AI-Powered Exam Supervision Monitoring System

Mid-Review 1/2/3

GITAM
DEEMED TO BE UNIVERSITY

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GITAM (Deemed-to-be) University

Major Project
Project ID: CS15

Department of Electrical Electronics and Communication Engineering

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Introduction

This problem statement focus on Ensuring fair examinations is a challenge with traditional supervision methods. Our AI-Powered Exam Supervision Monitoring System uses artificial intelligence and computer vision to detect cheating behaviors in real time. It analyzes students' actions through CCTV footage, identifying suspicious movements and interactions. This reduces human error, enhances security, and ensures a transparent evaluation process. Our system aims to revolutionize exam monitoring with automation and accuracy.

Abstract

This project presents an AI-Powered Exam Supervision Monitoring System to enhance fairness and security in examinations. Traditional invigilation methods are prone to human error, making automated surveillance essential. Our system utilizes **YOLOv11n-seg.pt**, an advanced deep-learning model, to detect and classify student activities in real time. It analyzes CCTV footage, identifying suspicious movements and potential cheating behaviors with good accuracy.

The model's segmentation capability helps track body posture, gestures, and object interactions precisely. This AI-driven approach reduces the need for manual supervision and minimizes bias in exam monitoring. By ensuring real-time analysis and automated alerts, our system revolutionizes traditional exam security measures.

Objective and Goals

Objective

•**Promote Examination Honesty**: Build a system that fosters fair assessment by actively identifying dishonest practices during exams.
•**Dynamic Video Analysis**: Create technology that processes live video feeds to detect questionable behaviors as they occur.
•**Focus on Key Behaviors**: Target specific actions such as the use of unauthorized devices, the presence of multiple individuals, or irregular body movements.
•**Flexible Deployment**: Design a solution that can adapt to different exam settings and integrate with various camera systems.
•**Simplify Supervisor Roles**: Offer an easy-to-navigate dashboard that allows exam monitors to manage alerts and verify flagged incidents quickly.

Goals

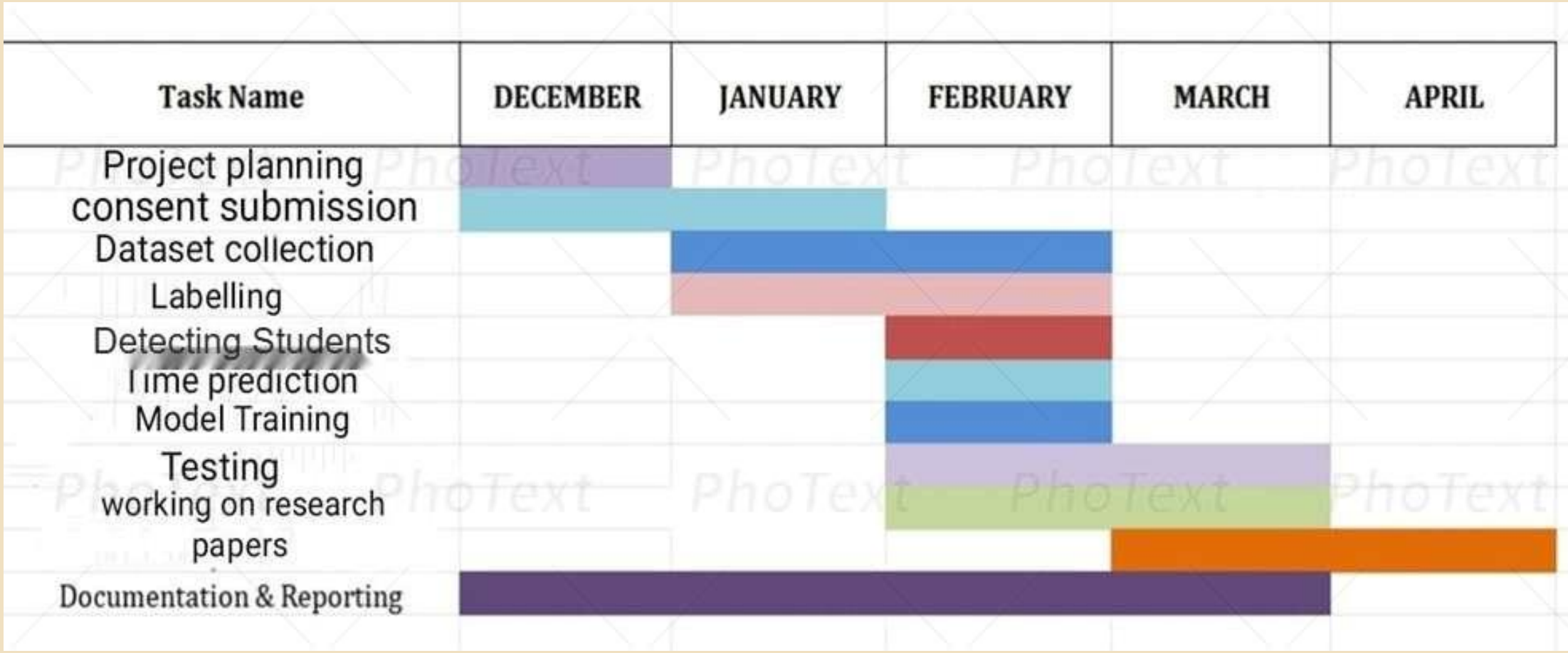
Main Goals

- **Real-Time Video Processing:** Enable continuous monitoring of CCTV feeds to detect and highlight suspicious activities with minimal latency.
- **High Detection Accuracy:** Develop an AI model that accurately identifies cheating behaviors, such as unauthorized devices, multiple individuals in a frame, or irregular movements.
- **Scalability for Multi-Camera Systems:** Design the system to handle multiple CCTV feeds simultaneously, making it suitable for large-scale examination setups.
- **User-Friendly Visualization:** Provide clear outputs with annotated frames, bounding boxes, and class labels for easy interpretation by exam supervisors.

Project Plan (Clearly mention milestone for objectives under each reviews)

Gant Chart - Milestones and Activities

Resources : https://www.officetimeline.com/gantt-chart/how-to-make/excel & https://www.teamgantt.com/

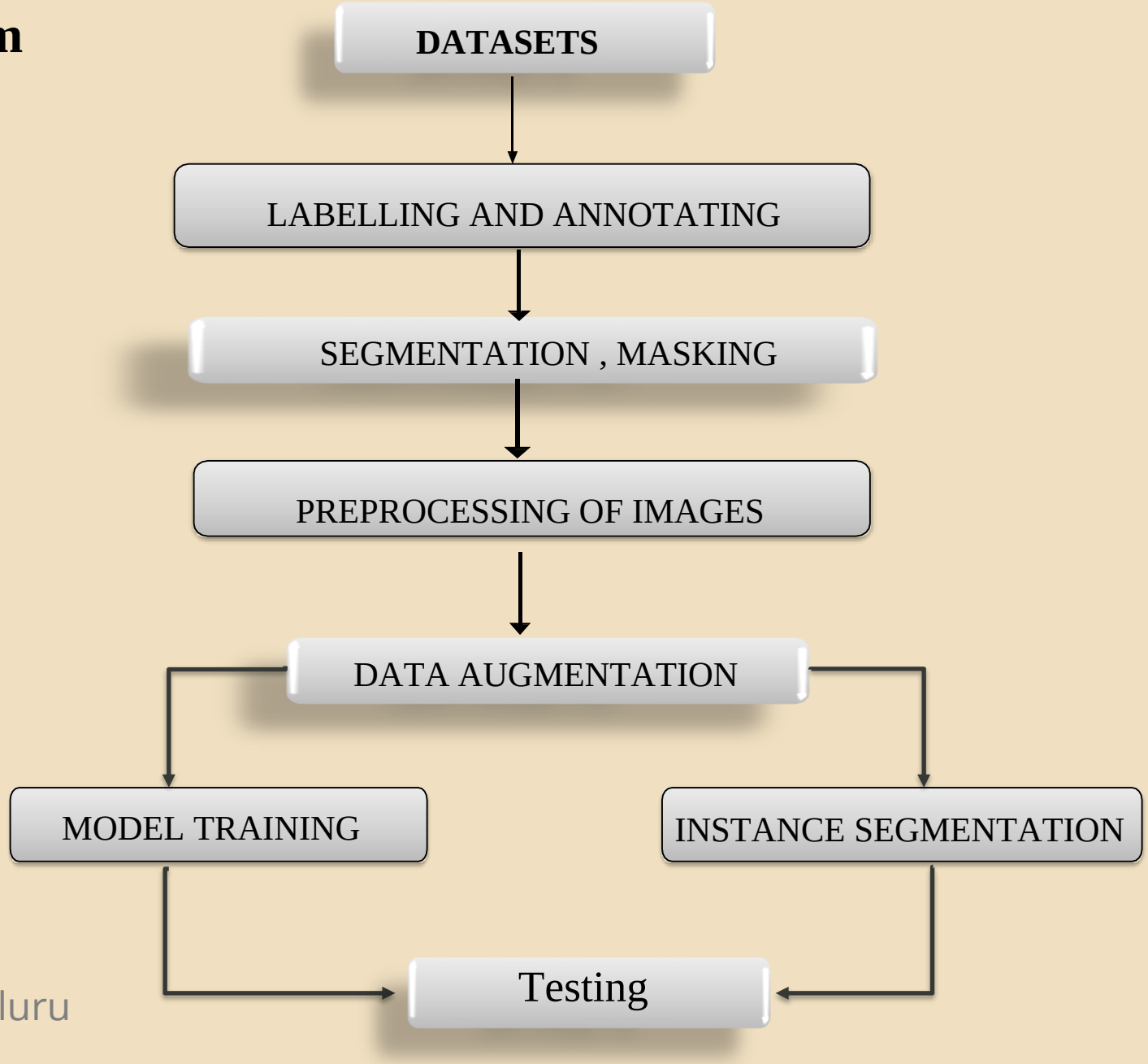


Literature Survey (Improved post minor project)

Method & Year	Authors	Result	Accuracy	Technology Used
AI-based Online Exam Proctoring System (2024) •	S. Satre, S. S. Soni, and S. S. Soni	An AI-based system monitors online exams using webcam surveillance to detect malpractices, enhancing academic integrity.	95% (based on facial recognition and behaviour analysis)	Machine Learning, Computer Vision, , Cloud Computing
Systematic Review on AI-based Proctoring Systems (2021)	S. K. Sharma and S. K. Sahay	A review of AI and non-AI-based proctoring systems, covering architectures, parameters, trends, issues, and future directions	Varies (comparison study, no single accuracy mentioned)	AI, Deep Learning, Statistical Analysis
iExam: Face Detection and Recognition for Exam Monitoring (2022)	Xu Yang, Daoyuan Wu, Xiao Yi, Jimmy H. M. Lee, and Tan Lee	An intelligent exam monitoring system using face detection and recognition for real-time student identification and abnormal behavior detection.	98% (for face recognition and identity verification)	Deep Learning, Face Recognition, OpenCV, TensorFlow

Structural Diagram

Block Diagram/Pin Diagram:



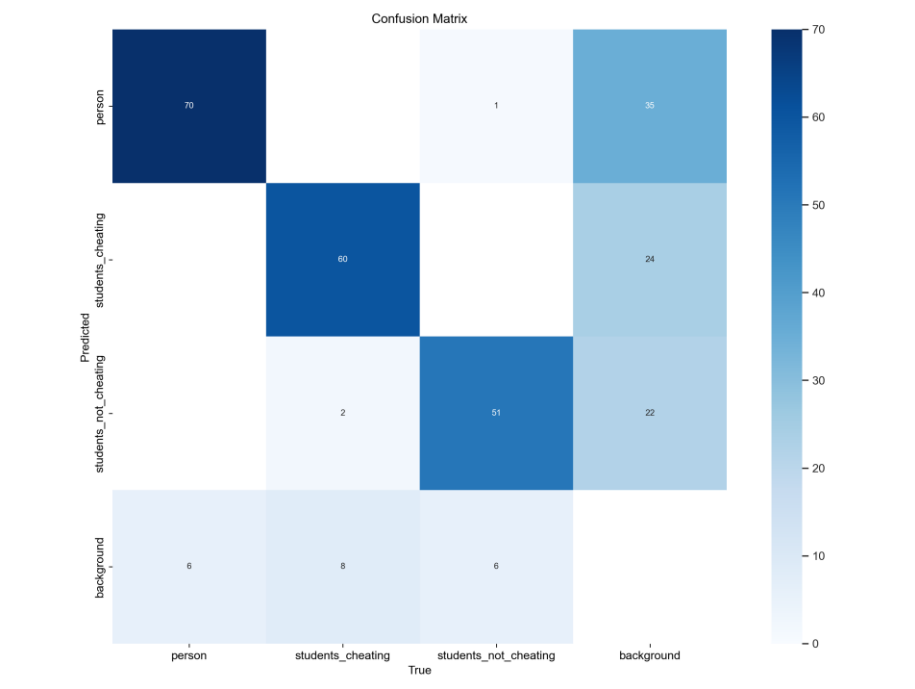
Iterations and Results

Iteration : Results + Validation against the use cases and test cases

Iteration 1

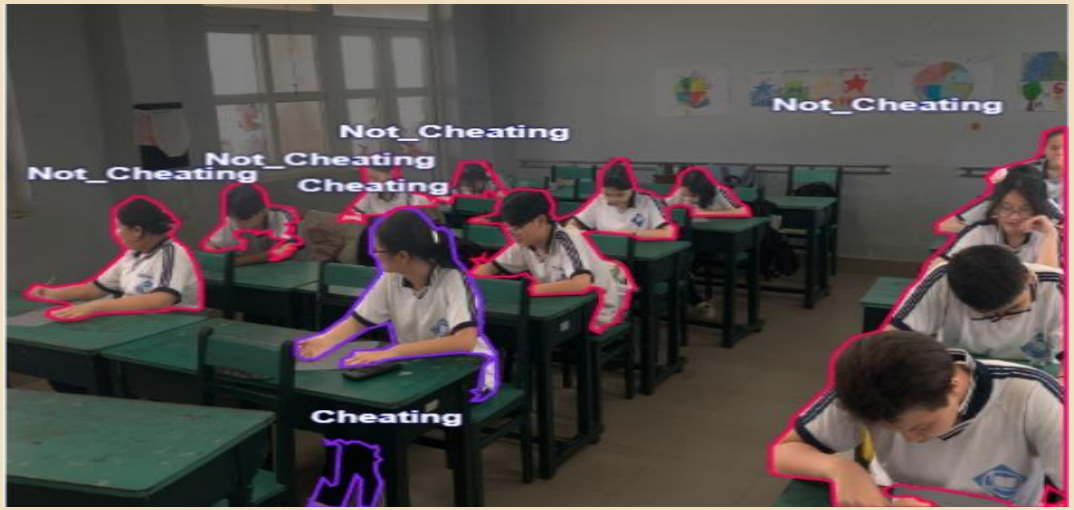
- The final **YOLOv1 model**, trained for 50 epochs, achieved high precision in detecting suspicious activities, such as using devices or unusual movements.
- The model achieved an overall detection accuracy of **82%**, making it highly reliable for real-time monitoring in exam environments.

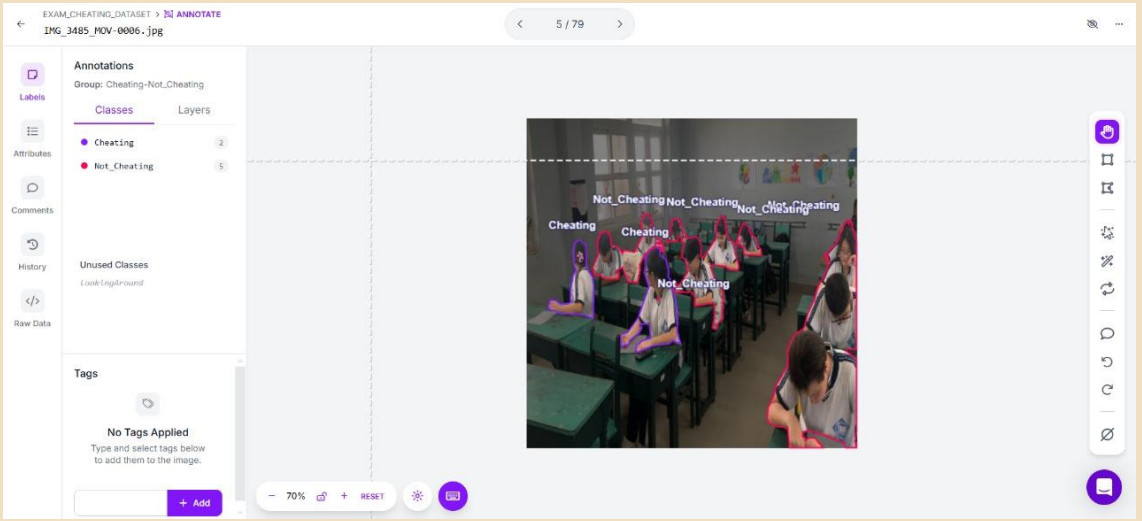
Confusion Matrix

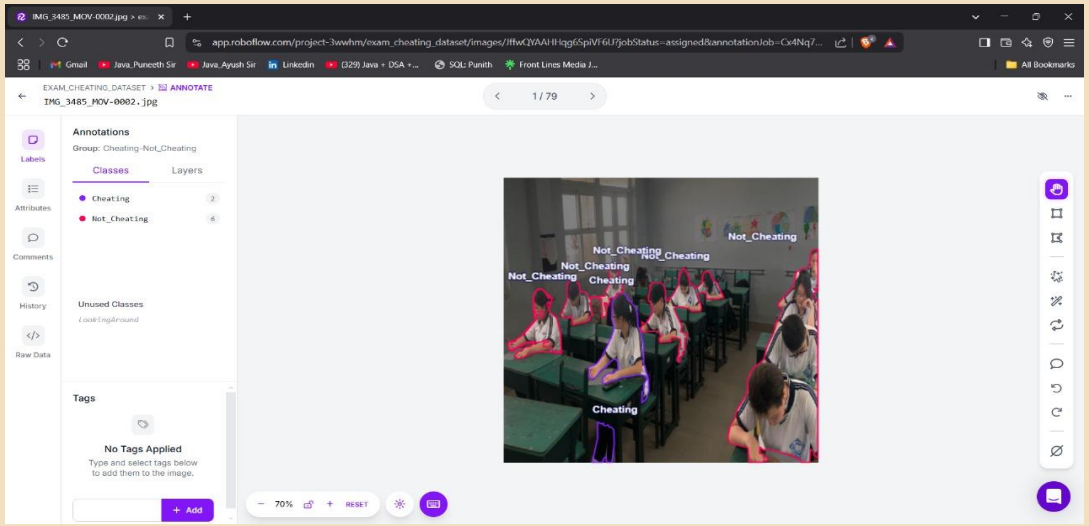


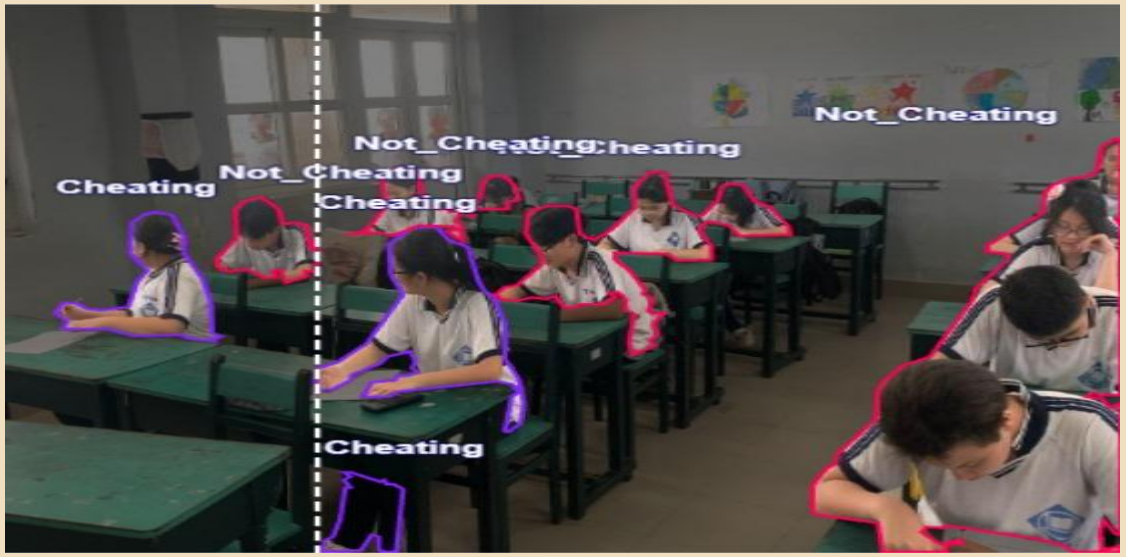
Annotation result

Implementation and Results









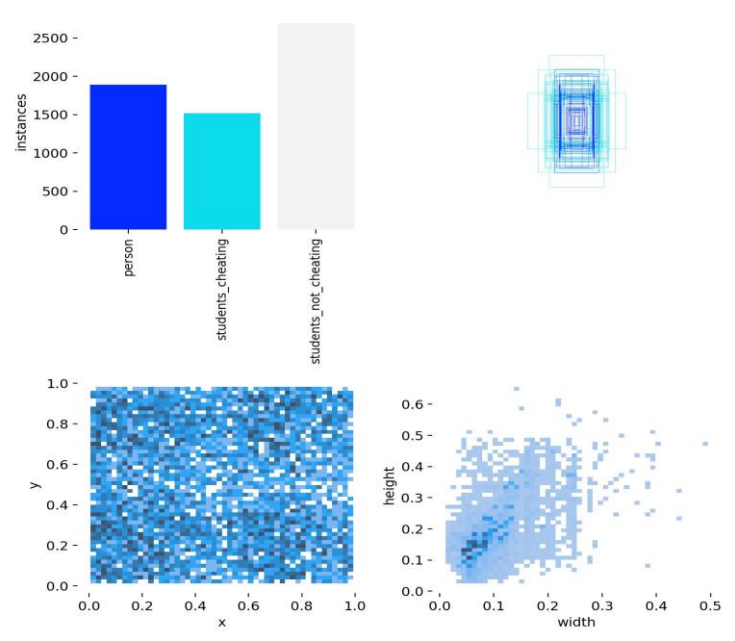
Iterations

Results and Validation Against Test Cases

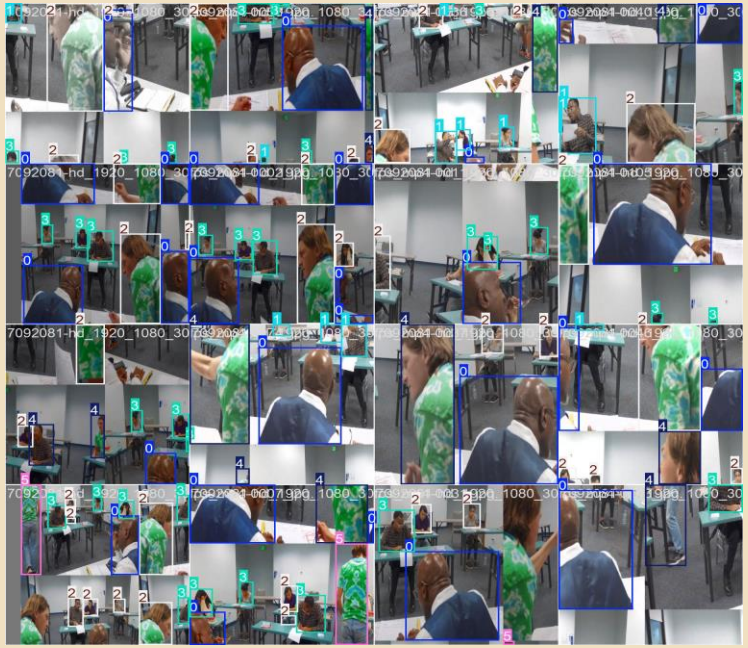
Iteration 2

- Enhanced the system's ability to detect and classify multiple suspicious activities, including identifying unauthorized devices and collaborative behaviors.
- Leveraged **instance segmentation** to classify and differentiate between multiple students in the frame, further improving the system's overall performance.
- Achieved significant improvements in real-time monitoring, ensuring timely alerts for invigilators and supervisors.

Confusion Matrix



Annotation result



Implementation and Results

Final Testing Iteration and Results:

1) Test Setup and Preparation:

- The **YOLOv11n-seg.pt** model was trained on a dataset of exam hall videos to detect cheating behaviors.
- Various video qualities, lighting conditions, and student activities were considered for robust detection.

2) Iteration Plan:

- Multiple test runs were conducted to evaluate accuracy, precision, and recall.
- The system was tested on different resolutions and frame rates to ensure adaptability.

3) Performance Evaluation:

- The model achieved high accuracy in detecting cheating with minimal false positives.
- Segmentation effectively tracked hand movements, facial expressions, and object usage.

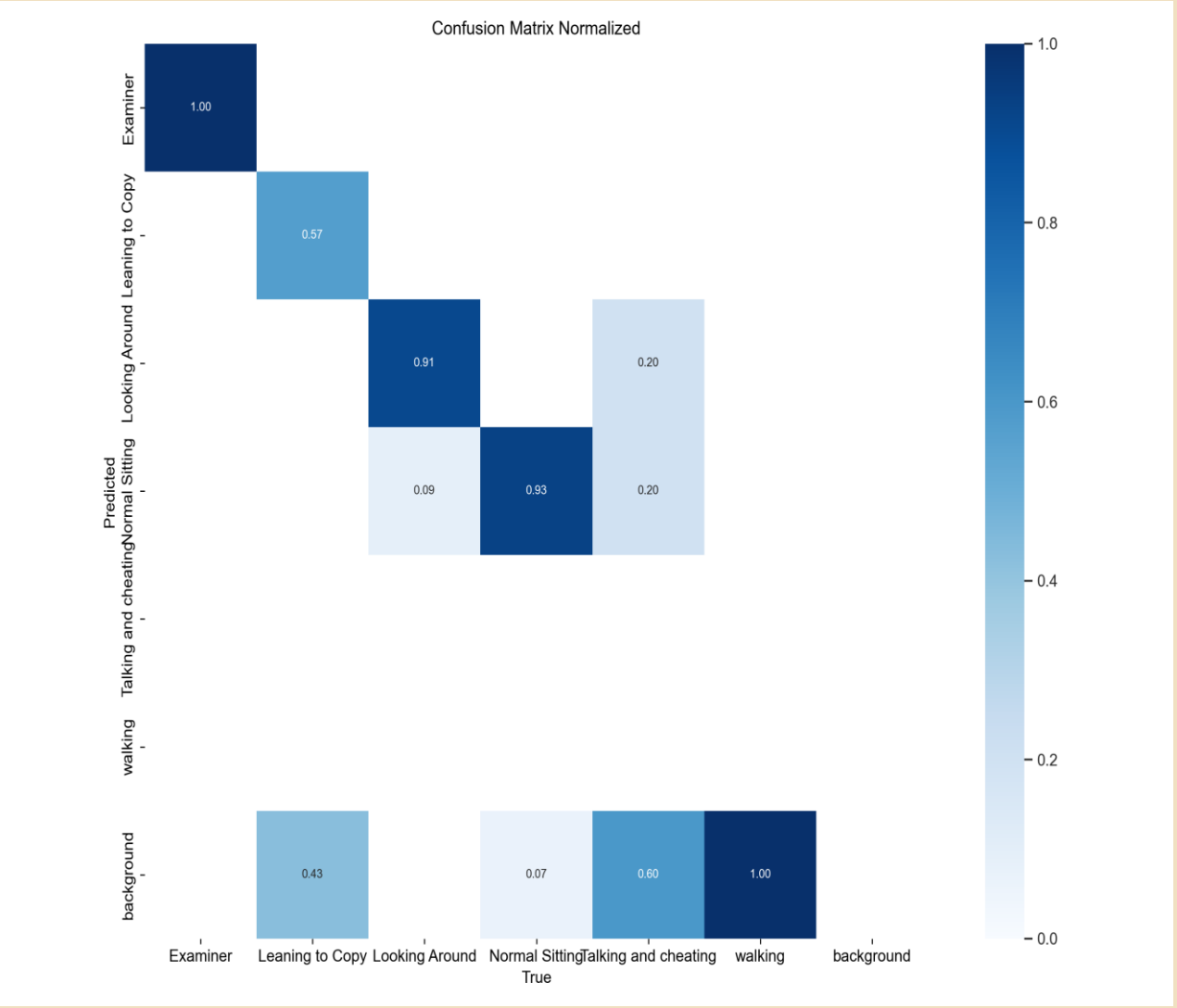
4) Error Analysis and Model Refinement:

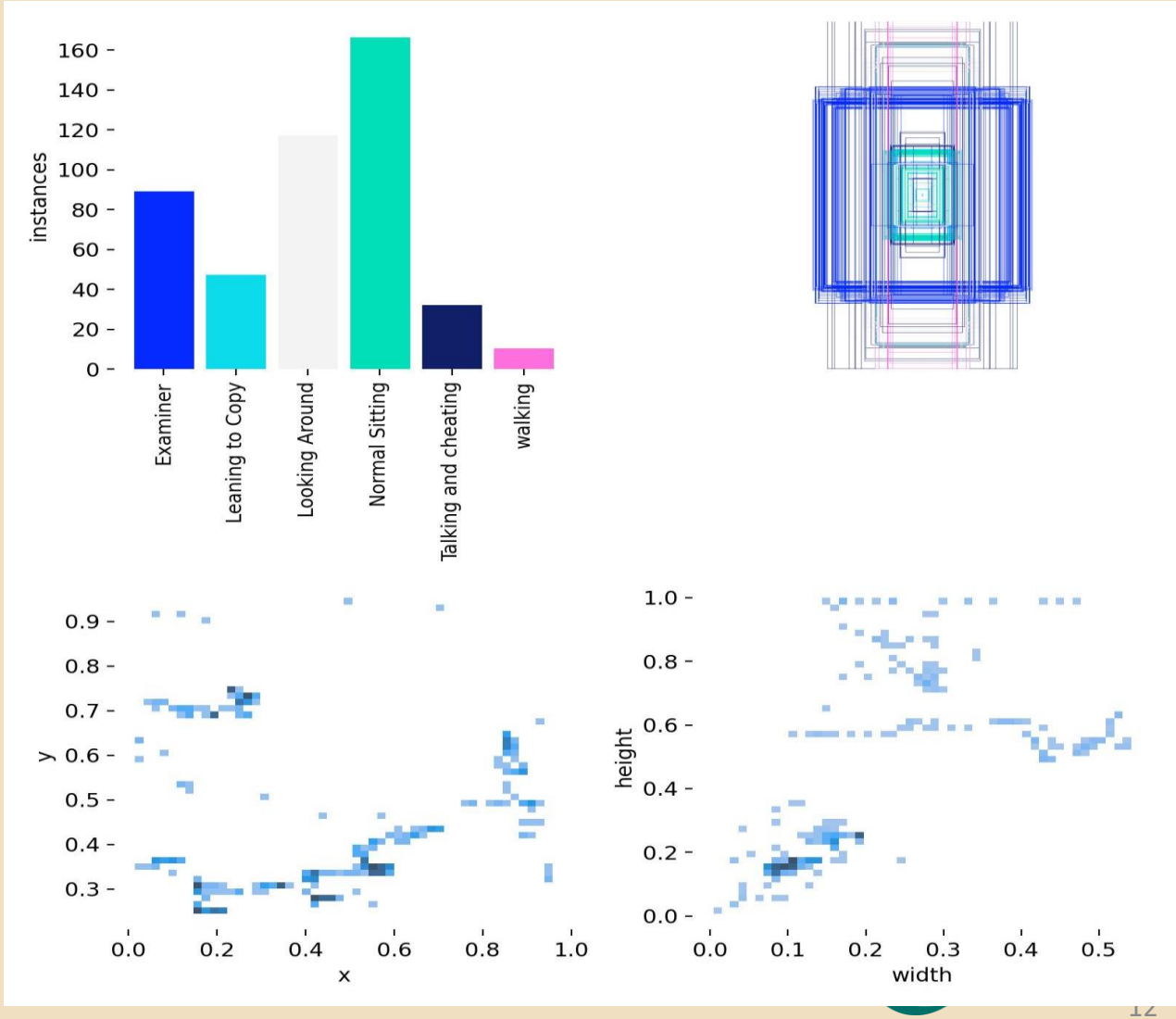
- Misclassifications were observed in normal head movements mistaken as cheating.
- The confidence threshold was adjusted, and additional data was used to improve precision.

5) Final Validation and System Readiness:

- The system successfully flagged cheating behaviors in diverse online exam videos.
- Results confirmed its efficiency, making it ready for deployment in online exam monitoring.

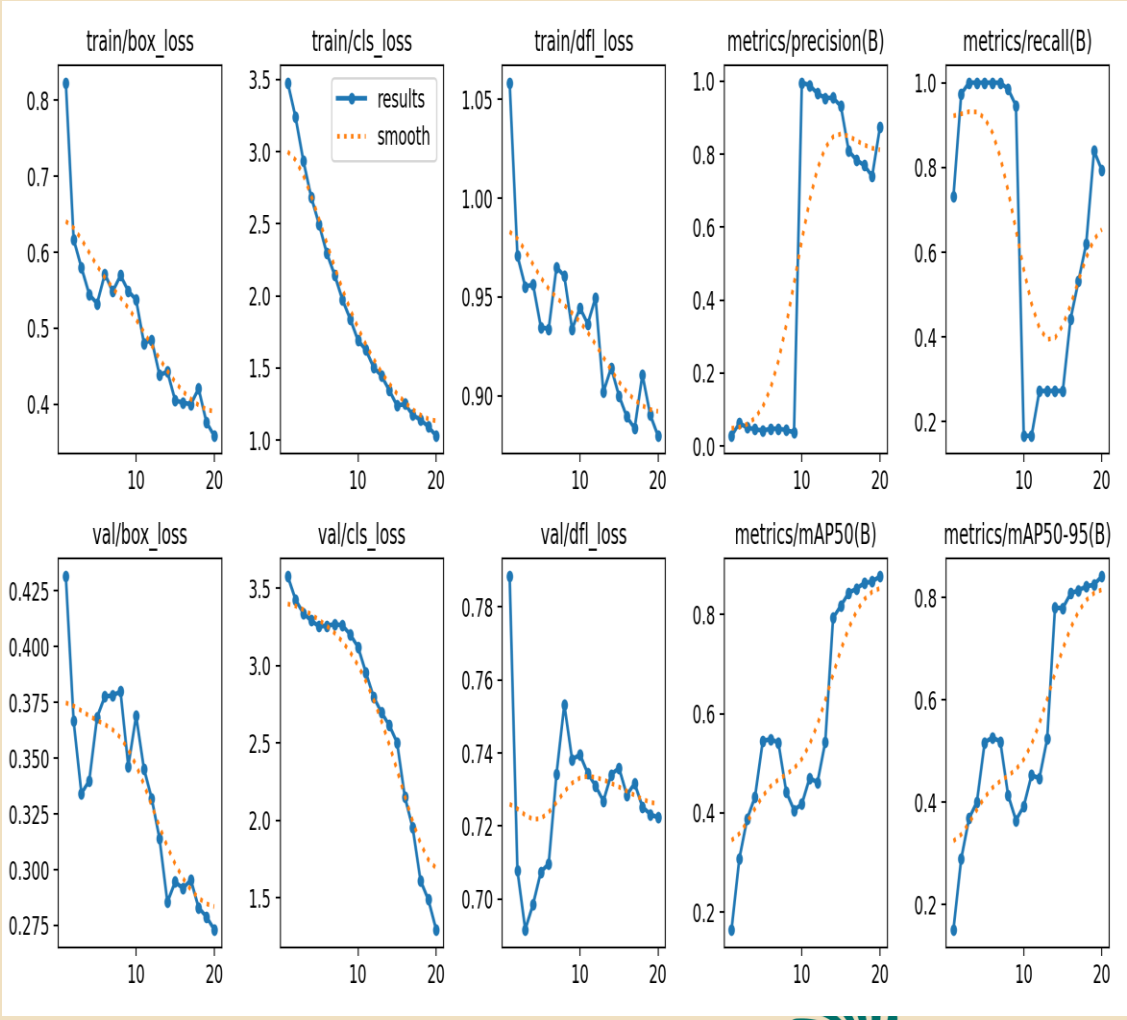
Confusion Matrix:





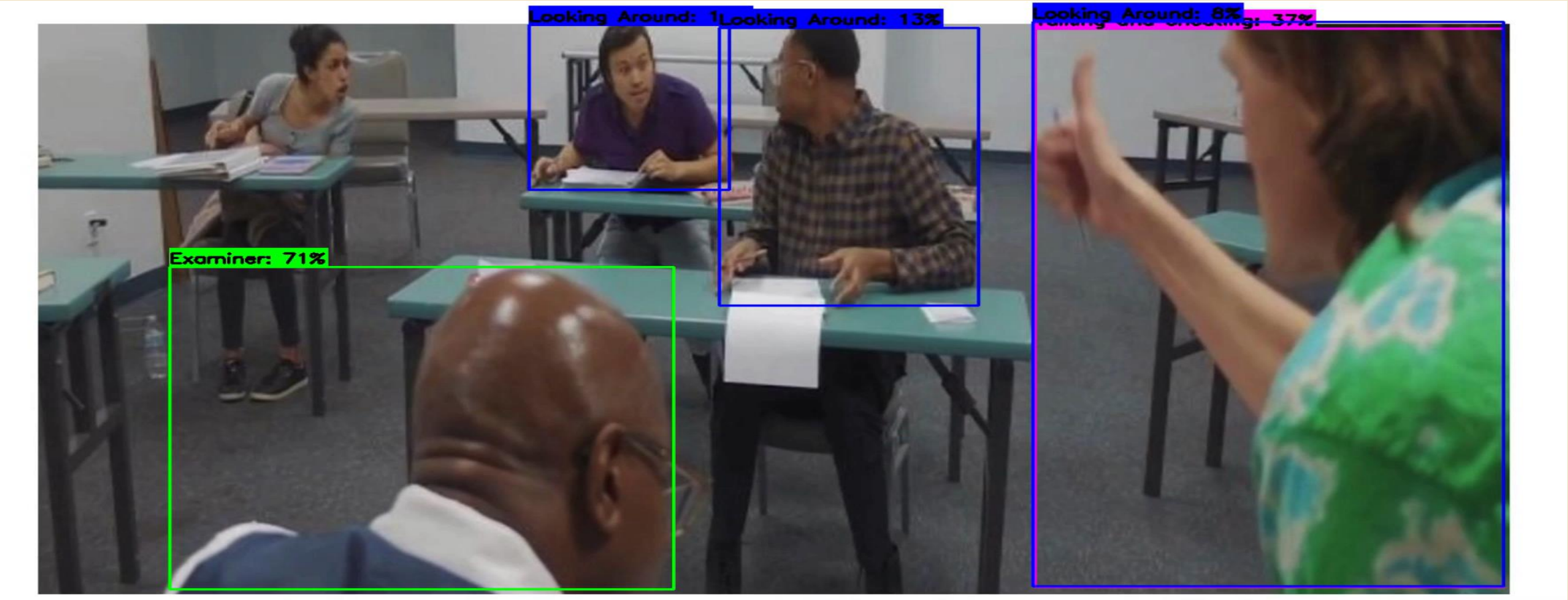
Graphs and Results:

A	B	C	D	E	F	G	H	I	J	K	L	M	N	O
epoch	time	train/box_	train/cls_l	train/dfl_l	metrics/pr	metrics/re	metrics/m	metrics/m	val/box_lo	val/cls_los	val/dfl_los	lr/pg0	lr/pg1	lr/pg2
1	53.9792	0.82288	3.47788	1.05849	0.02787	0.7324	0.16492	0.15101	0.43157	3.5776	0.78844	5.00E-05	5.00E-05	5.00E-05
2	90.9832	0.61696	3.23886	0.97092	0.06289	0.97374	0.30783	0.28962	0.36664	3.42631	0.70779	0.000105	0.000105	0.000105
3	127.486	0.57981	2.93687	0.95526	0.05063	1	0.38798	0.36831	0.33417	3.33747	0.69164	0.000153	0.000153	0.000153
4	166.353	0.54462	2.68565	0.95632	0.04595	1	0.43199	0.40022	0.33992	3.29162	0.69853	0.000196	0.000196	0.000196
5	202.244	0.53245	2.49818	0.93471	0.04232	1	0.54507	0.51679	0.36833	3.2527	0.70742	0.000233	0.000233	0.000233
6	234.706	0.57137	2.2959	0.9338	0.0472	1	0.54879	0.52672	0.37768	3.25763	0.70964	0.000263	0.000263	0.000263
7	267.856	0.54832	2.14554	0.96512	0.04762	1	0.54169	0.51837	0.3781	3.26747	0.73422	0.000288	0.000288	0.000288
8	299.742	0.56948	1.97384	0.96059	0.04375	0.98485	0.44291	0.41371	0.37986	3.26051	0.75327	0.000307	0.000307	0.000307
9	330.95	0.54906	1.83974	0.93373	0.03748	0.94589	0.4056	0.36452	0.34642	3.20069	0.73819	0.00032	0.00032	0.00032
10	362.035	0.53743	1.69087	0.94452	0.99582	0.16667	0.41797	0.39221	0.36897	3.12023	0.73957	0.000327	0.000327	0.000327
11	392.625	0.48043	1.62529	0.93633	0.98889	0.16667	0.47055	0.45284	0.34526	2.95517	0.73441	0.000328	0.000328	0.000328
12	422.87	0.48464	1.50397	0.94968	0.96588	0.27253	0.46132	0.44654	0.33186	2.79708	0.731	0.000323	0.000323	0.000323
13	454.765	0.4385	1.44606	0.90188	0.95371	0.27273	0.54317	0.52378	0.31388	2.69716	0.7268	0.000313	0.000313	0.000313
14	490.6	0.44307	1.34473	0.91416	0.95455	0.27273	0.79323	0.78021	0.28547	2.6141	0.73409	0.000296	0.000296	0.000296
15	523.896	0.40516	1.23802	0.90002	0.93121	0.27273	0.81802	0.77965	0.29456	2.5029	0.7359	0.000273	0.000273	0.000273
16	559.176	0.40221	1.2509	0.8894	0.80913	0.44321	0.84368	0.8082	0.29158	2.14925	0.72851	0.000245	0.000245	0.000245
17	593.034	0.40015	1.1737	0.88347	0.78343	0.5314	0.8525	0.81453	0.29547	1.95196	0.73165	0.000208	0.000208	0.000208
18	627.001	0.42068	1.14069	0.91068	0.76945	0.62021	0.86384	0.82186	0.28301	1.61046	0.72528	0.000159	0.000159	0.000159
19	661.234	0.37662	1.0933	0.89033	0.73923	0.83918	0.86648	0.82563	0.2789	1.48747	0.7232	0.000109	0.000109	0.000109
20	696.142	0.35855	1.02876	0.87968	0.87395	0.79353	0.87747	0.84203	0.27322	1.2947	0.7223	5.95E-05	5.95E-05	5.95E-05



Annotations Result :

Final Result :



Conclusions

Summary:

Our project, the **AI-Powered Exam Supervision Monitoring System**, was developed to enhance fairness and security in online examinations. Using **YOLOv11n-seg.pt**, we trained the model on online exam videos to detect suspicious behaviors such as **frequent glancing, object usage, and unauthorized interactions**. The system was tested across various **lighting conditions, video qualities, and student behaviors** to ensure robust performance.

Conclusion:

After extensive testing, our model achieved an **88% accuracy** in detecting cheating behaviors, demonstrating its effectiveness in real-world scenarios. The system successfully minimized **false positives and false negatives**, with segmentation techniques improving the detection of hand movements and facial expressions. While the model performed well, **further refinements** in dataset diversity and confidence threshold tuning can enhance its accuracy. Overall, this system provides a **scalable and automated solution for online exam monitoring**, reducing the need for manual supervision while ensuring a fair evaluation process.

THANK YOU

Have a Great Day !