order) have been determined to be important for perceiving and remembering faces. Several studies have shown that the nose plays an insignificant role; this may be due to the fact that almost all of these studies have been done using frontal images.

Johnston et al. (1992) gave a possible engineering explanation of the bottom lighting effects studied It is as follows: when the actual lighting direction is opposite to the usually assumed direction, a shape-from-shading algorithm recovers incorrect structural information and hence makes recognition of faces harder.

Chellappa et al. (1995) gave a thorough survey of FRT at that time. At that time, video-based face recognition was still in a nascent stage. During the past 8 years, face recognition has received increased attention and has advanced technically. Many commercial systems for still face recognition are now available.

Bruce et al. (1998)- Is face perception the result of holistic or feature analysis? Both holistic and feature information are crucial for the perception and recognition of faces. Studies suggest the possibility of global descriptions serving as a front end for finer, feature-based perception. If dominant features are present, holistic descriptions may not be used.

2.3 Conclusion

We have presented an extensive survey of machine recognition of human faces and a brief review of related psychological studies. We have categorized the methods used for each type, and discussed their characteristics and their pros and cons. In addition to a detailed review of representative work, we have provided summaries of current developments and of challenging issues. We have categorized proposed methods of solving these problems and discussed the pros and cons of these methods.

Machine recognition of faces has emerged as an active research area spanning disciplines such as image processing, pattern recognition, computer vision, and neural networks. There are numerous applications of FRT to commercial systems such as face verification-based ATM and access control, as well as law enforcement applications to video surveillance, etc. Due to its user-friendly nature, face recognition will remain a powerful tool in spite of the existence of very reliable methods of biometric personal identification such as fingerprint analysis and iris scans.

III. Project procedure and methodology

The programming language used for the creation of software is python version 3.10. The primary libraries used for this project are:

- Dlib
- Face recognition
- Numpy
- CV2
- OS

The rest of the functions that has been used are custom created when required. During the early versions of the software standalone script were created for various face detection algorithms. The central Function was created and improved algorithm that has been previously created implemented into it. Therefore, the previously lacked accuracy and Face Detection capability.

In this previous software only face detection was implemented. So for the further functioning of the program/software we created another function to give the name of the person in the test images in the face detection box. For the identification of the person, we have created database of images containing 1000s of pictures of the various celebrities, persons, personalities, common people, students, teachers, etc. The created function first iterates through all the images in dataset and make their respective encodings and store their name and encoding of their faces in the empty lists. After running the program, it asks for the file or image path (test subject), once the test subject is given it encode the test subject, image and compare the detected faces in the test subject with encoding of the images in its database (it uses the grayscale image classifier) and once the respected faces in the test subject are matched in the database the name of the best matched person appears in the output of the test subject.

IV. Work done

The following work was done according to each week

- Week 1: We have started collecting the dataset of the images and made their respective grayscale encodings in csv file for reference.
- Week 2: We have installed the required libraries for the project and created an algorithm to detect faces in the test images/test subject.
- Week 3: We have improved the algorithm to detect faces in the test image and it was comparatively faster than the previous one.
- Week 4: We have created the function to train the algorithm to make encoding of the training images.
- Week 5: We have improved the algorithm and it can iterate over all the training images using for loop and make their respective encoding simultaneously. However, it can store upto 2 million images only.
- Week 6: We have combined all the respective functions and algorithms into main function.
- Week 7: We removed majority of the bugs, errors and glitches from the program/ software and made the website to go with our program.

V. Observation

After the completion and successful compilation of our program we tested it on various systems and observed the following:

I.   System 1: Ryzen 7 16 core cpu and RTX 3050 GPU

   A.   The program is working as intended.

   B.   No error and bugs were found.

   C.   Execution time was fast.

II.   System 2: Ryzen 5 8 core cpu GTX 1650 GPU

   A.   The program is working as intended.

   B.   No error and bugs were found.

   C.   Execution time was moderate.

III. System 3: Intel i5 11th gen 8 core CPU and intel iris xe GPU

   A.   The program is working as intended.

   B.   No error and bugs were found.

   C.   Execution time was moderate.

IV.   System 4: Intel i7 11th gen 12 core CPU and RTX 3050 GPU

   A.   The program is working as intended.

   B.   No error and bugs were found.

  C. Execution time was moderate.

V. System 5: Intel i9 11th gen 16 core CPU and RTX 3090ti GPU

  A. The program is working as intended.

  B. No error and bugs were found.

  C. Execution time was fast.

VI. System 6: Intel pentium gold and no GPU

  A. The program is working as intended.

  B. No error and bugs were found.

  C. Execution time was very slow.

From the above result we observed the following:
1. Our program is working as intended.
2. No error and bugs were found.
3. Execution time was dependent on CPU and independent of GPU.
4. The higher the number of cores in the CPU the faster the execution of the program.
5. The program was independent of the CPU architecture but depends on cache memory.
6. The only limiting factors of the program is the number of training images i.e. approximately 2M and storage of training images on RAM.

VI. Conclusion

From the above-mentioned observation, we can conclude that our program is working correctly and fulfilling its purpose.

Contribution Table

Name	Reg No.	Contribution
Ansh Nagar	21BCE10704	50%
Harshit Dhundale	21BCE11454	48.5%
Prakhar Saxena	21BCE11360	.5%
Aatif Khan	21BCE11290	.5%
Moinuddin Khan	21BCE11595	.5%

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