

Artificial Intelligence and Computer Vision Internship at Virtusa

A REPORT

submitted by

Shravan Venkatraman 21BCE1200

in partial fulfilment for the award

of

B. Tech. Computer Science and Engineering

School of Computer Science and Engineering



VIT[®]
Vellore Institute of Technology
(Deemed to be University under section 3 of UGC Act, 1956)

April 2024



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DECLARATION

I hereby declare that the project entitled “**Title of the industry internship**” submitted by me to the School of Computer Science and Engineering, Vellore Institute of Technology, Chennai Campus, Chennai 600127 in partial fulfilment of the requirements for the award of the degree of **Bachelor of Technology – Computer Science and Engineering** is a record of bonafide work carried out by me. I further declare that the work reported in this report has not been submitted and will not be submitted, either in part or in full, for the award of any other degree or diploma of this institute or of any other institute or university.

Signature

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CERTIFICATE

The project report entitled “**Artificial Intelligence and Computer Vision Internship at Virtusa**” is prepared and submitted by **Shravan Venkatraman (Register No: 21BCE1200)**. It has been found satisfactory in terms of scope, quality, and presentation as partial fulfilment of the requirements for the award of the degree of **Bachelor of Technology – Computer Science and Engineering** in Vellore Institute of Technology, Chennai, India.

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Examiner I

Examiner II

INSERT THE CERTIFICATE OF MERIT OBTAINED FROM THE INDUSTRY WHERE YOU DID YOUR INTERNSHIP

1/2/24, 4:04 PM

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1 message

Chelsea Sherin R <chelsear@virtusa.com>
To: Shravan 18 <vshravan180803@gmail.com>

Tue, Jan 2, 2024 at 11:25 AM

To Whomsoever It May Concern,

This letter is to provisionally certify that **Shravan Venkatraman** from **Computer Science and Engineering** student at **Vellore Institute of Technology Chennai** was engaged in Internship at Virtusa Consulting Pvt Ltd in the **Cloud Application Engineering - Delivery** department from **21-08-2023** till **21-11-2023**.

He has been working as an intern AI/ML related to facial recognition and showed us a good demo of the same, under the guidance of Jegatheesan Veeramalai (Systems Architect, Virtusa)

During the period of internship, he/she has been demonstrating motivation and hard work to learn and develop new skills.

Kindly consider this mail as the formal communication from the company.

Please note that the internship does not create any Employer-Employee relationship between the Intern and Virtusa Consulting Pvt Ltd.

We wish you all the best for your future endeavours!

.....

ACKNOWLEDGEMENT

Give your acknowledgement here in the following format specification. Times new roman, 12 point scale, Normal, Justified with 1.5 line spacing. Do not sign in the acknowledgment page.

Follow the following hierarchy for acknowledging:

- Dr. Nithyanandam P, Head of the Department (HoD), B.Tech Computer Science and Engineering .SCSE, VIT Chennai
- Dr. Ganesan R, Dean of the School of Computer Science & Engineering, VIT Chennai
- Dr. Parvathi R , Associate Dean(Academics) of the School of Computer Science & Engineering, VIT Chennai
- Dr. Geetha S , Associate Dean(Research) of the School of Computer Science & Engineering, VIT Chennai
- Jegatheesan Veeramalai, Senior Architect, Virtusa
- Sanjay Gopi, Python and Golang Developer, Virtusa
- Siva, Golang and Web Developer, Virtusa

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LIST OF ABBREVIATIONS

Abbreviation	Expansion
AI	Artificial Intelligence
ML	Machine Learning
DL	Deep Learning
CV	Computer Vision
YOLO	You Only Look Once

ABSTRACT

In the realm of hostel management at VIT Chennai, attendance tracking has long been a manual and labor-intensive process. The current scenario involves relying on handwritten attendance sheets or cumbersome spreadsheet-based systems to record student attendance. This manual approach is not only time-consuming but also prone to errors and inconsistencies. Moreover, it poses challenges in terms of scalability and efficiency, particularly as the number of hostel residents grows over time. Recognizing these limitations, my project aims to revolutionize attendance management at VIT Chennai's hostels through the implementation of an automated face recognition system. The primary problem I seek to address is the inefficiency and unreliability of manual attendance-taking methods using the fingerprint scanner. The process of collating and analyzing attendance data is cumbersome and time-consuming for hostel administrators. These limitations hinder the timely and accurate tracking of student attendance, leading to administrative inefficiencies and potential discrepancies in attendance records.

My proposed solution, “FaceLog”, involves the development and implementation of an automated face recognition system tailored specifically for the hostel students. Leveraging state-of-the-art YOLO Computer Vision Technology and Deep Learning Algorithms, the system will be capable of accurately identifying students based on their facial features. By integrating with existing hostel management systems, my solution will streamline the attendance-taking process and eliminate the need for manual intervention. It will consider an attendance count for each student who enters the hostel and remove it if they exit. So, at the end of the day, the person who entered and never left, will be marked as a student currently present within the hostel, which would count for his attendance after 9PM when students are required to submit their attendance by scanning their fingerprints. The system will provide administrators with instant access to attendance data, enabling timely monitoring and analysis of student attendance patterns.

In conclusion, my project aims to address the shortcomings of manual attendance-taking methods through the implementation of an automated face recognition system. By harnessing the power of facial recognition technology and machine learning, I seek to enhance the efficiency, accuracy, and reliability of attendance management at VIT Chennai's hostels. My solution promises to streamline administrative processes, improve data accuracy, and ultimately contribute to a more efficient and effective hostel management system.

1 INTRODUCTION

The current method of attendance tracking in VIT Chennai's hostels relies on a manual fingerprint scanner system, which, while not prone to errors, is highly inefficient and time-consuming [1]. Handwritten sheets or spreadsheet-based systems, though error-prone and time-consuming, struggle to scale with increasing hostel populations [2]. Despite attempts at automation, the current fingerprint scanner system still faces challenges in efficiency and reliability [1]. Administrators find it cumbersome to collate and analyze attendance data, leading to administrative inefficiencies and discrepancies in records [2].

My proposed solution – “FaceLog” aims to revolutionize attendance management through an automated face recognition system tailored for hostel use. By leveraging advanced Computer Vision (CV) Technology, Deep Learning (DL) Algorithms in Artificial Intelligence (AI), the system will accurately identify students based on facial features [3]. Integration with existing hostel management systems will streamline attendance-taking, eliminating the need for manual intervention [2]. The system will track entries and exits, marking students present within the hostel, especially after the nightly attendance deadline [1]. This approach promises instant access to attendance data for administrators, facilitating timely monitoring and analysis of attendance patterns [3].

Research papers and studies have shown that machine learning (ML), AI, DL and CV in face recognition technology can significantly improve attendance management in educational institutions. For instance, the AttenFace system, as described in a research paper by Ashwin Rao, uses face recognition to analyze, track, and grant attendance in real-time. This system identifies students based on snapshots from live camera feeds, marking them as present in a class based on their presence in multiple snapshots taken throughout the class duration [4].

In conclusion, the project seeks to address the limitations of manual attendance-taking through automated face recognition technology [1]. By enhancing efficiency, accuracy, and reliability, the solution aims to streamline administrative processes and contribute to more effective hostel management at VIT Chennai [2].

2 PROPOSED WORK

In addressing the inefficiencies and challenges associated with manual attendance tracking in VIT Chennai's hostels, the proposed project embarked on a systematic approach to understand the limitations of the existing system. Extensive research was conducted to explore modern technologies and machine learning approaches that could potentially overcome these challenges. Through this research phase, the feasibility of implementing facial recognition technology as a solution to automate attendance tracking and improve accuracy and efficiency was thoroughly evaluated.

Following the research phase, careful consideration was given to selecting the appropriate technology stack for the development of the automated face recognition system. The YOLO (You Only Look Once) Computer Vision Technology emerged as the ideal choice for facial recognition tasks due to its state-of-the-art capabilities and suitability for real-time applications. It was trained on an annotated face recognition dataset for 250 epochs, resulting in top-notch performance. Additionally, Django, a high-level Python web framework, was chosen for backend development, offering robust features for server-side logic, database management, and API integrations.

Following the research phase, careful consideration was given to selecting the appropriate technology stack for the development of the automated face recognition system. The YOLO (You Only Look Once) Computer Vision Technology emerged as the ideal choice for facial recognition tasks due to its state-of-the-art capabilities and suitability for real-time applications. Additionally, Django, a high-level Python web framework, was chosen for backend development, offering robust features for server-side logic, database management, and API integrations.

The integration of the YOLO Computer Vision Technology into the system marked a critical milestone, as deep learning models were configured using TensorFlow or PyTorch to perform facial recognition tasks accurately and efficiently. Rigorous testing followed, encompassing unit tests, integration tests, and user acceptance testing to ensure the reliability, accuracy, and robustness of the system.

Concluding the project, the proposed automated face recognition system was successfully developed and demonstrated through a proof-of-concept (POC). The POC served as a valuable demonstration of the system's capabilities and potential to address the challenges of manual attendance tracking. The project contributed to expanding knowledge and understanding in the field of hostel management, providing a foundation for future initiatives and research endeavors aimed at enhancing efficiency, accuracy, and innovation in attendance tracking systems.

3 EXPERIMENTAL RESULTS

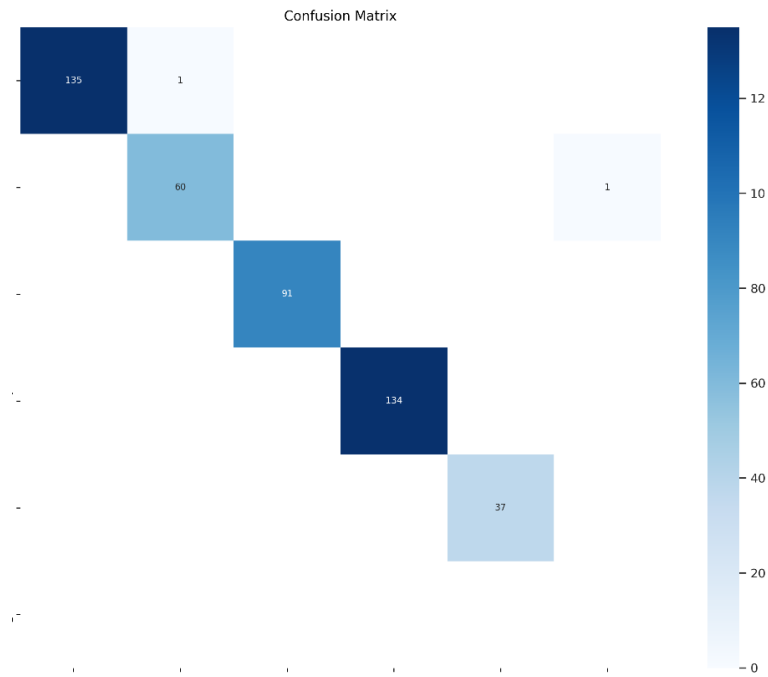


Fig 1. Confusion Matrix obtained on Test data.

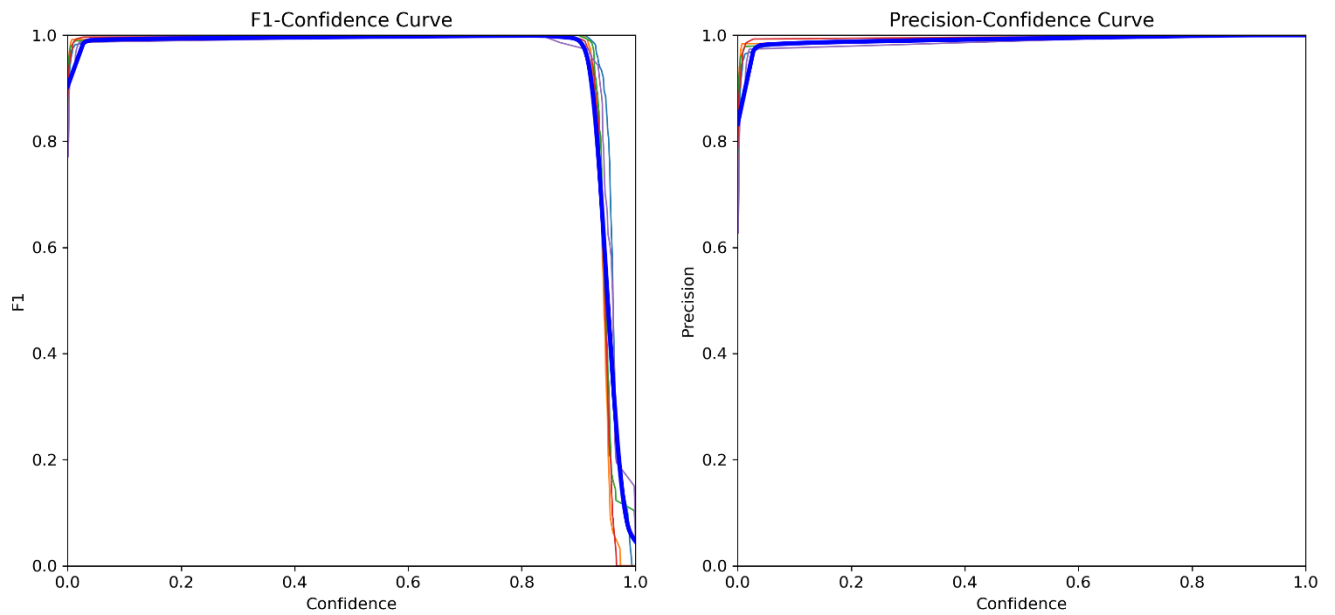


Fig 2. F1-Confidence and Precision-Confidence curve obtained during FaceLog Training.

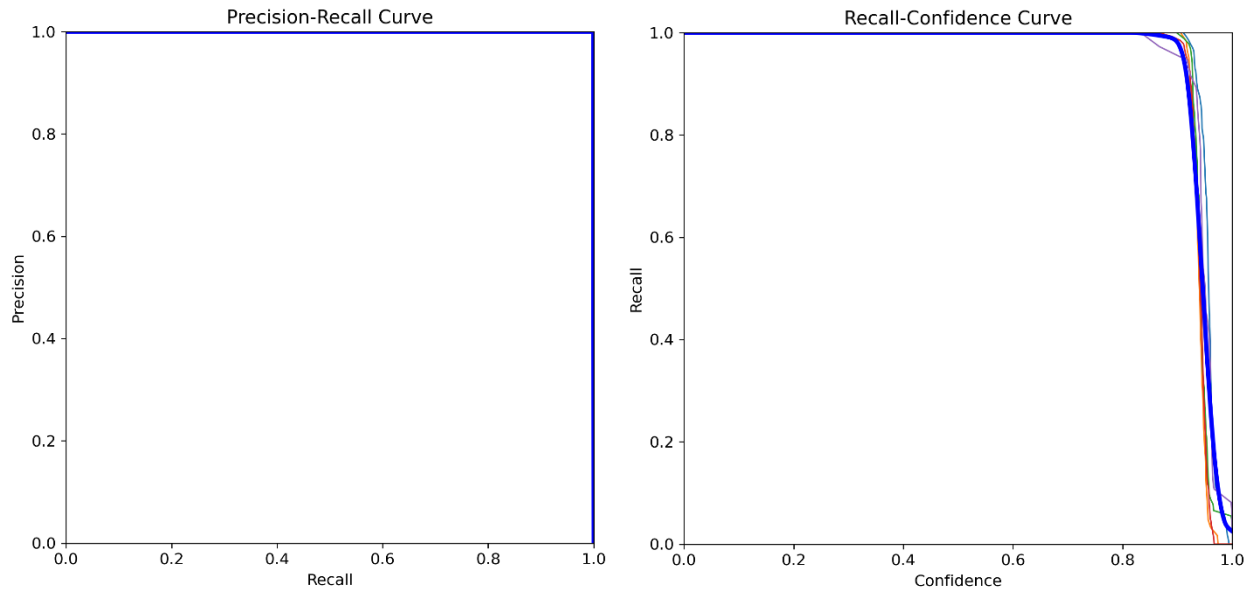


Fig 3. Precision-Recall and Recall-Confidence curve obtained during FaceLog Training.

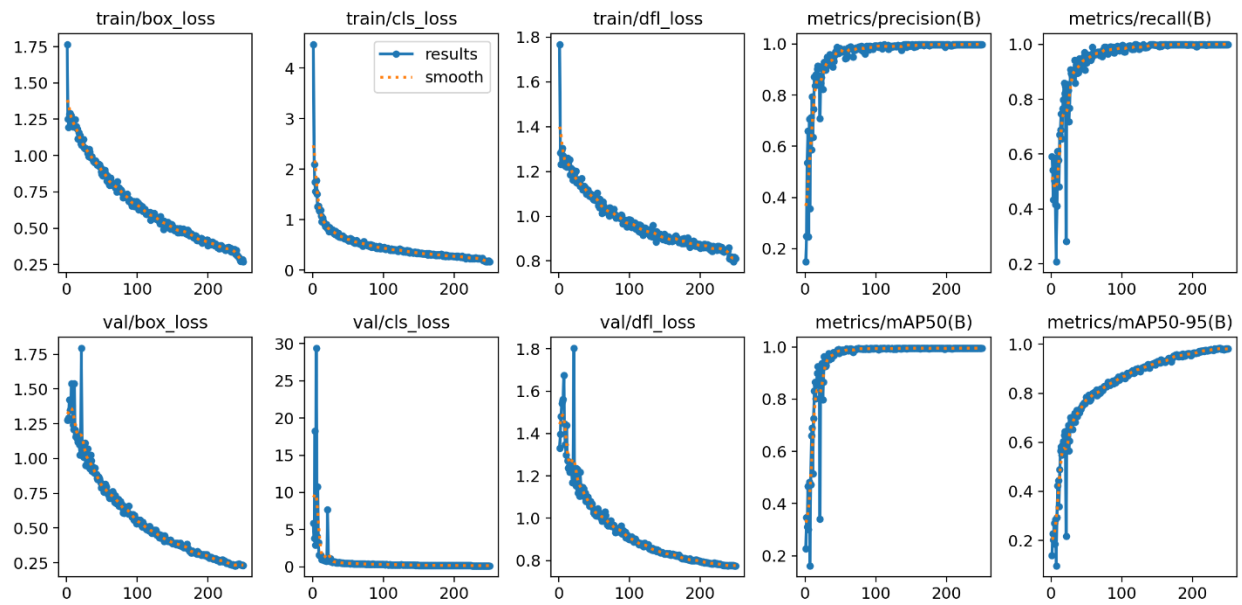


Fig 4. Combined Results obtained during FaceLog Training.

Table 1 Last 6 Epoch Results of YOLOv8 Face Recognition Model Training

epoch	train/box_loss	train/class_loss	train/dfl_loss	metrics/precision(B)	metrics/recall(B)	metrics/mAP50(B)	metrics/mAP50-95(B)	val/box_loss	val/class_loss	val/dfl_loss
245	0.18056	0.80531	0.99856	1	0.995	0.97786	0.24339	0.1629	0.77706	0.29647
246	0.17132	0.80865	0.99851	1	0.995	0.97939	0.23869	0.16007	0.77654	0.27872
247	0.1747	0.81415	0.99847	1	0.995	0.98052	0.23681	0.15802	0.77613	0.27284
248	0.16988	0.796	0.99852	1	0.995	0.98215	0.23669	0.15865	0.77599	0.2759
249	0.17927	0.81645	0.99858	1	0.995	0.98095	0.23474	0.15795	0.77512	0.28476
250	0.1844	0.81505	0.99864	1	0.995	0.98172	0.23185	0.15594	0.77498	0.28494

4 CONCLUSION

In conclusion, the development of the automated face recognition system represents a significant step forward in addressing the inefficiencies of manual attendance tracking methods in hostel management at VIT Chennai. Through the implementation of advanced YOLO Computer Vision Technology and Deep Learning Algorithms, the system has demonstrated its potential to streamline attendance management processes and improve overall efficiency.

While the project culminated in the successful creation of a proof-of-concept (POC), the deployment of the system in hostel environments was not pursued beyond this stage. Nevertheless, the POC provided valuable insights into the feasibility and effectiveness of the proposed solution, highlighting its ability to accurately identify students based on facial features and integrate seamlessly with existing management systems.

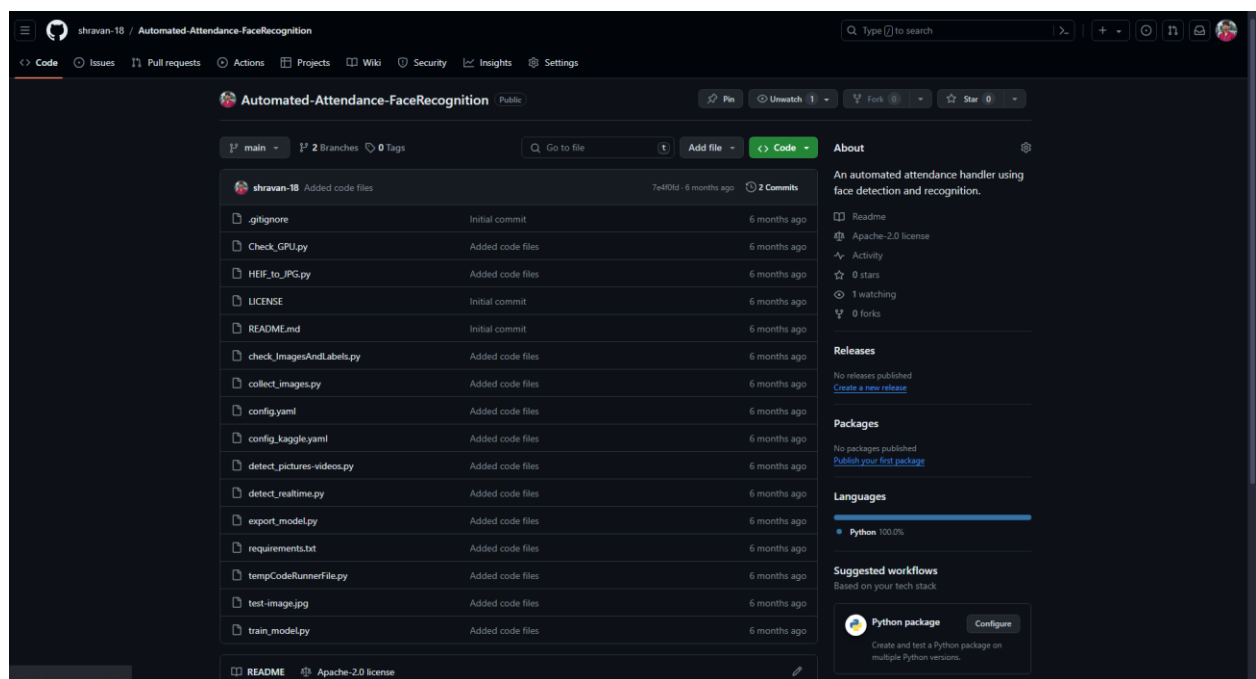
The project's outcomes underscore the importance of embracing innovative technologies, such as facial recognition and machine learning, to overcome challenges in attendance tracking and enhance administrative processes. Moving forward, the findings and experiences gained from this project can inform future initiatives aimed at optimizing attendance management practices and fostering a more efficient and effective hostel management system at VIT Chennai.

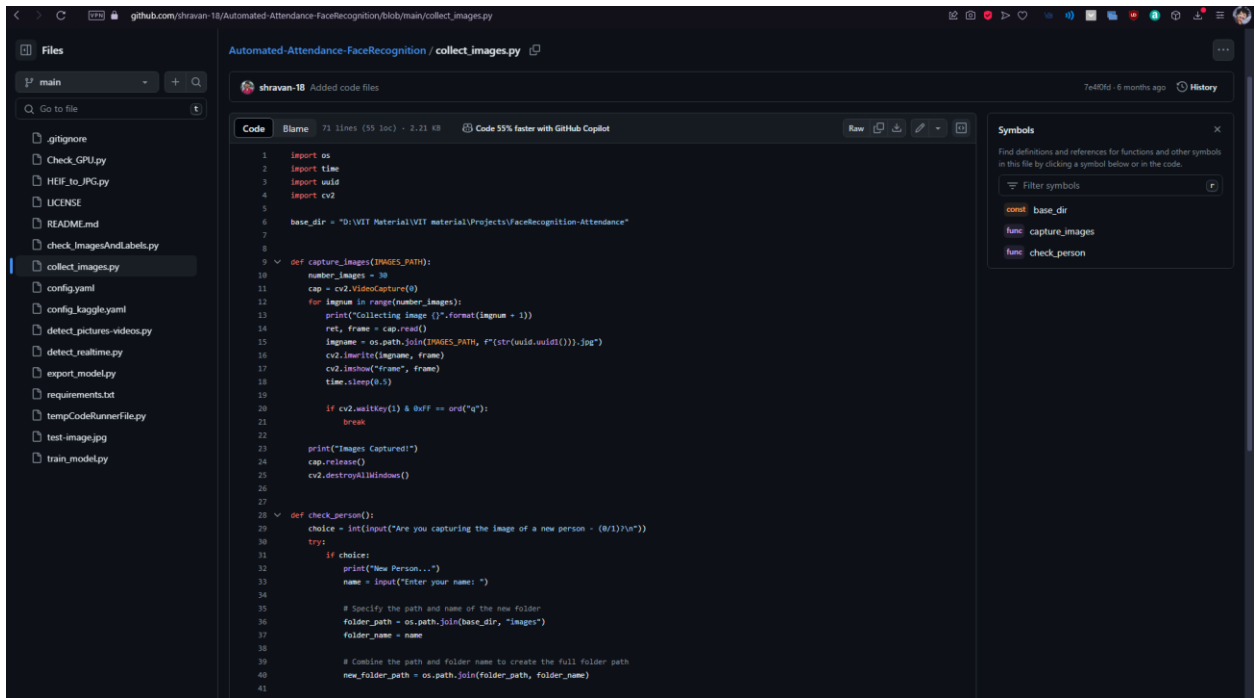
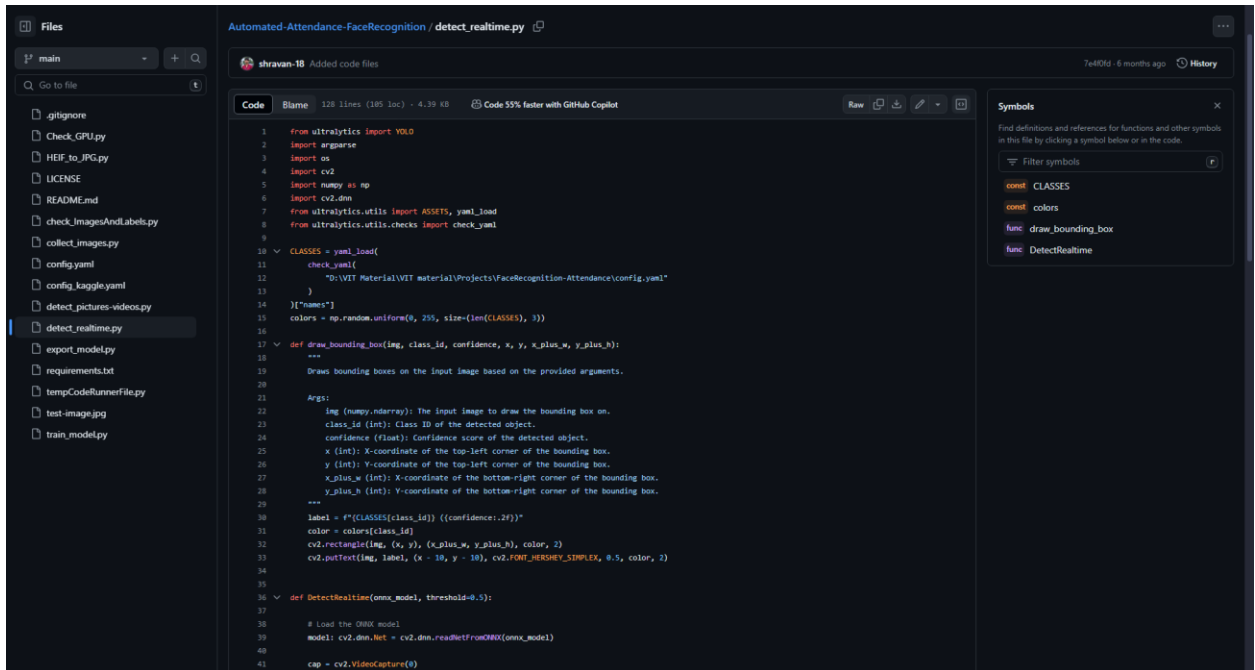
REFERENCES

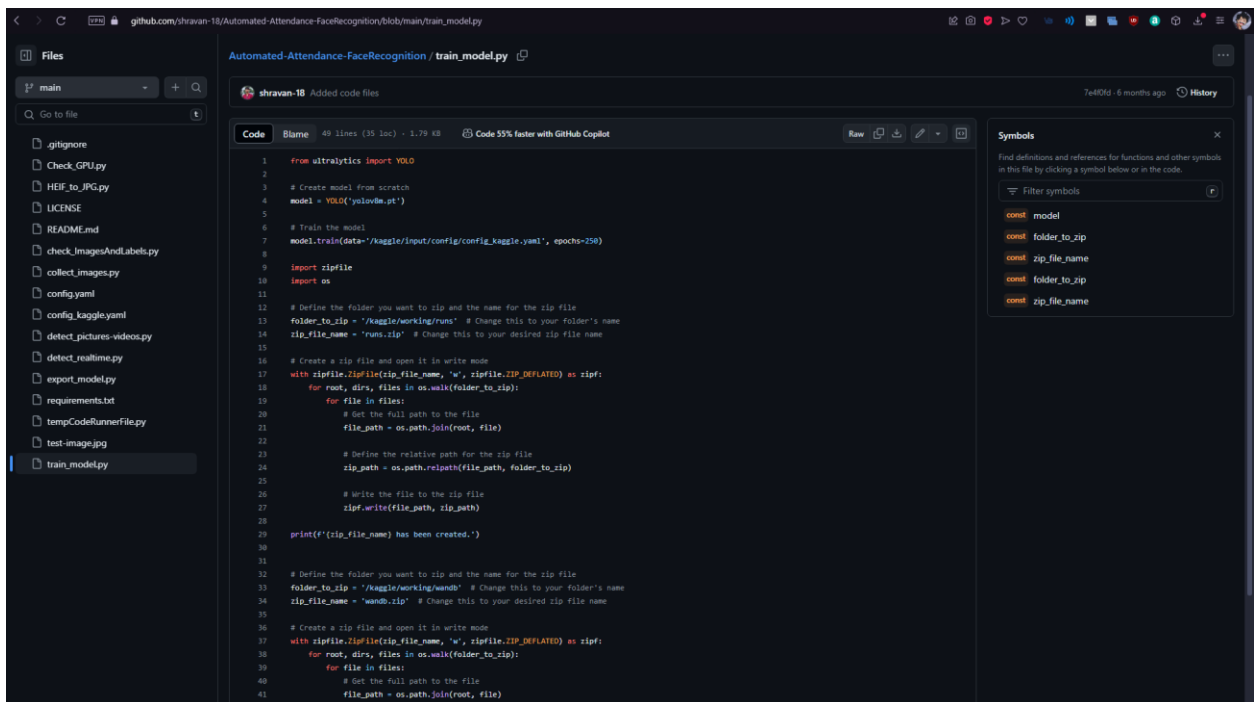
- [1] Pimpalkar, P., & Donald, A. D. G. (2022). Literature Review on Face Recognition System Based on Deep Learning. International Research Journal of Modernization in Engineering Technology and Science, 4(7), 1857-1864.
- [2] Barwuah, A., & Walkley, P. (1997). Monitoring Student Attendance. FEDA Paper. Further Education Development Agency, London (England).
- [3] V, S., H M, S., & G, S. (2019). Face Recognition Based Attendance Marking System. International Journal of Scientific Research in Computer Science, Engineering and Information Technology.
- [4] Rao, Ashwin. (2022). AttenFace: A Real Time Attendance System using Face Recognition. 10.48550/arXiv.2211.07582.

APPENDIX I

Github Link: <https://github.com/shravan-18/Automated-Attendance-FaceRecognition>

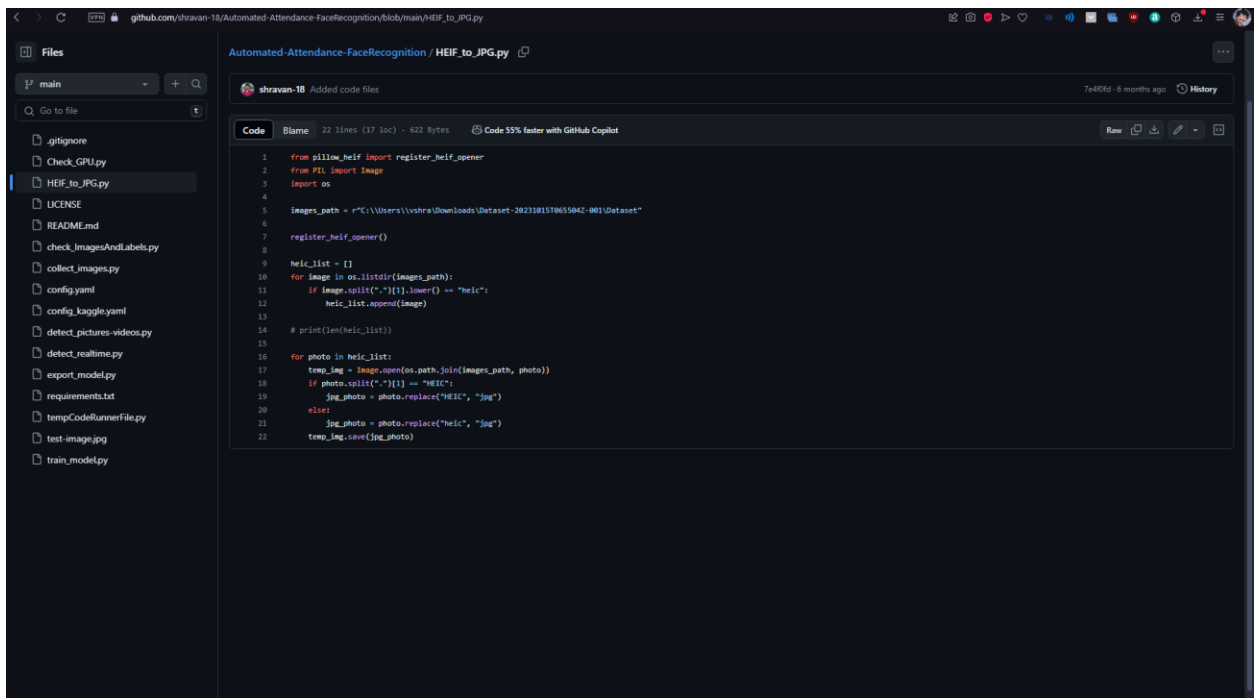






Automated-Arrance-FaceRecognition / train_model.py

```
1 from ultralytics import YOLO
2
3 # Create model from scratch
4 model = YOLO('yolov8a.pt')
5
6 # Train the model
7 model.train(data='/kaggle/input/config/config_kaggle.yaml', epochs=250)
8
9 import zipfile
10 import os
11
12 # Define the folder you want to zip and the name for the zip file
13 folder_to_zip = '/kaggle/working/runs' # Change this to your folder's name
14 zip_file_name = 'runs.zip' # Change this to your desired zip file name
15
16 # Create a zip file and open it in write mode
17 with zipfile.ZipFile(zip_file_name, 'w', zipfile.ZIP_DEFLATED) as zipf:
18     for root, dirs, files in os.walk(folder_to_zip):
19         for file in files:
20             # Get the full path to the file
21             file_path = os.path.join(root, file)
22             # Define the relative path for the zip file
23             zip_path = os.path.relpath(file_path, folder_to_zip)
24
25             # Write the file to the zip file
26             zipf.write(file_path, zip_path)
27
28 print(f'zip_file_name has been created.')
```




Automated-Arrance-FaceRecognition / HEIF_to_JPG.py

```
1 from pillow_heif import register_heif_opener
2 from PIL import Image
3 import os
4
5 images_path = r"C:\Users\svhra\Downloads\Dataset-2021015170655042-001\Dataset"
6
7 register_heif_opener()
8
9 heic_list = []
10 for image in os.listdir(images_path):
11     if image.split(".")[-1].lower() == "heic":
12         heic_list.append(image)
13
14 # print(len(heic_list))
15
16 for photo in heic_list:
17     temp_img = Image.open(os.path.join(images_path, photo))
18     if photo.split(".")[-1] == "HEIC":
19         jpg_photo = photo.replace("HEIC", "jpg")
20     else:
21         jpg_photo = photo.replace("heic", "jpg")
22     temp_img.save(jpg_photo)
```

github.com/shravan-18/Automated-FaceRecognition/tree/main

READMEApache-2.0 license

Hostel Attendance Management System



Introduction

The Hostel Attendance Management System is a web-based application designed to automate the attendance tracking process in hostel environments. It aims to replace manual attendance-taking methods with an efficient and reliable system. My proposed solution, "FaceLog", involves the development and implementation of an automated face recognition system tailored specifically for the hostel students. Leveraging state-of-the-art VIOLO Computer Vision Technology and Deep Learning Algorithms, the system will be capable of accurately identifying students based on their facial features. By integrating with existing hostel management systems, my solution will streamline the attendance-taking process and eliminate the need for manual intervention. It will consider an attendance count for each student who enters the hostel and remove it if they exit. So, at the end of the day, the person who entered and never left will be marked as a student currently present within the hostel, which would count for his attendance after 9PM when students are required to submit their attendance by scanning their fingerprints. The system will provide administrators with instant access to attendance data, enabling timely monitoring and analysis of student attendance patterns.

Features

- Automated attendance tracking using facial recognition technology
- Integration with existing hostel management systems
- Real-time monitoring and analysis of attendance data

Technologies Stack

- Frontend: HTML, CSS, JavaScript
- Backend: Django (Python)
- Database: Django DB
- Facial Recognition: OpenCV, VIOLOv8
- Source: Python

Django

Build and Test a Django Project

Configure

Python application

Create and test a Python application

Configure

More workflows

Discover suggestions

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