

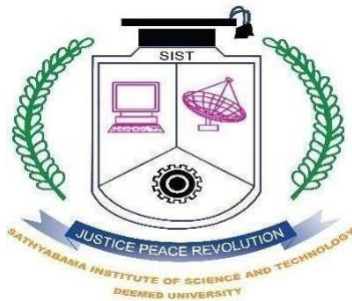
FACE RECOGNITION ATTENDANCE AND MASK DETECTOR

Submitted in partial fulfillment of the requirements for the award of
Bachelor of Engineering Degree in
Computer Science and Engineering

By

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BONAFIDE CERTIFICATE

This is to certify that ,this is the bonafide work of

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Face Recognition Attendance and Mask Detector

Abstract:

Classroom attendance checking is a contributing element to student engagement and the final triumph in the courses. Gaining attendance by calling over the names or moving around an attendance file are both time-consuming and hectic, especially the other half is to open passage to easy types of frauds. Face recognition and detection are used to regulate the location and adjustments of the faces in the ongoing class-room images and obtain some sub image for each face. Also, in face recognition, the taken face images which are detected will be differentiated with the database consisting of the images of people in the class, and then the attendance will be recorded appropriately. Neural networks are used for mostly most of the things these days. This project proposed is aimed to build a face recognition and mask detector, where the position will define the type of face to be achieved and the position names as well.

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CHAPTER 1

INTRODUCTION

N

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. 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.

The technology is used for a variety of purposes. These include:

- Unlocking phones

Various phones, including the most recent iPhones, use face recognition to unlock the device. The technology offers a powerful way to protect personal data and ensures that sensitive data remains inaccessible if the phone is stolen. Apple claims that the chance of a random face unlocking your phone is about one in 1 million.

- Law enforcement

Facial recognition is regularly being used by law enforcement. According to this NBC report, the technology is increasing amongst law enforcement agencies within the US, and the same is true in other countries. Police collects mugshots from arrestees and compare them against local, state, and federal face recognition databases. Once an arrestee's photo has been taken, their picture will be added to databases to be scanned whenever police carry out another criminal search.

Also, mobile face recognition allows officers to use smartphones, tablets, or other portable devices to take a photo of a driver or a pedestrian in the field and immediately

compare that photo against to one or more face recognition databases to attempt an identification.

- Airports and border control

Facial recognition has become a familiar sight at many airports around the world. Increasing numbers of travellers hold biometric passports, which allow them to skip the ordinarily long lines and instead walk through an automated ePassport control to reach the gate faster. Facial recognition not only reduces waiting times but also allows airports to improve security. The US Department of Homeland Security predicts that facial recognition will be used on 97% of travellers by 2023. As well as at airports and border crossings, the technology is used to enhance security at large-scale events such as the Olympics.



Fig. 1.1 Airport Face Recognition

- Finding missing persons

Facial recognition can be used to find missing persons and victims of human trafficking. Suppose missing individuals are added to a database. In that case, law enforcement

can be alerted as soon as they are recognized by face recognition — whether it is in an airport, retail store, or other public space.

- Reducing retail crime

Facial recognition is used to identify when known shoplifters, organized retail criminals, or people with a history of fraud enter stores. Photographs of individuals can be matched against large databases of criminals so that loss prevention and retail security professionals can be notified when shoppers who potentially represent a threat enter the store.

- Improving retail experiences

The technology offers the potential to improve retail experiences for customers. For example, kiosks in stores could recognize customers, make product suggestions based on their purchase history, and point them in the right direction. “Face pay” technology could allow shoppers to skip long checkout lines with slower payment methods.

- Banking

Biometric online banking is another benefit of face recognition. Instead of using one-time passwords, customers can authorize transactions by looking at their smartphone or computer. With facial recognition, there are no passwords for hackers to compromise. If hackers steal your photo database, 'liveless' detection – a technique used to determine whether the source of a biometric sample is a live human being or a fake representation – should (in theory) prevent them from using it for impersonation purposes. Face recognition could make debit cards and signatures a thing of the past.

- Marketing and advertising

Marketers have used facial recognition to enhance consumer experiences. For example, frozen pizza brand DiGiorno used facial recognition for a 2017 marketing campaign where it analyzed the expressions of people at DiGiorno-themed parties to

gauge people's emotional reactions to pizza. Media companies also use facial recognition to test audience reaction to movie trailers, characters in TV pilots, and

optimal placement of TV promotions. Billboards that incorporate face recognition technology – such as London’s Piccadilly Circus – means brands can trigger tailored advertisements.

- Healthcare

Hospitals use facial recognition to help with patient care. Healthcare providers are testing the use of facial recognition to access patient records, streamline patient registration, detect emotion and pain in patients, and even help to identify specific genetic diseases. AiCure has developed an app that uses facial recognition to ensure that people take their medication as prescribed. As biometric technology becomes less expensive, adoption within the healthcare sector is expected to increase.

- Tracking student or worker attendance

Some educational institutions in China use face recognition to ensure students are not skipping class. Tablets are used to scan students' faces and match them to photos in a database to validate their identities. More broadly, the technology can be used for workers to sign in and out of their workplaces, so that employers can track attendance.

- Recognizing drivers

According to this consumer report, *car companies* are experimenting with facial recognition to replace car keys. The technology would replace the key to access and start the car and remember drivers' preferences for seat and mirror positions and radio station presets.

- Monitoring gambling addictions

Facial recognition can help gambling companies protect their customers to a higher degree. Monitoring those entering and moving around gambling areas is difficult for human staff, especially in large crowded spaces such as casinos. Facial recognition technology enables companies to identify those who are registered as gambling

addicts

and keeps a record of their play so staff can advise when it is time to stop. Casinos can face hefty fines if gamblers on voluntary exclusion lists are caught gambling.

▪ **Examples of facial recognition technology**

1. Amazon previously promoted its cloud-based face recognition service named Rekognition to law enforcement agencies. However, in a June 2020 blog post, the company announced it was planning a one-year moratorium on the use of its technology by police. The rationale for this was to allow time for US federal laws to be initiated, to protect human rights and civil liberties.
2. Apple uses facial recognition to help users quickly unlock their phones, log in to apps, and make purchases.
3. British Airways enables facial recognition for passengers boarding flights from the US. Travellers' faces can be scanned by a camera to have their identity verified to board their plane without showing their passport or boarding pass. The airline has been using the technology on UK domestic flights from Heathrow and is working towards biometric boarding on international flights from the airport.
4. Cigna, a US-based healthcare insurer, allows customers in China to file health insurance claims which are signed using a photo, rather than a written signature, in a bid to cut down on instances of fraud.
5. Coca-Cola has used facial recognition in several ways across the world. Examples include rewarding customers for recycling at some of its vending machines in China, delivering personalized ads on its vending machines in Australia, and for event marketing in Israel.
6. Facebook began using facial recognition in the US in 2010 when it automatically tagged people in photos using its tag suggestions tool. The tool scans a user's face and offers suggestions about who that person is. Since 2019, Facebook has made the feature opt-in as part of a drive to become more privacy focused. Facebook provides information on how you can opt-in or out of face recognition [here](#).
7. Google incorporates the technology into Google Photos and uses it to sort pictures

and automatically tag them based on the people recognized.

8. MAC make-up, uses facial recognition technology in some of its brick-and-mortar stores, allowing customers to virtually "try on" make-up using in-store augmented reality mirrors.
9. McDonald's has used facial recognition in its Japanese restaurants to assess the quality of customer service provided there, including analyzing whether its employees are smiling while assisting customers.
10. Snapchat is one of the pioneers of facial recognition software: it allows brands and organizations to create filters which mould to the user's face — hence the ubiquitous puppy dog faces and flower crown filters seen on social media.

Technology companies that provide facial recognition technology include:

- Kairos
- Noldus
- Affectiva
- Sightcorp
- Nviso

1.1 SCOPE OF THE PROJECT

The prediction will also aid the players to make decisions such as the choice of movements or to discard a pose at an early stage in case of critical situations. Further, predicting poses can facilitate the players to have a better vision on their performance, improvements and its scheduling day-to-day basis. Thus, it is necessary to simulate & predict the pose yield before performing for efficient performance management and expected outcome. As there exists a non-linear relationship between pose yield and the factors influencing pitch and weather.

CHAPTER 2

LITERATURE SURVEY

2.1 SURVEY 1

Alexander Toshev ; Christian Szegedy “Face Recognition System” 2019 Fourth International Conference on Computing Communication Control and Automation (ICCUBEA)

In present times, face recognition has become one of the best technologies for computer vision. Face recognition is always a very difficult task in computer vision, illumination, pose, facial expression. Face recognition tracks target objects in live video images taken with a video camera. In simple words, it is a system application for automatically identifying a person from a still image or video frame. In this paper we proposed an automated face recognition system. This application based on face detection, feature extraction and recognition algorithms, which automatically detects the human face when the person in front of the camera recognizing him. We used KLT Algorithm, Viola-Jones Algorithm face detection which detect human face using Haar cascade classifier, however camera is continuously detecting the face every frame, PCA algorithm for feature selection. We apply a model combining to match the geometric characteristics of the human face

2.2 SURVEY 2

Naimat Ullah Khan, Wanggen Wan “A deep facial recognition system using computational intelligent algorithms”: Conference: 2018 International Conference on Audio, Language and Image Processing (ICALIP), 2018.

The development of biometric applications, such as facial recognition (FR), has recently become important in smart cities. Many scientists and engineers around the world have focused on establishing increasingly robust and accurate algorithms and

methods for these types of systems and their applications in everyday life. FR is developing

technology with multiple real-time applications. The goal of this paper is to develop a complete FR system using transfer learning in fog computing and cloud computing. The developed system uses deep convolutional neural networks (DCNN) because of the dominant representation; there are some conditions including occlusions, expressions, illuminations, and pose, which can affect the deep FR performance. DCNN is used to extract relevant facial features. These features allow us to compare faces between them in an efficient way. The system can be trained to recognize a set of people and to learn via an online method, by integrating the new people it processes and improving its predictions on the ones it already has. The proposed recognition method was tested with different three standard machine learning algorithms (Decision Tree (DT), K Nearest Neighbor(KNN), Support Vector Machine (SVM)). The proposed system has been evaluated using three datasets of face images (SDUMLA-HMT, 113, and CASIA) via performance metrics of accuracy, precision, sensitivity, specificity, and time. The experimental results show that the proposed method achieves superiority over other algorithms according to all parameters. The suggested algorithm results in higher accuracy (99.06%), higher precision (99.12%), higher recall (99.07%), and higher specificity (99.10%) than the comparison algorithms.

2.3 SURVEY 3

Anubhav Singh; Shruti Agarwal; Preeti Nagrath; Anmol Saxena; Narina Thakur

“Face Recognition System using Artificial Neural Networks Approach”

IEEE INSPEC Accession Number: 18620809: (2019)

Advances in face recognition have come from considering various aspects of this specialized perception problem. Earlier methods treated face recognition as a standard pattern recognition problem; later methods focused more on the representation aspect, after realizing its uniqueness using domain knowledge; more recent methods have been concerned with both representation and recognition, so a robust system with good generalization capability can be built by adopting

state-of-the-art techniques from learning, computer vision, and pattern recognition. A face recognition system based on recent method which concerned with both representation and recognition using artificial

neural networks is presented. This paper initially provides the overview of the proposed face recognition system, and explains the methodology used. It then evaluates the performance of the system by applying two (2) photometric normalization techniques: histogram equalization and homomorphic filtering, and comparing with euclidean distance, and normalized correlation classifiers. The system produces promising results for face verification and face recognition

2.4 SURVEY 4

CE ZHENG*, WENHAN WU*, CHEN CHEN, USA TAOJIANNAN YANG, “A Review of Person Recognition Based on Face Model”, International Conference on Computing, Communication and Automation , 2017.

Face recognition has become an attractive field in computer-based application development in the last few decades. This is because of the wide range of areas in which it is used. In addition, because of the wide variations of faces, face recognition from database images, real data, capture images, and sensor images are a challenging problem and limitation. Image processing, pattern recognition, and computer vision are relevant subjects to the face recognition field. The innovation of new approaches of face authentication technologies is a continuous subject to building much stronger face recognition algorithms. In this work, to identify a face, three major strategies for feature extractions are discussed. Appearance-based, Model-based methods and hybrid methods as feature extractions techniques are discussed too. There is also a review of major person recognition research. The characteristics of good face authentication applications, Classification, Distance measurements, and face databases are discussed while the final suggested methods are presented. This research has six sections ordered as follows: Section one is the introduction. Section two is dedicated to applications related to face recognition. In section three, face recognition techniques are presented by details. Then, classification types are illustrated in section four. In section five, standard face databases are presented. Finally, in section six, the conclusion is presented followed by the list of references.

2.5 SURVEY 5

Ramya M, Chetan Balaji, Girish L, “Image-based Face Detection and Recognition: State of the Art”, International Journal of Advanced Research in Computer Engineering & Technology (IJARCET) Volume 4 Issue 5, May 2015 .

Face recognition from image or video is a popular topic in biometrics research. Many public places usually have surveillance cameras for video capture and these cameras have their significant value for security purpose. It is widely acknowledged that the face recognition have played an important role in surveillance system as it doesn't need the object's cooperation. The actual advantages of face based identification over other biometrics are uniqueness and acceptance. As human face is a dynamic object having high degree of variability in its appearance, that makes face detection a difficult problem in computer vision. In this field, accuracy and speed of identification is a main issue. The goal of this paper is to evaluate various face detection and recognition methods, provide complete solution for image based face detection and recognition with higher accuracy, better response rate as an initial step for video surveillance. Solution is proposed based on performed tests on various face rich databases in terms of subjects, pose, emotions, race and light.

2.6 SURVEY 6

Rakesh Kumar, M.P. Singh, Prabhat Kumar and J.P. Singh, “Study of Face Recognition Techniques: A Survey”, Vel Tech Rangarajan Dr. Sagunthala R&D Institute of Science and Technology, Chennai, T.N., India. 6 - 8 May 2017. pp.138-145

With the rapid growth in multimedia contents, among such content face recognition has got much attention especially in past few years. Face as an object consists of distinct features for detection; therefore, it remains most challenging research area for scholars in the field of computer vision and image processing. In this survey paper, we

have tried to address most endeavoring face features such as pose invariance, aging, illuminations

and partial occlusion. They are considered to be indispensable factors in face recognition system when realized over facial images. This paper also studies state of the art face detection techniques, approaches, viz. Eigen face, Artificial Neural Networks (ANN), Support Vector Machines (SVM), Principal Component Analysis (PCA), Independent Component Analysis (ICA), Gabor Wavelets, Elastic Bunch Graph Matching, 3D morphable Model and Hidden Markov Models. In addition to the aforementioned works, we have mentioned different testing face databases which include AT & T (ORL), AR, FERET, LFW, YTF, and Yale, respectively for results analysis. However, aim of this research is to provide comprehensive literature review over face recognition along with its applications. And after in depth discussion, some of the major findings are given in conclusion.

2.7 SURVEY 7

Veenadhari, S., Bharat Misra, D Singh, “A belief-theoretical approach to example- based pose estimation” – A review article”, IJCST, International Journal of Computer Science and technology march 2016.

The In example-based human pose estimation, the configuration of an evolving object is sought given visual evidence, having to rely uniquely on a set of sample images. We assume here that, at each time instant of a training session, a number of feature measurements is extracted from the available images, while ground truth is provided in the form of the true object pose. In this scenario, a sensible approach consists in learning maps from features to poses, using the information provided by the training set. In particular, multi-valued mappings linking feature values to set of training poses can be constructed. To this purpose we propose a Belief Modeling Regression (BMR) approach in which a probability measure on any individual feature space maps to a convex set of probabilities on the set of training poses, in a form of a belief function. Given a test image, its feature measurements translate into a collection of belief functions on the set of training poses which, when combined, yield there an entire family of probability distributions. From the latter either a single central pose estimate

or a set of extremal ones can be computed, together with a measure of how reliable the estimate

is. Contrarily to other competing models, in BMR the sparsity of the training samples can be taken into account to model the level of uncertainty associated with these estimates. We illustrate BMR's performance in an application to human pose recovery, showing how it outperforms our implementation of both Relevant Vector Machine and Gaussian Process Regression. Finally, we discuss motivation and advantages of the proposed approach with respect to its most direct competitors. Index Terms Example-based pose estimation, feature-pose maps, theory of evidence, belief functions.

2.8 SURVEY 8

M.S.PrasadBabu, N.V.Ramana Murty, S.V.N.L.Narayana, "A Review of Face Recognition Technology", IJCSIT, Vol. 1 (1), 2010, 6-15.

Face recognition technology is a biometric technology, which is based on the identification of facial features of a person. People collect the face images, and the recognition equipment automatically processes the images. The paper introduces the related researches of face recognition from different perspectives. The paper describes the development stages and the related technologies of face recognition. We introduce the research of face recognition for real conditions, and we introduce the general evaluation standards and the general databases of face recognition. We give a forward- looking view of face recognition. Face recognition has become the future development direction and has many potential application prospects.

2.9 SURVEY 9

Leemans V, M F Destain, " Research on face recognition based on deep learning", J. Jood Eng., 2004, pages: 83-89.

With the deep learning in different areas of success, beyond the other methods, set off a new wave of neural network development. The concept of deep learning originated from the artificial neural network, in essence, refers to a class of neural networks with deep structure of the effective training methods[1]. As a powerful technology to realize

artificial intelligence, deep learning has been widely used in handwriting digital

recognition, dimension simplification, speech recognition, image comprehension, machine translation, protein structure prediction and emotion recognition. In this paper, we focus on the research hotspots of face recognition based on depth learning in the field of biometrics, Combined with the relevant theory and methods of depth learning, face recognition technology, along the order of depth learning, based on the depth of learning face recognition, face recognition application to start research.

2.10 SURVEY 10

R J Brooks, “Face Recognition and Identification using Deep Learning Approach”, European Journal of Agronomy, vol. 14, 2014

Human face is the significant characteristic to identify a person. Everyone has their own unique face even for twins. Thus, a face recognition and identification are required to distinguish each other. A face recognition system is the verification system to find a person's identity through biometric method. Face recognition has become a popular method nowadays in many applications such as phone unlock system, criminal identification and even home security system. This system is more secure as it does not need any dependencies such as key and card but only facial image is needed. Generally, human recognition system involves 2 phases which are face detection and face identification. This paper describes the concept on how to design and develop a face recognition system through deep learning using OpenCV in python. Deep learning is an approach to perform the face recognition and seems to be an adequate method to carry out face recognition due to its high accuracy. Experimental results are provided to demonstrate the accuracy of the proposed face recognition system.

CHAPTER 3

METHODOLOGY

3.1 IMPORTANCE OF FACIAL RECOGNITION

A facial recognition system is a technology capable of matching a human face from a digital image or a video frame against a database of faces, typically employed to authenticate users through ID verification services, works by pinpointing and measuring facial features from a given image.

Development began on similar systems in the 1960s, beginning as a form of computer application. Since their inception, facial recognition systems have seen wider uses in recent times on smartphones and in other forms of technology, such as robotics. Because computerized facial recognition involves the measurement of a human's physiological characteristics, facial recognition systems are categorized as biometrics. Although the accuracy of facial recognition systems as a biometric technology is lower than iris recognition and fingerprint recognition, it is widely adopted due to its contactless process.^[1] Facial recognition systems have been deployed in advanced human–computer interaction, video surveillance and automatic indexing of images.^[2]

Facial recognition systems are employed throughout the world today by governments and private companies.^[3] Their effectiveness varies, and some systems have previously been scrapped because of their ineffectiveness. The use of facial recognition systems has also raised controversy, with claims that the systems violate citizens' privacy, commonly make incorrect identifications, encourage gender norms and racial profiling, and do not protect important biometric data. These claims have led to the ban of facial recognition systems in several cities in the United States.^[4] As a result of growing societal concerns, Meta announced^[5] that it plans to shut down Facebook facial recognition system, deleting the face scan data of more than one billion users.^[6] This change will represent one of the largest shifts in facial recognition usage in the technology's history.

3.2 FACIAL RECOGNITION SECURITY - HOW TO PROTECT YOURSELF

While biometric data is generally considered one of the most reliable authentication methods, it also carries significant risk. That's because if someone's credit card details are hacked, that person has the option to freeze their credit and take steps to change the personal information that was breached.

Around the world, biometric information is being captured, stored, and analyzed in increasing quantities, often by organizations and governments, with a mixed record on cybersecurity. A question increasingly being asked is, how safe is the infrastructure that holds and processes all this data?

As facial recognition software is still in its relative infancy, the laws governing this area are evolving (and sometimes non-existent). Regular citizens whose information is compromised have relatively few legal avenues to pursue. Cybercriminals often elude the authorities or are sentenced years after the fact, while their victims receive no compensation and are left to fend for themselves.

As the use of facial recognition becomes more widespread, the scope for hackers to steal your facial data to commit fraud — increases.

A comprehensive cybersecurity package is an essential part of protecting your online privacy and security. We recommend Kaspersky Security Cloud which provides protection for all your devices and includes antivirus, anti-ransomware, mobile security, password management, VPN, and parental controls.

Biometric technology offers very compelling security solutions. Despite the risks, the systems are convenient and hard to duplicate. These systems will continue to develop in the future — the challenge will be to maximize their benefits while minimizing their risks.

3.3 ADVANTAGES OF FACE RECOGNITION

Aside from unlocking your smartphone, facial recognition brings other benefits:

1. Increased security: On a governmental level, facial recognition can help to identify terrorists or other criminals. On a personal level, facial recognition can be used as a security tool for locking personal devices and for personal surveillance cameras.
2. Reduced crime: Face recognition makes it easier to track down burglars, thieves, and trespassers. The sole knowledge of the presence of a face recognition system can serve as a deterrence, especially to petty crime. Aside from physical security, there are benefits to cybersecurity as well. Companies can use face recognition technology as a substitute for passwords to access computers. In theory, the technology cannot be hacked as there is nothing to steal or change, as is the case with a password.
3. Removing bias from stop and search: Public concern over unjustified stops and searches is a source of controversy for the police — facial recognition technology could improve the process. By singling out suspects among crowds through an automated rather than human process, face recognition technology could help reduce potential bias and decrease stops and searches on law-abiding citizens.
4. Greater convenience: As the technology becomes more widespread, customers will be able to pay in stores using their face, rather than pulling out their credit cards or cash. This could save time in checkout lines. Since there is no contact required for facial recognition as there is with fingerprinting or other security measures – useful in the post- COVID world – facial recognition offers a quick, automatic, and seamless verification experience.
5. Faster processing: The process of recognizing a face takes only a second, which has benefits for the companies that use facial recognition. In an era of cyber-attacks and advanced hacking tools, companies need both secure and fast technologies. Facial recognition enables quick and efficient verification of a person's identity.
6. Integration with other technologies: Most facial recognition solutions are compatible with most security software. In fact, it is easily integrated. This limits the amount of additional investment required to implement it.

3.4 DISADVANTAGES OF FACE RECOGNITION

While some people do not mind being filmed in public and do not object to the use of facial recognition where there is a clear benefit or rationale, the technology can inspire intense reactions from others. Some of the disadvantages or concerns include: Surveillance: Some worry that the use of facial recognition along with ubiquitous video cameras, artificial intelligence, and data analytics creates the potential for mass surveillance, which could restrict individual freedom. While facial recognition technology allows governments to track down criminals, it could also allow them to track down ordinary and innocent people at any time.

1. Scope for error: Facial recognition data is not free from error, which could lead to people being implicated for crimes they have not committed. For example, a slight change in camera angle or a change in appearance, such as a new hairstyle, could lead to error. In 2018, Newsweek reported that Amazon's facial recognition technology had falsely identified 28 members of the US Congress as people arrested for crimes.
2. Breach of privacy: The question of ethics and privacy is the most contentious one. Governments have been known to store several citizens' pictures without their consent. In 2020, the European Commission said it was considering a ban on facial recognition technology in public spaces for up to five years, to allow time to work out a regulatory framework to prevent privacy and ethical abuses.
3. Massive data storage: Facial recognition software relies on machine learning technology, which requires massive data sets to "learn" to deliver accurate results. Such large data sets require robust data storage. Small and medium-sized companies may not have sufficient resources to store the required data.

3.5 MODULES

The phase of the proposed work

1. Collecting the dataset
2. Python & OpenCV
3. Build the neural network

4. Image Data Generation/Augmentation and Training the Model

3.5.1 COLLECTING THE DATASET

The dataset that are being worked on consists of 1375 images with 691 images containing images of students of wearing masks and 685 images with students without masks. Initially, it had a class imbalance, where it had a collection of blurred out and distorted images. Then, we have gone through the image on a file viewer system to remove any ir-relevant data. To resolve the class im-balance issue, we used the ImageDataGenerator class from the dataset to put forward real-time data augmentation to our data.



Fig 3.1 Dataset

Facial recognition data collection helps in analyzing and comparing an individual's facial details.

An important step in the entire process is face detection. It locates as well as detects human faces in videos as well as images.

The next step is the transformation of the analog information i.e a face into a set of digital information based on the person's facial features. This process is known as the face capture process.

If two faces belong to the same person is verified by the face match process.

These processes are measured to be the most normal ones of all bio-metric measurements.

For example we recognize ourselves by looking at our faces not by looking at our irises or fingerprints.

3.5.2 PYTHON & OPENCV

In this project proposed, we are building a model that detects face in real-time mechanism. We will try to do this using the concepts/techniques of computer vision using the OpenCV library. Using the computer vision techniques in Python, we will/can identify faces. We are/were going to build this project in two parts. In the first portion, we will be trying to write a python code using Keras to instruct face_mask detecting model. In the 2nd half, we will test the result in a realtime using webcam using OpenCV. Now, Deep learning is a sub-set of ML in artificial intelligence (AI) that has network that are capable of learning all the unsupervised from data that are unstructured or unlabeled. The face recognition system is also built upon for matching human faces with a digital picture. Ultimately what the computer recognized is pixels in values ranging from about 0-250. In Computer Vision face recognition has been in since ages and has evolved over the years. Many researchers came up with many new methods/techniques to efficiently uncover and tell apart faces. There are also many usecases such as authentication and verifying of users. In this ML project, we are going to use Jupyter Notebook as our IDE for the development. Import all the library and modules required.

```
from keras.optimizers import RMSprop
from keras.preprocessing.image import ImageDataGenerator
import cv2
from keras.model import Sequential
from keras.layer import Conv2D, Input, ZeroPadding2D, BatchNormalization, Activation, MaxPooling2D, Flatten, Dense, Dropout
from keras.models import Model, load_model
from keras.callbacks import TensorBoard, ModelCheckpoint
from sklearn.model_selection import train_test_split
from sklearn.metrics import f1_score
from sklearn.utils import shuffle
import imutils
import numpy as np
```

3.5.3 BUILD THE NEURAL NETWORK

Neural networks are very influential and robust classification techniques which can be

used to predict not only for the knowable data, but also for the unknowable data. It work well for both linear and non linear separable dataset. NN have been in used in many other areas such as interpreting visual scene, speech recognitions, faces detection/recognition, fingerprint recognitions, iris detection/recognition etc. An ANN is also composed of the networks of artificial neurons also called as "nodes". Those nodes are connected with each other, and their strength of it's connection to one another that has been or is assigned values based on there strength. Inhibitions (max being -1.0) and excitation (max being +1.0), if the values of the connections is high enough, then it indicate that their is a strong connection. Within each nodes design, a transformation function is built in. There are three types of the neutrons in ANN, input node, hidden node and output node. The convolution networks consist of two pair of Conv and MaxPool layer for extracting feature from our data_set. Which is then maintained by a Flatten and Dropout layers to converted the data in 1D or ensure over_fitting. And later two Dense layer for classification method.

And then two Dense layers for classification.

```
model = Sequential([
    Conv2D(100, (3,3), activation='relu', input_shape=(150, 150, 3)),
    MaxPooling2D(2,2),
    Conv2D(100, (3,3),
    activation='relu'),
    MaxPooling2D(2,2),
    Flatten(),
    Dropout(0.5)
    ,
    Dense(50, activation='relu'),
    Dense(2, activation='softmax')
])
model.compile(optimizer='adam', loss='binary_crossentropy', metrics=['acc'])
```

3.5.4 IMAGE DATA GENERATION/AUGMENTATION

Image data augmentations is a technique/method which can be used for artificially and virtually expand the sizes of the training data-set by making modified version of pictures in the dataset.

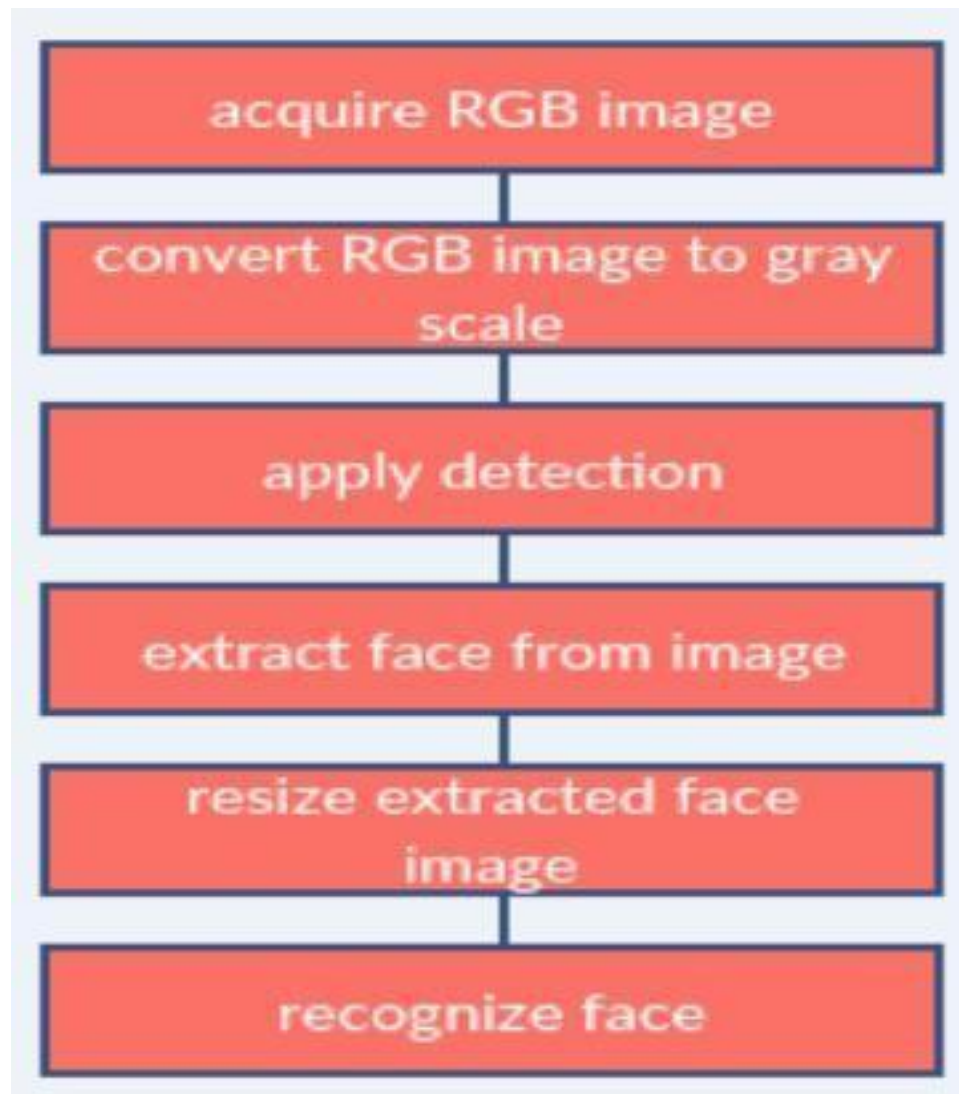


Fig 3.2 Image Preprocessing

```
TRAINING_DIR = "./train"
train_datagen = ImageDataGenerator(rescale=1.0/255,
rotation_range=39,
width_shift_range=0.3,
height_shift_range=0.3,
shear_range=0.3,
zoom_range=0.3,
horizontal_flip==True,
fill_mode='nearest')
train_generator = train_datagen.flow_from_directory(TRAINING_DIR,
batch_size=10,
target_size=(150, 150))
VALIDATION_DIR = "./test"
validation_datagen = ImageDataGenerator(rescale=1.0/255)
```

```
validation_generator = validation_datagen.flow_from_directory(VALIDATION_DIR,
batch_size=10,
target_size=(150, 150))
```

Instructing deep learning and their neural networks model on large data can produce in more skill_ful model, and the augmeentation technique can produce variations of the pictures that were improving the ability of the fitting model for generalizing what is being learned to new picyures.

The Keras deep learnings and neural networks library gives the capabilities to fit model using picture data augmentation via the ImageDataGenerator class. Initialize a call-back check-point to keep saving one of the best models after each of epoch while training.

```
checkpoint = ModelCheckpoint('model2-{epoch:03d}.model', monitor='val_loss',
verbose=0, save_best_only=True,mode='auto')
```

Train the model:

```
history = model.fit_generator(train_generator,
epochs=11,
validation_data=validation_generator,
callback=[checkpoint])
```

```
In [7]: TRAINING_DIR = "/train"
train_datagen = ImageDataGenerator(rescale=1.0/255,
rotation_range=40,
width_shift_range=0.2,
height_shift_range=0.2,
shear_range=0.2,
zoom_range=0.2,
horizontal_flip=True,
fill_mode='nearest')

train_generator = train_datagen.flow_from_directory(TRAINING_DIR,
batch_size=10,
target_size=(150, 150))

VALIDATION_DIR = "/test"
validation_datagen = ImageDataGenerator(rescale=1.0/255)
validation_generator = validation_datagen.flow_from_directory(VALIDATION_DIR,
batch_size=10,
target_size=(150, 150))

checkpoint = ModelCheckpoint('model-{epoch:03d}.model', monitor='val_loss',
verbose=0, save_best_only=True, mode='auto')

Found 1315 images belonging to 2 classes.
Found 194 images belonging to 2 classes.

In [8]: history = model.fit_generator(train_generator,
epochs=10,
validation_data=validation_generator,
callback=[checkpoint])

WARNING:tensorflow:From /home/shivam/.local/lib/python3.6/site-packages/tensorflow/python/ops/math_grad.py:1250: add_dispatch_support.<locals>.<wrapper from tensorflow.python.ops.array_ops> is deprecated and will be removed in a future version.
Instructions for updating:
Use tf.nn.where in 2.0, which has the same broadcast rule as np.where
WARNING:tensorflow:From /home/shivam/.local/lib/python3.6/site-packages/keras/backend/tensorflow_backend.py:442: The name tf.global_variables is deprecated. Please use tf.compat.v1.global_variables instead.

Epoch 1/10
132/132 [=====] 1.90s 685ms/step - loss: 0.4981 - acc: 0.7878 - val_loss: 1.1581 - val_acc: 0.0995
Epoch 2/10
132/132 [=====] 1.92s 733ms/step -
```

Fig 3.3 Training model

3.6 HARDWARE REQUIREMENTS

- System: I3 PROCESSOR
- Hard Disk: 300 GB.
- Floppy Drive: 1.44 Mb.
- Monitor: 15 VGA Colour.
- Mouse: Logitech.
- Ram: 4 gb.

3.7 SOFTWARE REQUIREMENTS

- Category: Deep Learning, Machine Learning, Computer Vision
- Programming Language: Python
- Tools & Libraries: face-recognition 1.3.0, OpenCV
- IDE: Kite is a free AI-powered coding assistant, Google Colab
- Front End: Login page
- Back End: Python
- Prerequisites: Python, Deep Learning, Machine Learnin

3.8 SYSTEM ARCHITECTURE

Most educational institutions are concerned with students' participation in courses since student contribution in the classroom leads to effective learning and increases success rates. Also, a high participation rate in the classroom is a motivating factor for teachers and contributes to a suitable environment for more willing and informative teaching. The most usual practice known is to increase the attendance in a particular course is by taking the attendance on regular basis. There are two usual ways to obtain attendance data. Some people prefer to call out names and put ticks for absence and presence accordingly. Other people prefer to roll around a sheet for signing out. After collecting the attendance dataset via either of the above two methods, teachers manually enter the data into the existing system. However, those non-technological methods are not efficient ways since they are timeconsuming and prone to mistakes/fraud. The present paper aim to propose a attendance-taking process via the existing technological infrastructure with some improvements. A face recognition/detection-based mobile automatic class-room attendaance management organization has been created with a face recognition-based infrastructure allowing the usage of smart phone devices. In this extent, a filtering system that was based on Euclidean distance and calculated by namely three face recognition and detection techniques, namely Eigen_faces, Fisher_faces, and Local Binary Pattern (LBP), has been established for face recognition and detection. The proposed method includes three different types of applications for tutor, students, and their parents to be installed on their smart phones/ mobiles to manage and perform a real-time polling process, data tracking, and reporting. The data set is stored in a cloud server and accessible from everywhere at any time. Web services are a popular way of communication for online systems, and RESTful is an optimal example of web services for mobile online systems.



Fig. 3.4 Detecting the face

In our presented system, REST-ful web service are used for communication among teaching staff, student, and parent applications and the cloud server. Attendance results are stored in a database and accessible by the teacher, student and parent mobile applications. To recognize the faces is the next task to be done after detecting faces of students from image. For face recognition, there are various techniques available like Eigen face, PCA and LDA hybrid algorithm, etc. we are going to utilize Eigen face technique along with principle component analysis. In the Eigen face, when faces are detected, they are cropped from image. Each student's face is cropped and the various features are obtained from them like distance between eyes, nose, outline of face, etc. using these faces as eigen features, the student are recognized and by comparing them with that face database and their attendance is marked. A database of faces needs to be created for the purpose of comparison. By registering the students to that data_base, we can arrange the infonnation of the students like register number, student's full name, and her or his picture for the identification.

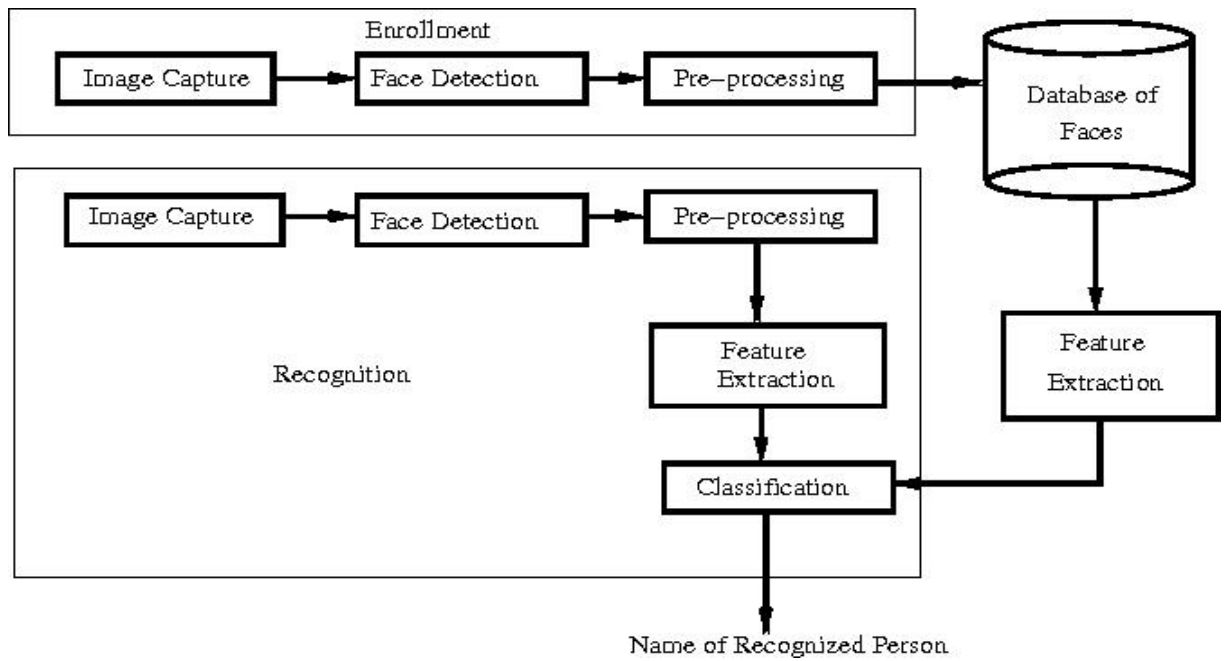


Fig 3.5 System Architecture

CHAPTER 4

RESULT AND DISCUSSION

Face recognition/detection is often presented as a process that first includes four steps that are: face identification, face alignment, features extractions, and finally the face recognition/detection.

Face Detection: Navigate one or more face in the picture and make a note with a bounding box.

Face Alignment: Normalize and Stabilize the face to have consistency with the databases, such as geometrical segments and photo-metrics.



Fig 4.1 Face Alignment

Feature Extraction: Extract basic feature of the face which can be used as the recognition work.

Face Recognition: Performing matching on the face against many known other faces in a functional and prepared database.

A provided system may have some separate modules or programs for each steps, which were traditionally the cases, and may combine some other and all of the processes into a single task.



Fig 4.2 Face Recognition

Face with Mask Recognition: The presented system is also able to judge whether the mask is on the face or not with the detection of nose and lips presence and absence and acts accordingly.



Fig 4.3 Face with Mask Recognition

CHAPTER 5

CONCLUSION AND FUTURE WORK

The smart and automated attendance system can be proven as an efficient system for classroom attendance. By using our system the chances of fake and malpracticed attendance and proxy can be reduced. There are a presence of Biometrics System and architectures which may be used in for managing the attendance, but the face recognition/detection has the best overall performance. So we need to implement a reliable and efficient attendance system for classroom attendance which can work for multiple face recognition at one time. We found the solution for light intensified issue and head poseture problem for which we can use the Illumination Invariant algorithm. Also to implement this system, no any specialized hardware is required. A camera device and a standalone PC, database servers are sufficient for constructing the smart attendance system. From our experiment, we noticed the face recognition was sensitive to face background, light, and head orientations. This technique described the accurate and efficient method of automatic attendance in the classroom which could replace the traditional method. An automatic attendance has many advantages, most of the existing systems are time consuming and require semi manual interference from lecturers, our system seeks to solve these issues by using face recognition in the process to save the time and labor. And No need for installing complex hardware for taking the attendance in classroom, all we need is a camera and laptop. We used algorithms that can detect and recognize faces in the image. Automatic attendance system can be improved by increasing the number of features which can be extracted to increase accuracy of face recognition. Once the software is developed and tested properly, it could be improved to cover full institutions such as the faculty of engineering.

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APPENDIX

A. SOURCE CODE:

```
1      Import all the libraries and modules
required. from keras.optimizers import
RMSprop
from keras.preprocessing.image import ImageDataGenerator
import cv2
from keras.models import Sequential
from keras.layers import Conv2D, Input, ZeroPadding2D, BatchNormalization,
Activation, MaxPooling2D, Flatten, Dense,Dropout
from keras.models import Model, load_model
from keras.callbacks import TensorBoard, ModelCheckpoint
from sklearn.model_selection import train_test_split
from sklearn.metrics import f1_score
from sklearn.utils import shuffle
import imutils
import numpy as np

2 Build the neural network:
model = Sequential([
    Conv2D(100, (3,3), activation='relu', input_shape=(150, 150, 3)),
    MaxPooling2D(2,2),

    Conv2D(100, (3,3), activation='relu'),
    MaxPooling2D(2,2),

    Flatten(),
    Dropout(0.5),
```

```
Dense(50, activation='relu'),
```

```
Dense(2, activation='softmax')
])
model.compile(optimizer='adam', loss='binary_crossentropy', metrics=['acc'])
```

3 Image Data

Generation/Augmentation:

```
TRAINING_DIR = "./train"
```

```
train_datagen = ImageDataGenerator(rescale=1.0/255,
                                   rotation_range=40,
                                   width_shift_range=0.2,
                                   height_shift_range=0.2,
                                   shear_range=0.2,
                                   zoom_range=0.2,
                                   horizontal_flip=True,
                                   fill_mode='nearest')
```

```
train_generator = train_datagen.flow_from_directory(TRAINING_DIR,
                                                    batch_size=10,
                                                    target_size=(150, 150))
```

```
VALIDATION_DIR = "./test"
```

```
validation_datagen = ImageDataGenerator(rescale=1.0/255)
```

```
validation_generator =
```

```
validation_datagen.flow_from_directory(VALIDATION_DIR,
                                       batch_size=10,
                                       target_size=(150, 150))
```

4 Initialize a callback checkpoint to keep saving best model after each epoch while training:

```
checkpoint = ModelCheckpoint('model2-  
{epoch:03d}.model',monitor='val_loss',verbose=0,save_best_only=True,mode  
='auto')
```

5 Train the model:

```
history = model.fit_generator(train_generator,  
                              epochs=10,  
                              validation_data=validation_generator,  
                              callbacks=[checkpoint])
```

```
import cv2  
import numpy as np  
from keras.models import load_model  
model=load_model("./model-010.h5")
```

```
results={0:'without mask',1:'mask'}  
GR_dict={0:(0,0,255),1:(0,255,0)}
```

```
rect_size = 4  
cap = cv2.VideoCapture(0)
```

```
haarcascade =  
cv2.CascadeClassifier('/home/user_name/.local/lib/python3.6/site-  
packages/cv2/data/haarcascade_frontalface_default.xml')
```

```
while True:  
    (rval, im) = cap.read()  
    im=cv2.flip(im,1,1)
```

```

    rrect_size = cv2.resize(im, (im.shape[1] // rect_size, im.shape[0] //
rect_size))
    faces = haarcascade.detectMultiScale(rrect_size)
    for f in faces:
        (x, y, w, h) = [v * rect_size for v in f]

        face_img = im[y:y+h, x:x+w]
        rrect_sized=cv2.resize(face_img,(150,150))
        normalized=rrect_sized/255.0
        reshaped=np.reshape(normalized,(1,150,150,3))
        reshaped = np.vstack([reshaped])
        result=model.predict(reshaped)

        label=np.argmax(result,axis=1)[0]

        cv2.rectangle(im,(x,y),(x+w,y+h),GR_dict[label],2)
        cv2.rectangle(im,(x,y-40),(x+w,y),GR_dict[label],-1)
        cv2.putText(im, results[label], (x, y-
10),cv2.FONT_HERSHEY_SIMPLEX,0.8,(255,255,255),2)

    cv2.imshow('LIVE', im)
    key = cv2.waitKey(10)

    if key == 27:
        break

cap.release()

cv2.destroyAllWindows()

```

