**MINI PROJECT Report**

**ON**

**ONLINE FACE RECOGNITION SYSTEM**

**VI SEM BTECH CS-IT**

**DEPARTMENT**

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**CERTIFICATE**

*(from Internal PANKAJ KUMAR of MINI PROJECT i.e.  PRANAV MORE)*

Certified that Mr. RISHABH AGGARWAL (Roll No.- 1918909) have Completed MINI PROJECT “**ONLINE FACE RECOGNITION SYSTEM”** on the topic under the guidance of MR MOHD NOOR for full filament of IT 6 Semester mini project in Graphic Era Deemed University, Dehradun. Students have successfully Completed this Course as best of my knowledge.

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**INTRODUCTION**

### About Project-

The project on Face recognition attendance system is based on python and open- cv .

The project is divided into different modules . To do different tasks different functions are made which make the project more easy and handy.

Facial recognition is a way of identifying or confirming an individual’s identity using their face. Facial recognition systems can be used to identify people in photos, videos, or in real-time.

Facial recognition is a category of [biometric security](https://www.kaspersky.com/resource-center/definitions/biometrics). Other forms of biometric software include voice recognition, fingerprint recognition, and eye retina or iris recognition. The technology is mostly used for security and law enforcement, though there is increasing interest in other areas of use.

Face recognition attendance system allows us mark the attendance accordingly. The functionalities of this system are maintaining employees, students etc records.

Following are the features of the project:-

* It will detect the face of the person accordingly.
* Match it with the record of that particular person.
* It will store the data of the user.
* Maintain the record of the user.

### Project Description-

*Minimum System Requirements:*

* Intel intel i5 and Windows 10
* Memory 6 GB
* PyCharm Community Edition 2020.1.1
* Open-cv

#### OPEN-CV:

OpenCV is a cross-platform library using which we can develop real- time **computer vision applications**. It mainly focuses on image processing, video capture and analysis including features like face detection and object detection.

OpenCV (Open Source Computer Vision Library) is an open source computer vision and machine learning software library. OpenCV was built to provide a common infrastructure for computer vision applications and to accelerate the use of machine perception in the commercial products. Being a BSD-licensed product, OpenCV makes it easy for businesses to utilize and modify the code.

The library has more than 2500 optimized algorithms, which includes a comprehensive set of both classic and state-of-the-art computer vision and machine learning algorithms. These algorithms can be used to detect and recognize faces, identify objects, classify human actions in videos, track camera movements, track moving objects, extract 3D models of objects, produce 3D point clouds from stereo cameras, stitch images together to produce a high resolution image of an entire scene, find similar images from an image database, remove red eyes from images taken using flash, follow eye movements, recognize scenery and establish markers to overlay it with augmented reality, etc. OpenCV has more than 47 thousand people of user community and estimated number of downloads exceeding [18 million](https://sourceforge.net/projects/opencvlibrary/files/stats/timeline?dates=2001-09-20+to+2019-01-30). The library is used extensively in companies, research groups and by governmental bodies.

Along with well-established companies like Google, Yahoo, Microsoft, Intel, IBM, Sony, Honda, Toyota that employ the library, there are many startups such as Applied Minds, VideoSurf, and Zeitera, that make extensive use of OpenCV. OpenCV’s deployed uses span the range from stitching streetview images together, detecting intrusions in surveillance video in Israel, monitoring mine equipment in China, helping robots navigate and pick up objects at Willow Garage, detection of swimming pool drowning accidents in Europe, running interactive art in Spain and New York, checking runways for debris in Turkey, inspecting labels on products in factories around the world on to rapid face detection in Japan.

WHAT IS FACE RECOGNITION

While humans can recognize faces without much effort, facial recognition is a challenging pattern recognition problem in computing. Facial recognition systems attempt to identify a human face, which is three-dimensional and changes in appearance with lighting and facial expression, based on its two-dimensional image. To accomplish this computational task, facial recognition systems perform four steps. First face detection is used to segment the face from the image background. In the second step the segmented face image is aligned to account for face [pose](https://en.wikipedia.org/wiki/Pose), image size and photographic properties, such as illumination and grayscale. The purpose of the alignment process is to enable the accurate localization of facial features in the third step, the facial feature extraction. Features such as eyes, nose and mouth are pinpointed and measured in the image to represent the face. The so established feature vector of the face is then, in the fourth step, matched against a database of faces.

### **Human identification at a distance (HID)**

To enable human identification at a distance (HID) low-resolution images of faces are enhanced using face hallucination. In CCTV imagery faces are often very small. But because facial recognition algorithms that identify and plot facial features require high resolution images, resolution enhancement techniques have been developed to enable facial recognition systems to work with imagery that has been captured in environments with a high signal-to-noise ratio. Face hallucination algorithms that are applied to images prior to those images being submitted to the facial recognition system use example-based machine learning with pixel substitution or nearest neighbour distribution indexes that may also incorporate demographic and age related facial characteristics. Use of face hallucination techniques improves the performance of high resolution facial recognition algorithms and may be used to overcome the inherent limitations of super-resolution algorithms. Face hallucination techniques are also used to pre-treat imagery where faces are disguised. Here the disguise, such as sunglasses, is removed and the face hallucination algorithm is applied to the image. Such face hallucination algorithms need to be trained on similar face images with and without disguise. To fill in the area uncovered by removing the disguise, face hallucination algorithms need to correctly map the entire state of the face, which may be not possible due to the momentary facial expression captured in the low resolution image.

**3-DIAMENTIONAL RECOGNITION**

Three-dimensional face recognition technique uses 3D sensors to capture information about the shape of a face. This information is then used to identify distinctive features on the surface of a face, such as the contour of the eye sockets, nose, and chin. One advantage of 3D face recognition is that it is not affected by changes in lighting like other techniques. It can also identify a face from a range of viewing angles, including a profile view. Three-dimensional data points from a face vastly improve the precision of face recognition. 3D-dimensional face recognition research is enabled by the development of sophisticated sensors that project structured light onto the face.

3D matching technique are sensitive to expressions, therefore researchers at Technion applied tools from metric geometry to treat expressions as isometries.A new method of capturing 3D images of faces uses three tracking cameras that point at different angles; one camera will be pointing at the front of the subject, second one to the side, and third one at an angle. All these cameras will work together so it can track a subject's face in real-time and be able to face detect and recognize.

**APPLICATION**

### Social media

Founded in 2013, Looksery went on to raise money for its face modification app on Kickstarter. After successful crowdfunding, Looksery launched in October 2014. The application allows video chat with others through a special filter for faces that modifies the look of users. Image augmenting applications already on the market, such as Facetune and Perfect365, were limited to static images, whereas Looksery allowed augmented reality to live videos. In late 2015 SnapChat purchased Looksery, which would then become its landmark lenses function.[]](https://en.wikipedia.org/wiki/Facial_recognition_system#cite_note-51) Snapchat filter applications use face detection technology and on the basis of the facial features identified in an image a 3D mesh mask is layered over the face.

DeepFace is a deep learning facial recognition system created by a research group at Facebook. It identifies human faces in digital images. It employs a nine-layer neural net with over 120 million connection weights, and was trained on four million images uploaded by Facebook users The system is said to be 97% accurate, compared to 85% for the FBI's Next Generation Identification system.

TikTok's algorithm has been regarded as especially effective, but many were left to wonder at the exact programming that caused the app to be so effective in guessing the user's desired content.[]](https://en.wikipedia.org/wiki/Facial_recognition_system#cite_note-56) In June 2020, Tiktok released a statement regarding the "For You" page, and how they recommended videos to users, which did not include facial recognition. In February 2021, however, Tiktok agreed to a $92 million settlement to a US lawsuit which alleged that the app had used facial recognition in both user videos and its algorithm to identify age, gender and ethnicity.

### ID verification

The emerging use of facial recognition is in the use of ID verification services. Many companies and others are working in the market now to provide these services to banks, ICOs, and other e-businesses. Face recognition has been leveraged as a form of biometric authentication for various computing platforms and devices; Android 4.0 "Ice Cream Sandwich" added facial recognition using a smartphone's front camera as a means of unlocking devices while Microsoft introduced face recognition login to its Xbox 360 video game console through its Kinect accessory, as well as Windows 10 via its "Windows Hello" platform (which requires an infrared-illuminated camera). In 2017, Apple's iPhone X smartphone introduced facial recognition to the product line with its "Face ID" platform, which uses an infrared illumination system.

#### Face ID

Apple introduced Face ID on the flagship iPhone X as a biometric authentication successor to the Touch ID, a fingerprint based system. Face ID has a facial recognition sensor that consists of two parts: a "Romeo" module that projects more than 30,000 infrared dots onto the user's face, and a "Juliet" module that reads the pattern. The pattern is sent to a local "Secure Enclave" in the device's central processing unit (CPU) to confirm a match with the phone owner's face.

The facial pattern is not accessible by Apple. The system will not work with eyes closed, in an effort to prevent unauthorized access. The technology learns from changes in a user's appearance, and therefore works with hats, scarves, glasses, and many sunglasses, beard and makeup. It also works in the dark. This is done by using a "Flood Illuminator", which is a dedicated infrared flash that throws out invisible infrared light onto the user's face to properly read the 30,000 facial points.

### Deployment of FRT for availing government services

In an interview, the National Health Authority chief Dr. R.S. Sharma said that facial recognition technology would be used in conjunction with [Aadhaar](https://en.wikipedia.org/wiki/Aadhaar) to authenticate the identity of people seeking vaccines.[]](https://en.wikipedia.org/wiki/Facial_recognition_system#cite_note-69) Ten human rights and digital rights organizations and more than 150 individuals signed a statement by the Internet Freedom Foundation that raised alarm against the deployment of facial recognition technology in the central government's vaccination drive process. Implementation of an error-prone system without adequate legislation containing mandatory safeguards, would deprive citizens of essential services and linking this untested technology to the vaccination roll-out in India will only exclude persons from the vaccine delivery system.

In July, 2021, a press release by the Government of Meghalaya stated that facial recognition technology (FRT) would be used to verify the identity of pensioners to issue a Digital Life Certificate using “Pensioner’s Life Certification Verification” mobile application The notice, according to the press release, purports to offer pensioners “a secure, easy and hassle-free interface for verifying their liveness to the Pension Disbursing Authorities from the comfort of their homes using smart phones”. Mr. Jade Jeremiah Lyngdoh, a law student, sent a legal notice to the relevant authorities highlighting that “The application has been rolled out without any anchoring legislation which governs the processing of personal data and thus, lacks lawfulness and the Government is not empowered to process data.

**USE OF SOFTWARE AND LIBRARY**

OPENCV

## **Computer Vision**

**Computer vision** is a process by which we can understand the images and videos how they are stored and how we can manipulate and retrieve data from them. Computer Vision is the base or mostly used for Artificial Intelligence. Computer-Vision is playing a major role in self-driving cars, robotics as well as in photo correction apps. 

## **OpenCV**

OpenCV is the huge open-source library for the computer vision, machine learning, and image processing and now it plays a major role in real-time operation which is very important in today’s systems. By using it, one can process images and videos to identify objects, faces, or even handwriting of a human. When it integrated with various libraries, such as NumPy, python is capable of processing the OpenCV array structure for analysis. To Identify image pattern and its various features we use vector space and perform mathematical operations on these features.

The first OpenCV version was 1.0. OpenCV is released under a BSD license and hence it’s free for both **academic** and **commercial** use. It has C++, C, Python and Java interfaces and supports Windows, Linux, Mac OS, iOS and Android. When OpenCV was designed the main focus was real-time applications for computational efficiency. All things are written in optimized C/C++ to take advantage of multi-core processing.   
Look at the following images

**Applications of OpenCV:**There are lots of applications which are solved using OpenCV, some of them are listed below 

* face recognition
* Automated inspection and surveillance
* number of people – count (foot traffic in a mall, etc)
* Vehicle counting on highways along with their speeds
* Interactive art installations
* Anamoly (defect) detection in the manufacturing process (the odd defective products)
* Street view image stitching
* Video/image search and retrieval
* Robot and driver-less car navigation and control
* object recognition
* Medical image analysis
* Movies – 3D structure from motion
* TV Channels advertisement recognition

**OpenCV Functionality** 

* Image/video I/O, processing, display (core, imgproc, highgui)
* Object/feature detection (objdetect, features2d, nonfree)
* Geometry-based monocular or stereo computer vision (calib3d, stitching, videostab)
* Computational photography (photo, video, superres)
* Machine learning & clustering (ml, flann)
* CUDA acceleration (gpu)

## **Image-Processing**

Image processing is a method to perform some operations on an image, in order to get an enhanced image and or to extract some useful information from it.   
If we talk about the basic definition of image processing then **“Image processing is the analysis and manipulation of a digitized image, especially in order to improve its quality”.**

**Digital-Image :**  
An image may be defined as a two-dimensional function f(x, y), where x and y are spatial(plane) coordinates, and the amplitude of fat any pair of coordinates (x, y) is called the intensity or grey level of the image at that point.   
In another word An image is nothing more than a two-dimensional matrix (3-D in case of coloured images) which is defined by the mathematical function f(x, y) at any point is giving the pixel value at that point of an image, the pixel value describes how bright that pixel is, and what colour it should be.   
Image processing is basically signal processing in which input is an image and output is image or characteristics according to requirement associated with that image.   
**Image processing basically includes the following three steps:** 

1. Importing the image
2. Analysing and manipulating the image
3. Output in which result can be altered image or report that is based on image analysis

**NUMPY**

NumPy is a general-purpose array-processing package. It provides a high-performance multidimensional array object, and tools for working with these arrays. It is the fundamental package for scientific computing with Python. It is open-source software. It contains various features including these important ones:

* A powerful N-dimensional array object
* Tools for integrating C/C++ and Fortran code
* Useful linear algebra, Fourier transform, and random number capabilities

Besides its obvious scientific uses, NumPy can also be used as an efficient multi-dimensional container of generic data. Arbitrary data-types can be defined using Numpy which allows NumPy to seamlessly and speedily integrate with a wide variety of databases. **Installation:**

* **Mac**and **Linux**users can install NumPy via pip command:

pip install numpy.

* **Windows** does not have any package manager analogous to that in linux or mac.Please download the pre-built windows installer for NumPy from [here](http://www.lfd.uci.edu/~gohlke/pythonlibs/#numpy) (according to your system configuration and Python version). And then install the packages manually.

**Note:**All the examples discussed below will not run on an **online IDE.** **1. Arrays in NumPy:** NumPy’s main object is the homogeneous multidimensional array.

* It is a table of elements (usually numbers), all of the same type, indexed by a tuple of positive integers.
* In NumPy dimensions are called *axes*. The number of axes is *rank*.
* NumPy’s array class is called **ndarray**. It is also known by the alias **array**.

## CONCLUSION

* To start the project first I have to understand the project , for that I used internet and understand about the project
* To divide the project into different modules , I checked a sample project and by taking idea from that I divided my project into different modules
* To check the syntax of different inbuilt functions I read the books
* To debug the program I compile it and rectify the errors one by one

After facing different challenges and overcoming them with the help of books, internet , I was able to rectify and complete the modules of the project and hence was finally successful in completing the project.

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