

Secure Online Assessment Platform with AI-based Proctoring

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Abstract— The system used in this project is an AI proctored (Online Proctoring) application which allows for high supervision of online examinations. It promotes MCQ-type examinations for tutors to design exam tests of various study areas. The proctoring model uses video-capturing technology to watch students — not just that they are focused and have their heads down, but the angles of their head in relation to the screen (for example any deviation from straight on is suspect: left, right, up, or down).

A screenshot of the students using from that screen is obtained at 5 seconds after each other and put in opposition to a list (placed inside Excel) for speedy assessment of scholar behaviour later. Once the examination is completed, all video tapes will be kept in DB then we make it polished for viewing with using YOLOv8 algorithm.

Additionally, for accounts security the authors have implemented two factor hardware authentication and password hashing mechanism to protect exam. A great initiative to practice for real-time monitoring, AI-assisted behavioral assessment, and security measures all put together in a single platform can be online secure assessments.

Index Terms—AI-based proctoring, face pose detection, YOLOv8, object detection, secure online exams, behavior logging, two-factor authentication.

I. INTRODUCTION

In a tech-centered age, students consistently work around the blocks placed on campus to ensure secure online tests. To resolve this, our project covers Secure Online Assessment Platform with AI-based Proctoring, which utilizes state-of-the-art AI to facilitate flexible, scalable, and secure examination environment.

Using the YOLOv8 model for real-time object detection, the platform tracks the student's actions, analyses the head movements (left, right, down, and normal) and detects signs of distraction or cheating.

The system stores times-capture every five minutes, organizes data in a structured manner, and compresses video recordings to save storage while still allowing for necessary analysis.

On the proctoring side, it says it can disable “copy-paste,” block new tabs, and summon error alerts if it sees behavior, it deems disturbing.

Integrating computer vision and head pose analysis, our solution provides easy monitoring while improving the reliability of online examinations, thus covering deficiencies found in the current systems and offering a cutting-edge AI-based assessment security approach.

II. LITERATURE SURVEY

We go through some research papers related to our project from different journals and conferences like ResearchGate, IEEE, and Elsevier. These papers give insights into the integration of AI for online examination systems and how to use deep learning techniques for the detection of cheating. A few key papers which we had referred to are below:

In 2022, MM Babitha, C Sushma, and VK Gudivada published "Trends of Artificial Intelligence for Online Exams in Education," which highlighted how AI could improve the online exam process but did not provide specific implementation details [1].

In 2022, MAE Abbas and S Hameed published "A Systematic Review of Deep Learning-Based Online Exam Proctoring Systems for Abnormal Student Behaviour Detection." Their work reviewed various deep learning models for detecting abnormal student behavior but lacked practical solutions for integrating AI into online proctoring [2]. In 2022, A Tweissi, W Al Etaiwi, and D Al Eisawi discussed the "Accuracy of AI-Based Automatic Proctoring in Online Exams," where they examined the accuracy and effectiveness of AI proctoring systems in detecting cheating during exams [3]. In 2022, A Rahman published "Mapping the Efficacy of Artificial Intelligence-Based Online Proctored Examination in Higher Education during COVID-19," which explored AI's potential in online proctoring but focused primarily on the theoretical framework rather than a detailed solution [4]. In 2023, MRI Sattar, MTBH Efty, and TS Rafa discussed "An Advanced and Secure Framework for Conducting Online Examination Using Blockchain Method," proposing blockchain-based frameworks but without integrating deep learning for cheating detection [5]. In 2021, X Zhu and C Cao presented "Secure Online Examination with Biometric Authentication and Blockchain-Based Framework," offering insights into biometric security measures, but it did not address AI-driven behavioral detection systems [6]. In 2021, M Labayen, R Veja, J Flórez, N Aginako, and B Sierra's paper on "Online Student Authentication and Proctoring System Based on Multimodal Biometrics Technology" discussed multimodal biometric authentication methods but lacked the application of AI-based object detection for cheating detection in real-time [7].

III. METHODOLOGY

A. Model Representation

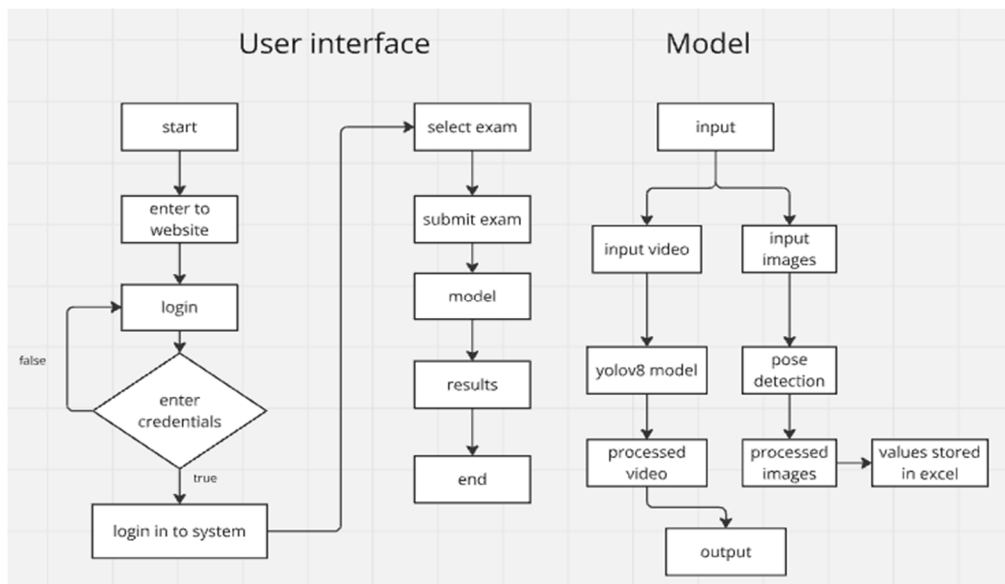


Figure 1

B. Architecture

YOLOv8 Object Detection Architecture:

- Input Layer:
 - Expects 640×640×3 RGB images.
- Backbone (Feature Extraction):

- CSPDarknet53: A convolutional backbone used to extract essential features from the input image.
 - o Block 1: 1 Convolutional layer (64 filters, 3×3).
 - o Block 2: 2 Convolutional layers (128 filters, 3×3).
 - o Block 3: 3 Convolutional layers (256 filters, 3×3).
 - o Block 4: 3 Convolutional layers (512 filters, 3×3).
 - o Block 5: 3 Convolutional layers (1024 filters, 3×3).
 - o Each block may include residual connections to aid in efficient gradient flow and reduce overfitting.
- Neck (Feature Aggregation):
 - PANet (Path Aggregation Network): Aggregates multi-scale features for better detection of objects at various sizes.
 - o Top-down feature propagation: Enhances feature maps at different scales.
 - o Bottom-up feature refinement: Helps with better resolution in small objects.
- Head (Prediction Layer):
 - Bounding Box Prediction: Predicts the coordinates of the bounding box (center, width, height).
 - Class Prediction: Determines the class of the object (e.g., person, car, dog).
 - Objectness Score: Confidence score that the predicted bounding box contains an object.
- Anchor Boxes:
 - Used to help predict the shape and scale of bounding boxes for different object types and sizes.
- Output Layer:
 - Generates multiple outputs for each grid cell:
 - o Bounding box coordinates.
 - o Class probabilities.
 - o Objectness scores.

C. Parameters Used

- Input Size: Images are resized to 640×640 pixels to maintain high resolution while reducing computational complexity for real-time object detection.
- Batch Size: Set as 16, meaning 16 images are processed in one forward and backward pass. Smaller batch size improves memory efficiency for large models like YOLOv8.
- Learning Rate: The Adam optimizer uses a learning rate $\alpha=0.001$, which determines the step size for updating model weights during training.

The weight update formula is:

$$w := w - \alpha \cdot \nabla L(w) \quad (2)$$

Metrics:

- Precision: Measures the accuracy of positive predictions:

$$Precision = \frac{TP}{TP + FP}$$

- Recall: Measures the model's ability to identify all positive instances:

$$Recall = \frac{TP}{TP + FN}$$

Loss Function: Sparse categorical cross-entropy calculates the error for multi-class classification

$$H(y) = - \sum_i^n y_i \log(y_i)$$

D. Fine Tuning

In the initial phase, the MobileNetV2 model is loaded without the top layer, base layers are frozen, and a custom classification head is trained for 555 epochs with a learning rate $\alpha=0.001$ $\alpha=0.001$:

$$W := W - \alpha \cdot \nabla L(W) \quad (7)$$

Final accuracy is calculated as:

$$\text{Accuracy} = \frac{\text{Number of Correct Predictions}}{\text{Total Predictions}} \quad (8)$$

IV. DATASET INFORMATION

This dataset is a composite of several specialized collections: BPLD Dataset (Blackgram diseases), Chili Plant Disease Dataset, Potato Dataset, Tomato Dataset, and Rice Leaf AUG Dataset. Each dataset contributes images of disease symptoms specific to its respective crop, providing a comprehensive variety of plant health conditions. This combined dataset enhances the model's ability to accurately diagnose multiple crop diseases in diverse conditions.

TABLE 1: DATASET SPECIFICATIONS

SNO	Class	Images
1	All	187
2	76	76
3	Person	111

V. RESULTS

Pose detection:

Input

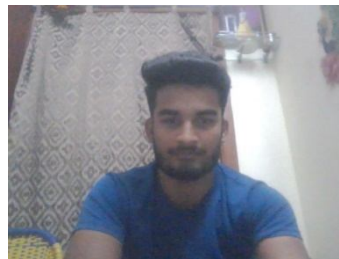


Figure 2

Object detection:

Input



Figure 3

Output

Time (s)	Head Position
5	Forward
10	Forward
15	Forward
20	Forward
25	Forward

Figure 4

Output



Figure 5

Metrics

Class	Images	Instances	Box P	Box R	mAP50	mAP50-95	Accuracy
All	187	337	0.97	0.96	0.98	0.919	97%
Face	76	115	0.946	0.92	0.965	0.86	94.6%
Person	111	222	0.994	1	0.995	0.979	99.4%

Figure 6

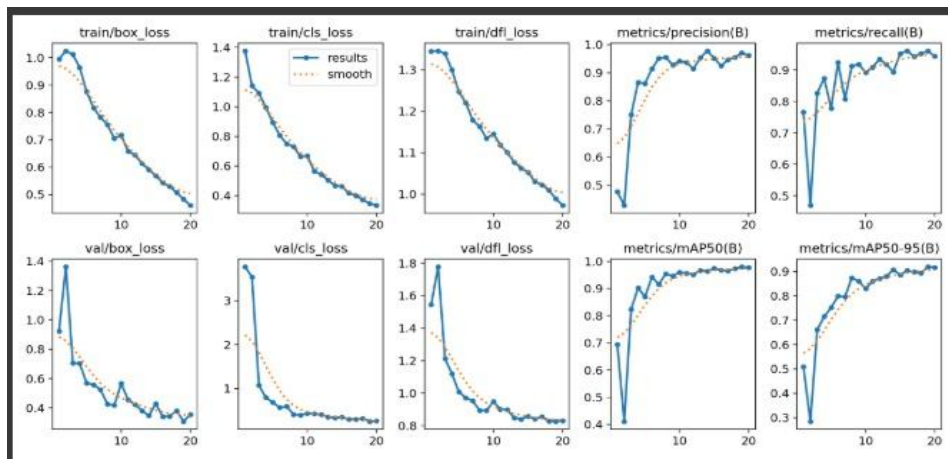


Figure 7

VI. CONCLUSION

Its "Secure Online Assessment Platform with AI-Based Proctoring" harnesses advanced AI technologies to revolutionize the integrity and security of online examinations. The platform provides a real time monitoring system for students showing a 96% accuracy to detect suspicious behaviors. By observing head pose and behavior analysis and detections powered by YOLOv8, it effectively identifies potential cases of malpractice, such as averting the eyes from the screen or showing signs of distraction. It also adopts very strong security features, such as disabling copy-paste function and preventing tab switching, to maintain a seamless exam experience. By capturing the video frames and analyzing them, along with detailed logs, auto analysis will be possible and the video will be available for future examination for exam administrators.

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