PIMPRI CHINCHWAD EDUCATION TRUST's

PIMPRI CHINCHWAD COLLEGE OF ENGINEERING

An Autonomous Institute, permanently affiliated to SPPU, Pune - 411044

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DEPARTMENT OF COMPUTER ENGINEERING

A MINI PROJECT REPORT ON

"Face Recognition"

Submitted in fulfilment of the requirements for the

Award of the degree of

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IN

COMPUTER ENGINEERING

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CERTIFICATE

This is to certify that project report entitled **"Face Recognition"** is bonafide work carried out as a PBL-V mini project by **Mihir Katariya (BTCOB98), Om Kinge(BTCOB108), Aviraj Mane(BTCOB129) and Saurabh Pardhi(BTCOB140)**in partial fulfilment for the award of Degree of B.Tech Computer Engineering in Seventh Semester of the "PCET's Pimpri Chinchwad College of Engineering, Nigdi, Pune-44**"** duringthe year 2023-2024.

Project Guide	**HoD**
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ABSTRACT

With the advent of increasing globalization in the world, the internet has paved various new ways for people to communicate their thoughts or ideas with the world. In the early 2000s, the world saw a rise in social media platforms. This indeed made communication easier and more interactive. It attracted people! It became a common platform for everyone to communicate on daily-basis. This collectively shaped the world into more connected and interdependent place. Besides this, great amount of data is also generated from these social media activities every second. As the data increased with time, its vulnerability to get altered also increased. Primary data types like photos and videos are no longer reliable because they can be easily duped with tools like GNU Gimp, Adobe Photoshop, and other image and video editing applications. Such manipulated data is a major source of false information and is frequently utilised in malevolent ways, including to instigate mobs and spread false propaganda. The legitimacy must be confirmed before any action, based on a dubious image, is taken. Over years, to regain the faith in the image data and detect such doctored data, various methods have been implemented, and are still under development. In this paper, we shall aim at performing analysis on the feature extraction of images using the Thepade's Sorted Block Truncation Code (SBTC) Technique and Bernsen Local Thresholding Technique.

Keywords : Thepade's Sorted Block Truncation Code(TSBTC), Image Splicing, Copy-Move Forgery Detection(CMFD), Image segmentation, Local and Global Thresholding.

Chapter 1

INTRODUCTION

Face recognition, a dynamic and rapidly evolving field of computer vision and artificial intelligence, has witnessed unprecedented growth and diversified applications in recent years. It represents a cutting-edge technology designed to identify and verify individuals based on their distinctive facial features. Unlike traditional identification methods, such as passwords or PINs, face recognition offers a seamless and secure means of authentication, revolutionizing the way we interact with technology and access secure locations. The motivation behind face recognition is multifaceted, with primary objectives including enhanced security, efficiency, and convenience. This technology has found its footing in diverse sectors, from law enforcement and public safety, where it aids in suspect identification and missing persons' searches, to the corporate world, where it streamlines time and attendance management and personalizes customer experiences. Notably, it has played a crucial role in public health efforts, allowing for contactless temperature screening and mask detection during global health crises.

1.1 Motivation

The motivation for the development and deployment of face recognition systems is driven by a diverse array of practical and technological considerations. Foremost among these motivations is the desire to enhance security. Face recognition technology provides a convenient and secure means of access control, offering an alternative to traditional authentication methods like passwords and PINs. This enhanced security is particularly valuable in scenarios such as unlocking smartphones, accessing secure facilities, and authorizing financial transactions. Furthermore, face recognition plays a pivotal role in law enforcement and public safety. It assists in the identification and apprehension of suspects, locating missing persons, and monitoring public spaces for potential threats. Its application spans crime prevention, investigation, and solving, contributing significantly to the safety of communities. The technology also aims to improve the overall user experience. Its capacity to offer seamless and user-friendly interactions in unlocking devices, making payments, and personalizing digital content simplifies daily interactions and minimizes the need for manual inputs. Businesses leverage face recognition to provide a more personalized customer experience, enhance service efficiency, and offer tailored recommendations, especially in areas like retail marketing.

1.2Project Idea

Proposed is the development of a Facial Attendance and Engagement Tracking System (FAETS) that leverages face recognition technology to enhance the online learning experience. FAETS aims to address the growing demand for interactive and accountable online learning environments in educational institutions, training programs, and corporate e-learning. This innovative system offers the ability to capture and recognize students' or participants' faces for attendance purposes and continuously monitors their engagement levels through facial expressions and gaze direction. Real-time data visualization, user authentication, and integration with popular online platforms are key features. The system provides valuable data for instructors and administrators, allowing them to make data-driven decisions and improvements. It prioritizes data privacy and consent, and its success will be measured by its impact on attendance

1.4 Literature Review

[1] M Arunasalam , N Yaakob , A.Amir , M Elshaikh and F Azahar "Real time driver drowsiness detection with alert notification"

The author purposed that if the car is stopped at some place due to the detection of drowsiness the GPS will be getting activated and it will send the location of that particular place where is the car is being is stopped and the a GSM model is used to send the message that includes the warning message related to the drowsiness and the location of place.

[2] Anil Kumar Diswal , Debabrata Singh ,Binod Kumar Pattanayak ,Debabrata Samanta "Detection the fatigue of the person with the help of IOT module"

In these paper author purposed that when the EAR value goes about any certain frequency that is being set then the alert Email is send to the authorised person or the person which is being mentioned and the alarm will be start ringing in the car. To perform the Email sending the smtp library is used which is available in the python.

[3] Debasis Parida "An Ardunio based Driver drowsiness and alerting system"

In these paper the writer says that a specific is used to count the blink eyes and if the blink eyes are more than the some limited specified value then the alarm start ringing until the driver comes completely out of the drowsiness state. They performed the alarm system with the help of the eye blink count.

[4] Ismail Nasari, Mohammed Karrouchi "A Review on the driver drowsiness and alert system"

A frequency is the measured, a condition related to the frequency is created that if the frequency is greater than 50 then the driver is in not in the drowsiness and the if it is less than the 50 then the driver is in the drowsiness state then the alert message is send to the respective person and the alarm starts ring.

[5] L. Ramesh*, M. Monisha, A. Shirley Pradeeksha, P. Sowmiyaa, S.K. Vedhashre **“**Driver drowsiness monitoring and Alarming”

This paper purposes that the they are measuring the drowsiness of the driver with help of the signals , it is very delicate and sensitive system which detects the movements of the steering wheel of the driver and if finds out it faulty then it activates the alarm system.

Chapter 2

PROPOSED MODEL

2.1 HAAR ALGORITHM FOR FACE DETECTION:

HAAR Cascade Algorithms is a machine learning algorithm which is implemented to detect faces in images or live video. HAAR algorithm uses concept of positive and negative images, Positive images means images that we want to process in our case we want only face image so face is our positive image. Negative image means images that we can neglect. In these algorithm we don't want images other than face so except face all other images are negative images.

Formula for Haar-like Features:

The formula for a simple Haar-like feature can be expressed as:

$H(x, y) = \sum(p \text{ in white region}) I(p) - \sum(q \text{ in black region}) I(q)$

In this formula:

H(x, y) represents the computed Haar-like feature value at a specific location (x, y).
I(p) represents the pixel value at position p within the white region.
I(q) represents the pixel value at position q within the black region
The Haar-like features are applied to different regions of the image, and by comparing the values of these features at different locations and scales, the HAAR algorithm can identify patterns that distinguish the object of interest (e.g., a face) from the background. The strength of a feature depends on how well it distinguishes between object and non-object regions during the training process. In practice, Haar-like features are used to construct a robust cascade of classifiers that collectively identify the object in an image, and this cascade is trained using a large dataset of positive and negative samples. The HAAR algorithm has been successfully used in various applications, including face detection in digital cameras, security systems, and image editing software. It provides a foundation for understanding the principles behind object detection using machine learning techniques.

2.2 DLIB Library for landmarks detection:

As HAAR algorithm returns the faces from the given image or recording. For finding drowsiness we need to consider different landmarks for face which is given by DLIB library, it identifies the nodal points on face and give about 68 landmarks to face including 6 landmarks to eye. This landmarks are displayed as light green dots. This landmarks are easy to recognize distinct human face.

Dlib is an open-source library that offers a range of functionalities related to computer vision and machine learning. It includes tools for facial landmark detection, object tracking, and image classification. Face recognition with Dlib typically involves the following key components:

Face Detection: Dlib can be used for face detection, identifying the presence and location of faces within an image or video stream. It employs the Histogram of Oriented Gradients (HOG) features and a linear SVM classifier for this purpose

Facial Landmark Detection: Dlib's facial landmark detection is used to locate specific points on a detected face, such as the eyes, nose, and mouth. The library provides pre-trained models for

facial landmark detection, which can be used to accurately locate these points.

Face Descriptor Extraction: Dlib calculates a face descriptor, which is a numerical representation of a face, based on the detected facial landmarks. These descriptors capture unique features of the face and are used for face recognition.

Face Recognition: Dlib employs machine learning models, typically Support Vector Machines (SVM), for face recognition. The face descriptors of known individuals are used to train a classifier, and then, during recognition, the system compares the descriptor of an unknown face with those of known individuals to determine identity.

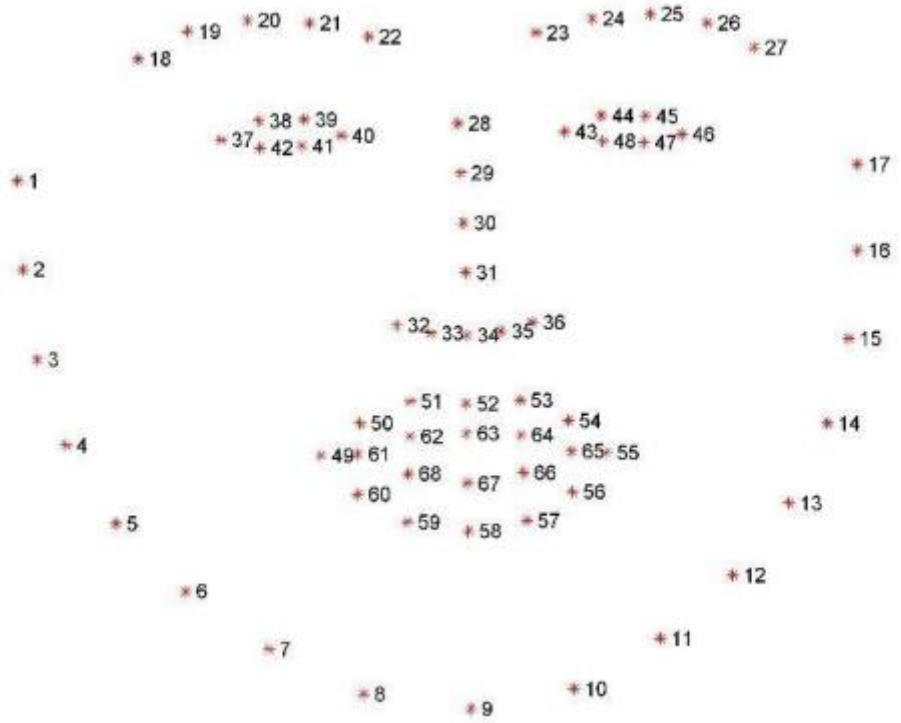

Fig: 2.2.1.*Landmarks on the face*

2.3 Experimentation Evaluation

2.3.1 Tools and Libaries used:

1.OpenCV:OpenCV(Open Source Computer vision) is open source library or package that widely used for machine learning and image processing applications. It has modules which are useful in many computer vision problems. But the most useful part of OpenCV is it's memory management. OpenCV has frameworks which are use for manipulating images and videos as our choice without considering the memory needed for allocation and reallocation of image by OpenCV algorithm or own algorithm. The OpenCV libraries are highly optimized that they can be used for real time video and image processing. This highly optimized image and video processing capabilities are used by author for real time image processing by live video feeds using camera.

2.Python: Python is Object-oriented programming language. Python is designed for rapid processing of complex application. Companies like NASA, Youtube, Google uses python programming language. It is also widely used in AI, neural network and other advance area of computer engineering. In this paper author have uses python as primary coding language due to its crossplatform compatibility. OpenCV and dilb libraries used for calculation of EAR uses python interpreter and uses inbuilt functions. Python is computer language used to build website, software and do data analysis. Python is not specialized for any specific problem it is created for a variety of different problems.

3.PyCharm: PyCharm, developed by JetBrains, is a renowned integrated development environment (IDE) designed specifically for Python programming. It offers two editions: the free-to-use PyCharm Community edition and the feature-rich PyCharm Professional edition, which is available as a paid version. Python developers widely embrace PyCharm for its comprehensive feature set and productivity-enhancing tools, simplifying the software development process.

At its core, PyCharm provides a robust code editor equipped with syntax highlighting, code completion, and intelligent code suggestions, making it effortless to write clean, error-free Python code. Its integrated debugger supports local and remote debugging, offering essential features such as breakpoints and variable inspection to facilitate issue identification and resolution.

Moreover, PyCharm serves as a complete development environment, encompassing support for web development technologies (HTML, CSS, JavaScript), database tools, and integration with version control systems like Git. It offers intelligent code assistance tools, including code navigation, code analysis, code refactoring, and quick fixes, to expedite coding tasks and maintain code quality.

One of its distinctive strengths is its seamless support for scientific tools and libraries, rendering it a preferred choice for data scientists and researchers working with Python. Additionally, PyCharm excels in project management, enabling developers to create virtual environments, run tests, and manage project dependencies via package managers such as pip.

Web developers appreciate the IDE's extensive support for popular Python web frameworks like Django and Flask. PyCharm's database tools allow users to interact with databases.

Chapter 3

RESULTS AND DISCUSSIONS

The results of a face recognition system encompass various outcomes, largely contingent on the system's design, the quality of employed algorithms, and its intended application. Chief among these outcomes is face identification, where the system correctly verifies individuals based on their unique facial features, enabling access or authentication. A pivotal result is recognition accuracy, with a focus on minimizing false positives and false negatives, ensuring the reliable identification of authorized individuals while reducing errors. Efficiency is a prominent outcome, with a high-performing system enabling real-time or near real-time identification for expeditious access control and security. Moreover, the technology bolsters security by replacing or augmenting traditional authentication methods like passwords or PINs with biometric-based face recognition, offering a robust defense against unauthorized access. Enhanced user experience is achieved as users can effortlessly access systems and devices with a simple glance, eliminating the need for manual inputs. Some systems can go further by accurately detecting facial landmarks, recognizing emotions, estimating age and gender, and automating attendance tracking, amplifying their versatility. Customization, integration with other systems, and robust performance under diverse environmental conditions are additional commendable outcomes. Notably, ethical and privacy considerations have become increasingly significant, emphasizing the importance of compliance with privacy regulations and the acquisition of user consent for the collection and processing of facial data. Scalability, training and maintenance, and the transparent logging of access and recognition data are further facets of successful outcomes. In essence, the results of a face recognition system encompass a blend of enhanced security, efficiency, and user experience while addressing privacy and ethical considerations in an increasingly interconnected world.

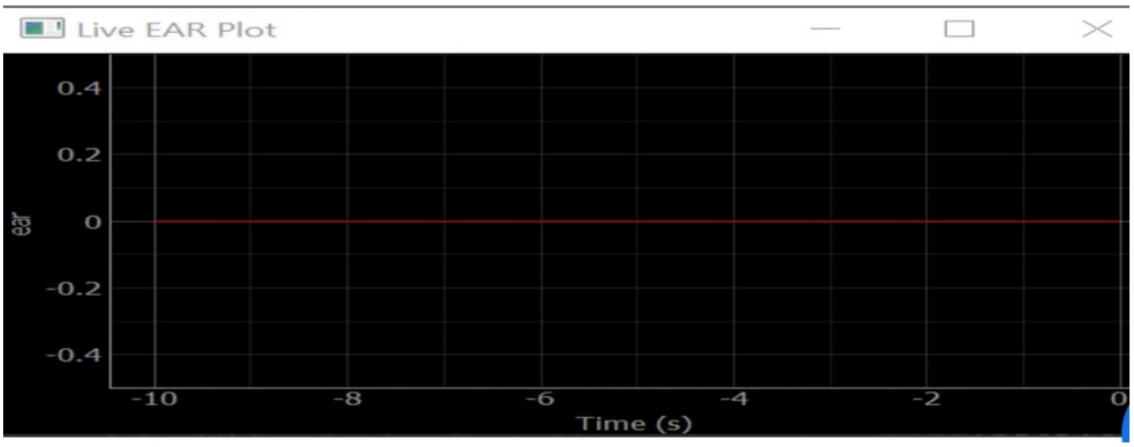

Fig: 3.1. *Live EAR Plot for active condition*

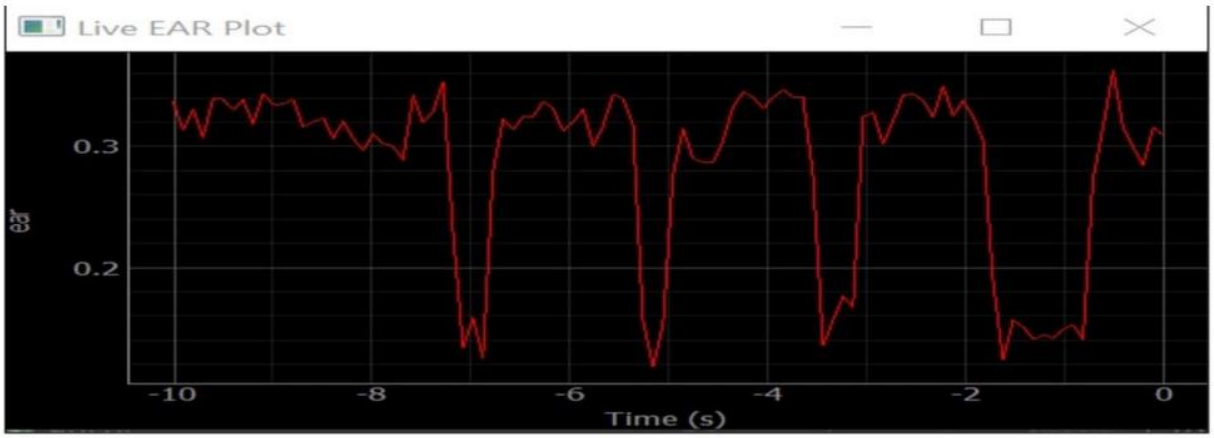

Fig: 3.2. *Live EAR Plot for blinks and Microsleep*

Gender	Total Experimented Blinks	True Detection	False Detection	Missed Blinks	% Accuracy of Blink Detection	% False Detection	% Missed Detection
	Accuracy Measurements from Base Paper [8] **Driver Drowsiness Detection using Eye-Closeness Detection**						
Male-1	**95**	95	0	0	**100.00**	0.00	0.00
Male-2	**103**	102	0	1	**99.03**	0.00	0.97
Male-3	**100**	99	1	1	**99.00**	1.00	1.00
Female-1	**99**	98	0	1	**98.99**	0.00	1.01
Female-2	**100**	100	3	0	**100.00**	3.00	0.00
Female-3	**100**	100	1	0	**100.00**	1.00	0.00
Total	**597**	**594**	**5**	**3**	**99.50**	**0.84**	**0.50**

Fig: 3.3. *Test Results*

Chapter 4

CONCLUSION

In conclusion, face recognition technology has emerged as a transformative force with far-reaching implications across diverse domains. Its capacity to accurately identify and verify individuals based on their unique facial features has revolutionized security, convenience, and efficiency. With a focus on enhancing user experience and bolstering security, face recognition plays a pivotal role in access control, public safety, and law enforcement, aiding in suspect identification and missing persons' searches. It has proved invaluable in public health crises, facilitating contactless screening and mask detection. Beyond these applications, it has found relevance in web development, database management, and the scientific community, aligning with evolving technological trends. However, as it reshapes our interactions and secures our digital lives, ethical considerations and data privacy remain paramount. Ensuring responsible and accountable use of face recognition technology is vital to its continued success. The journey of face recognition continues to evolve, promising a future where security, efficiency, and privacy coexist harmoniously in an increasingly interconnected world.

Chapter 5

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