MINI PROJECT - I (2020-21)
FACE DETECTION WEB APPLICATION

MID TERM REPORT

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INTRODUCTION

Facial recognition is the process of identifying or verifying the identity of a person using their face. It captures, analyzes, and compares patterns based on the person's facial details.

The face detection process is an essential step as it detects and locates human faces in images and videos.
The face capture process transforms analog information (a face) into a set of digital information (data) based on the person's facial features.
The face match process verifies if two faces belong to the same person.
Today it's considered to be the most natural of all biometric measurements.

And for a good reason – we recognize ourselves not by looking at our fingerprints or irises, for example, but by looking at our faces.

Face recognition, as one of the most successful applications of image analysis, has recently gained significant attention. It is due to availability of feasible technologies, including mobile solutions. Research in automatic face recognition has been conducted since the 1960s, but the problem is still largely unsolved. Last decade has provided significant progress in this area owing to advances in face modelling and analysis techniques. Although systems have been developed for face detection and tracking, reliable face recognition still offers a great challenge to computer vision and pattern recognition researchers. There are several reasons for recent increased interest in face recognition, including rising public concern for security, the need for identity verification in the digital world, face analysis and modelling techniques in multimedia data management and computer entertainment. In this chapter, we have discussed face recognition processing, including major components such as face detection, tracking, alignment and feature extraction, and it points out the technical challenges of building a face recognition system. We focus on the importance of the most successful solutions available so far. The final part of the chapter describes chosen face recognition methods and applications and their potential use in areas not related to face recognition.

AREA OF COMPUTER SCIENCE

Face recognition systems use computer algorithms to pick out specific, distinctive details about a person's face. These details, such as distance between the eyes or shape of the chin, are then converted into a mathematical representation and compared to data on other faces collected in a face recognition database. The data about a particular face is often called a face template and is distinct from a photograph because it's designed to only include certain details that can be used to distinguish one face from another.

Some face recognition systems, instead of positively identifying an unknown person, are designed to calculate a probability match score between the unknown person and specific face templates stored in the database. These systems will offer up several potential matches, ranked in order of likelihood of correct identification, instead of just returning a single result.

Face recognition systems vary in their ability to identify people under challenging conditions such as poor lighting, low quality image resolution, and suboptimal angle of view (such as in a photograph taken from above looking down on an unknown person).

When it comes to errors, there are two key concepts to understand:

A "false negative" is when the face recognition system fails to match a person's face to an image that is, in fact, contained in a database. In other words, the system will erroneously return zero results in response to a query.

A "false positive" is when the face recognition system does match a person's face to an image in a database, but that match is actually incorrect. This is when a police officer submits an image of "Joe," but the system erroneously tells the officer that the photo is of "Jack."

When researching a face recognition system, it is important to look closely at the "false positive" rate and the "false negative" rate, since there is almost always a trade-off. For example, if you are using face recognition to unlock your phone, it is better if the system fails to identify you a few times (false negative) than it is for the system to misidentify other people as you and lets those people unlock your phone (false positive). If the result of a misidentification is that an innocent person goes to jail (like a misidentification in a mugshot database), then the system should be designed to have as few false positives as possible.

HARDWARE AND SOFTWARE REQUIREMENTS

❖ The hardware
❖ The software Hardware Requirement:
▪ Processor: Intel CORE i5 (8th Gen)
▪ Main Memory(RAM) :4 GB ▪ Cache Memory : 512 KB
▪ Monitor : 14 inch Color Monitor
▪ Keyboard : 108 Keys
▪ Mouse : Optical Mouse
▪ Hard Disk : 160 GB Software Requirements:
▪ Programming Language: HTML, CSS, JavaScript
▪ Additional Tools : Pycharm
▪ Operating System : Windows 10

PROBLEM DEFINITION

Used proportionately and responsibly, facial recognition can and should be a force for good. It has the ability to do a lot more to increase security in the future – from street crime to airport security, all the way through to helping those battling addiction, the technology can take security and operations to new heights.

The Rise In Knife Crime
Knife crime has dominated the headlines in the UK throughout the year. Recent statistics show the number of people being admitted to emergency care due to attacks by a sharp object to be up by nearly 40 per cent from two years ago, while the number of children under the age of 18 being admitted to hospitals with stab wounds is up by 86 per cent in only four years.

This recent surge in knife crime has put police forces under immense pressure, and the intelligent use of facial recognition has a role to play in enabling more informed stop & search interventions.

Currently UK police can stop and search an individual they suspect to be carrying drugs or weapons or both, or they can stop and search a person in a location where there have been or are considered likely to be “incidents involving serious violence.” In both cases they must do so with access to limited information, leaving themselves open to accusations of bias or discrimination.
Police Systems Benefiting Crime Investigations

This is where facial recognition can offer up additional intelligence. These systems can memorize the faces of persons of interest, networks of gang members, wanted criminals and those suspected of involvement in serious violent crimes. Furthermore, these systems don't need prior personal engagement to recognize an individual and see only data, not gender, age or race.

The technology doesn't take the decision away from the human police officer. However, it does bring greater transparency and context to the decision-making process of whether a stop and search intervention is justified.

Similarly, the advanced technology can recognize and match an individual seen on a CCTV camera at a crime scene to someone the police encounters on the streets some time later, justifying a stop and search on that individual.

Its ability to check in real time if a person is on a criminal watchlist adds an extra layer to the decision-making process prior to conducting a stop and search, lowering the likelihood of discrimination. Facial recognition thus helps eliminate both weapons and criminals off the streets and potentially prevent crimes before they have a chance to take place.

Gambling Addiction And How Facial Recognition Can Help

There are an estimated 593,000 people in the UK currently battling a gambling problem, making it a serious public health issue in the country. Having understood the gravity of the issue, the UK gambling commission have set limits and advice in place to help those suffering this addiction; yet as with all addictions, gambling is a tough habit to beat. In order to put effective limitations in place and make a real difference, the gambling commission needs the right technology to protect those most vulnerable in the industry. Facial recognition technology is able to keep track of customers and thus help gambling companies in protecting their customers to a higher degree. Monitoring those entering and moving around gambling areas is an extremely difficult task for human staff to do alone, especially in large crowded areas such as casinos.

Facial recognition technology installed around the premises would be able to help the company and the staff to identify people who have registered as gambling addicts, and keep record of their day's play in order to inform staff if and when it was time for them to stop. It would also be able to ensure effective self-exclusion procedures, by identifying a self-excluded individual via CCTV as soon as they entered the venue to then allow security staff to respectfully escort them out.

Utilizing Facial Recognition At Airport Security

Facial recognition has by now become a normal sight at many airports around the world. Several people today hold a so-called biometric passport, which allows them to skip the normally longer queues and instead walk through an automated ePassport control to proceed to the gate faster without having to deal with control officers. Facial recognition used in this way has managed to significantly cut waiting times at the passport control, but it also has the ability to enhance security in and around airports. Facial recognition uses algorithms to match physical characteristics against photos and videos of people's faces

Earlier this year, facial recognition technology managed to catch an imposter trying to enter the US at the Washington Dulles Airport. The false passport may have been uncaught by the human eye, yet due to the accuracy of the facial recognition technology it managed to help officers catch the imposter and bring him to justice.

Facial recognition thus allows officers to identify an individual faster and more accurately than the human eye. Facial recognition uses algorithms to match physical characteristics against photos and videos of people's faces, which have been collected from visas, passports and other sources.
While some critics may worry about issues of privacy related to the technology, at airports the use of facial recognition has proved to both enhance security as well as speed up processes such as check-in and, in the future, even boarding proceedings.

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If used correctly and proportionately, facial recognition can help safeguard the public and improve national security on several fronts. While the many benefits of facial recognition are evident, the lack of regulation and understanding of the technology has led to misconception around how it works and what it is used for.

Facial recognition technology can match faces in crowded public places against criminal watch lists, and register faces that match with those on criminal watch lists – while ignoring everyone else.

OBJECTIVE

We will detect the face of an individual whose face images are already stored in our local computer and every unique face is provided with a unique id by which we would

extract the data of a particular individual whose face is detected. After detecting face , data of a particular individual would pop up on the screen of mobile/laptop or desktop and if face is not detected then no data would be shown of that individual and a message would be shown on screen, " Face not recognised" .

IMPLEMENTATION DETAILS

A. Module –I: Face Detection

In this phase we detect the face region from input video, extracting it into frames. To extract face region we perform lighting compensation on image, then extract skin region and remove all the noisy data from image region. We now find skin color blocks from the image and then check face criterions of the image. In lighting compensation we normalize the intensity of the image, when extracting skin region we apply threshold for the chrominance and then we select the pixels that are satisfying the threshold to find the color blocks.The skin color blocks are identified based on the measure properties of image regions in the image. Height and width ratio is computed and minimal face dimension constraint is implemented. Crop the current region, existence and localization of mouth then compute vertical mouth histogram.

B. Module –II: Mouth Region Detection

Mouth region localization is done by subtracting the present frame with the previous frame,morphing takes place. Skin and lip color analysis is performed. Sorting the areas in descending order and obtaining the major difference region, then find the bounding box for the region we find the centroid of the region and perform this for all the frames. We take the mean of all the centroids and extract the mouth region. We calculate all left and
right limits, middle boundary, up and down limits. Detection of the key points the three upper points and the mouth corners and the lower points . It is done through a two step process. I. Upper edge localization, II. Detection of the key points on this edge.

C. Module –III: Lip Region Extraction

In the lip region extraction phase firstly lip color analysis is performed. The polynomial model and fine tuning of corners positions are calculated. We propose a much more flexible model made of 5 independent curves. Each one of them describes a part of the

lip boundary. Between P, and P, Cupid's bow, is drawn with a broken line and the other parts are approximated by 4 cubic polynomial curves y1, they are flexible enough to reproduce the specificity of very different mouth shapes. For each one of them 4 parameters has to be estimated. This ensures a fast and stable convergence for the fitting process. The 4cubic's are fitted by using an edge criterion. The method to find the mouth corners is based on a local criterion.[9] We only consider the value of Luminance along the line Ldn. Most of the time, it is a good cue because the difference of luminance between lips and skin is usually high. In that case the estimation of corners position is reliable because the transition interval, where luminance increases is narrow. However, in particular conditions this interval may be wide and the estimation is coarse.

PROGRESS TILL DATE AND REMAINING WORK

Backend

The logic has already been decided by our group and we have successfully designed the backend of our face recognition application using the framework of python named as **Django**. Thus this section of our application has already been successfully executed and compiled.

Frontend

This section of our mini project is yet to be worked upon by us as we are yet to decide how our application will look like when our viewers will first view it. As we all know that first impression is the last impression, so it is a big decision to make sure that it leaves a long lasting impression on our users. We have started working on the languages namely **HTML, CSS and JavaScript** but are yet to complete the full frontend as to how it would look when completed.

Database

We have built a complete application which even comprises of a Database which consists of the names and data of the people whose face would be recognised by the computer/device using the web cam. Thus using the database has been an essential task to complete the main aim of our application which is to provide the full data of the person whose face is to be recognised.

Code & Technology

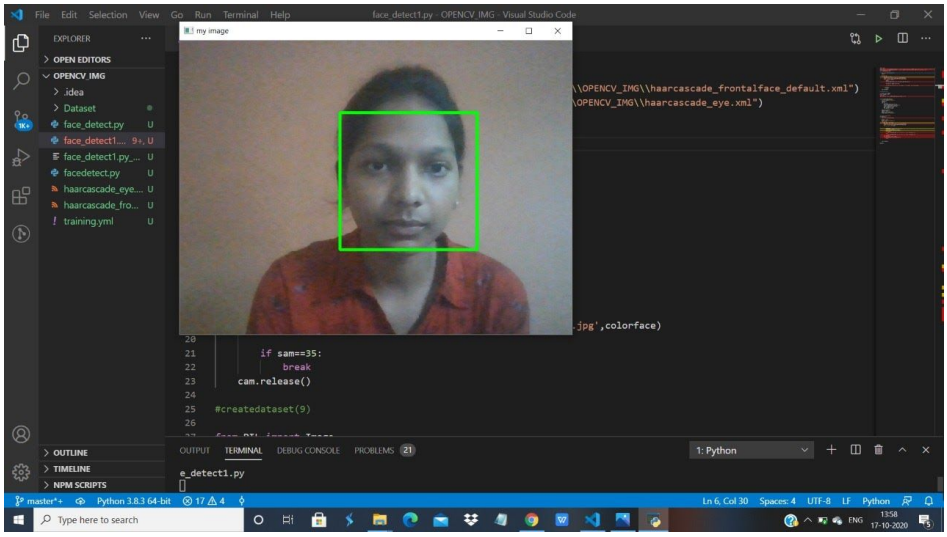
The technology we have used here in our mini project is **Computer Vision.** Computer Vision is a field of Artificial Intelligence (AI) that trains computers to interpret and understand the visual world. Using digital images from cameras and videos and deep learning models, machines can accurately identify and classify objects and then react what the ‘see’. Thus to identify faces we had to use this technology and it is a really vast field of computer science so it is not an easy task to get to know it fully so easily. Thus we are still working on it and have completed most of it for what all is required to fulfil the motive of our project.

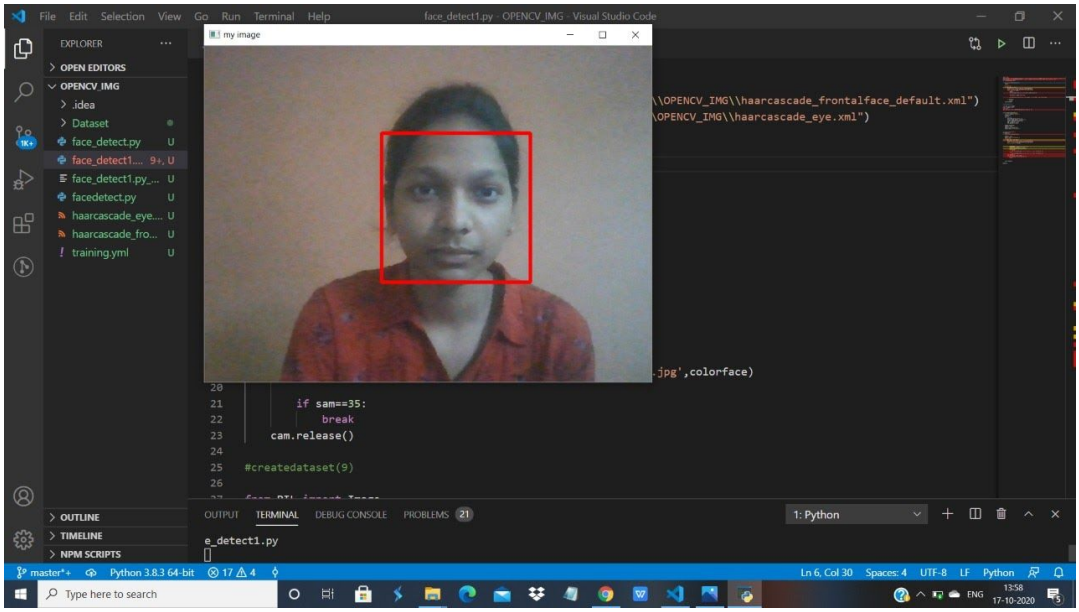
The code required to use this technology is completed to most extent and just a few errors need to be solved out and then I guess our project would be ready to go straight for the frontend. Just a few things more are to be learned in the technology of computer vison and then our implementation is to be done on code in Python.

Remaining Work

If we talk about our overall progress and the work we have done till date from the starting when this mini project was assigned to us, then we can say that we have completed 75-80% of our work so far. Talking about the work remaining then we still have to do the work on our frontend and some of the code is still remaining to be completed as the technology hasn’t been learnt to the extent that we can complete our assignment to the best. Rest, we think that we are going at a good pace and we can cope up with the deadline that has been assigned to us regarding the submission.

SOME SCREENSHOTS





REFERENCE

https://github.com/jyoti-varshney7/Face-Detection-web-Application