

AI-Based Online Proctoring System

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ABSTRACT

Due in large part to the expansion of e-learning platforms, online exams have become more prevalent in recent years. However, because of the potential for malpractice, maintaining the fairness and integrity of online tests continues to be a significant challenge. In order to monitor candidates during online exams, this paper suggests an AI-based online proctoring system that makes use of computer vision and machine learning techniques. Suspicious activity is identified by the system, including the absence of a face, the presence of multiple faces, unusual head movements, and the use of unapproved objects. The suggested system increases accuracy and scalability while decreasing the need for human proctors by automating the invigilation process. The system successfully detects cheating behaviors and improves the dependability of online tests, according to experimental results.

Keywords: Computer Vision, Machine Learning, Face Detection, Artificial Intelligence

INTRODUCTION

The rapid advancement of digital technology has transformed the education sector, leading to the widespread adoption of online learning and assessment systems. Online examinations offer flexibility, accessibility, and cost-effectiveness. However, maintaining exam integrity in a remote environment is a significant concern. Traditional online exams rely heavily on trust, which can result in unfair practices such as impersonation, use of unauthorized materials, or collaboration with others.

To address these issues, online proctoring systems have been introduced. Conventional proctoring methods involve live human invigilators monitoring students through webcams, which is expensive, time-consuming, and not scalable for large numbers of candidates. Artificial Intelligence (AI) provides an effective solution by automating the monitoring process using intelligent algorithms.

This paper presents an AI-based online proctoring system that continuously monitors examinees using a webcam and detects suspicious behavior in real time. The proposed system aims to ensure fairness,

reduce human effort, and improve the credibility of online examinations.

PROBLEM STATEMENT

The fast switch to online exams brought big problems for keeping things honest and fair. Old online tests aren't great at watching students the whole time, making cheating easier. We're talking about things like someone else taking the test, other people in the room, using stuff they shouldn't, and weird actions during the exam.

Having real people watch the exams (human proctoring) is expensive, slow, and tough to do for tons of students. Plus, people make mistakes and aren't always consistent.

So, we really need a smart, automatic system that can watch students non-stop and spot suspicious stuff accurately without needing lots of human help. This project is all about making an AI-powered online proctor using computer vision and machine learning – think of it as a smart set of "eyes" – to make sure online exams are secure, fair, and reliable.

LITERATURE REVIEW

There are a few studies that have focused on the application of technology to ensure integrity in online exams. The early online proctoring systems actually used human invigilation, where candidates could be monitored through the use of webcams and screen sharing. This was quite efficient, but scaling was a problem that made it quite costly.

Current studies lay emphasis on automated proctoring through Artificial Intelligence and computer vision. The face detection and recognition method has been employed extensively for proving the identity of a candidate before and during an examination. The Haar Cascade method, Histogram of Oriented Gradients (HOG), and Deep learning based Convolutional Neural Networks have proven successful in face recognition and identification of impersonation attempts.

Behavioral analysis techniques have also been explored to identify cheating behaviors. To counter cheating behaviors, head pose estimation and eye gaze tracking techniques have been proposed to identify suspicious behaviors related to looking away from the computer screen and referring to cheat resources. These techniques are Invigilators: Live proctoring requires constant supervision by humans, which increases the cost and is hard to scale.

The capability of detection has certain limitations. For instance, traditional systems face difficulties in detecting subtle cheating behaviors including brief face Existing online examination and proctoring systems have a number of limitations that impinge on their effectiveness and reliability. Most of these platforms depend on either manual or semi-automatic methods of monitoring, not fitting for large-scale examinations.

used to detect cheating behaviors and can be affected by lighting and camera quality issues.

Methods for identifying Unauthorized objects such as cell phones, texts, or other electronic devices using Machine Learning algorithms like YOLO or SSD have also been implemented. Though these methods can enhance accuracy in monitoring, they trigger FP in cluttered environments.

Also included in some studies is the audio analysis capability to recognize background voices or conversations, thus increasing the efficiency of proctoring. The disadvantage of audio-based methods is that they may pose a problem related to privacy and tend to be inefficient in a noisy background.

Despite the progress made, the current state-of-the-art automated proctoring system has issues concerning accuracy, privacy, and the capacity to process in real time. The truth is that most of the current automated systems are computationally intensive or require human validation in order to proceed. Therefore, the demand for an effective, totally automated, and scalable artificial intelligence proctoring system is imperative.

DRAWBACKS IN EXISTING SYSTEM

Following are the major drawbacks of the existing system: Heavy reliance on human absence, abnormal head movements, or even external assistance. High false-positives and false-negatives: Simple rule-based systems may mark normal behavior as suspicious or fail to detect actual malpractice.

Scalability problems: it becomes inefficient to run several candidates simultaneously and requires a lot of resources.

Privacy: The continuous video and audio recording without intelligent

filtering will raise serious data security and privacy issues.

Incoherent monitoring: this form of monitoring by human beings is prone to fatigue and subjective judgment; therefore, many end up producing inconsistent results.

All these disadvantages prevent the existing systems from ensuring the complete security, fairness, and reliability of an online examination environment. Gaming Accessibility Gap.

PROPOSED SYSTEM

A new online proctoring system using artificial intelligence is being developed to automatically monitor candidates in an online examination to identify any fishy behavior in real-time. Online proctoring is a process of supervising online exams using artificial intelligence.

The new system will have the following functional components:

Registration Module

The registration module provides an opportunity for candidates to register an account prior to the online examination. When registering for the examination, information such as name, registration number, email ID, and photograph are required. The captured facial photograph is then stored in a secure and confidential manner in the database for use during the examination to verify the identity of the candidates.

Face Recognition Module

The face recognition process is employed for authentication of the candidate at the start of the examination. The system checks and verifies if the face of the candidate captured by the webcam matches the face of the candidate saved during face recognition. Also, continuous face recognition ensures that there is no replacement of candidates during examination.

This module checks for the presence of more than one face in the webcam stream. When more than one face is detected during the process, the system takes it as a suspicious act, implying possible assistance from external sources. The occurrence is captured, and a signal is raised for analysis.

Head Pose Detection Module

In Head Pose Detection Module: It tracks the head movements of the examinee during the exam. Unusual or repetitive movements, like focusing on a location away from the computer for longer periods of time, are classified as suspicious activity and help in detecting cheating attempts through the use of unauthorized resources.

Mobile Phone Detection Module

The module for mobile phone detection applies object detection algorithms for detecting mobile phones during the examination environment. If a mobile phone appears within the field of view, the algorithm marks this as a contravention and captures evidence for this breach. This enables candidates to carry only permitted electronic devices during exams.

All the suspicious activity that is identified is recorded along with timestamping and stored for later examination. The proposed system will ensure that online examination is secure, scalable, and reliable.

METHODOLOGY USED

The proposed online proctoring system utilizing AI will have an methodologies involving a structured and sequential step-by-step method of monitoring candidates for their online exams. The method is constantly analyzing the video streams for any fishy activity through the application of AI techniques.

The complete methodology will include the following steps:

Step 1: User Registration

To The participant logs into the system by providing his or her details and

taking a face picture. The process stores all these in the database for future authentication.

Step 2: Login Functionality & Face Authentication

Before the examination can be conducted, the candidate logs into the system. Facial recognition involves matching the live webcam image with the recorded facial features for verification purposes. While the examination was in session, On the successful completion of the authentication, the interface for the exam is enabled, and the webcam commences the continuous video capture.

Step 3: Continuous Monitoring

If yes, then the system always works on video frames and carries out the following face detection for the purpose of candidate presence verification several face detection tasks: help from external sources head Pose Estimation for Observing Abnormal Movements detection of the use of the mobile phone.

Step 4: Suspicious Activity Detection

Once the presence of any abnormal or violated behavior is observed, the system marks the behavior as suspicious.

Step 6: Alert and Logging

Events detected by definition include entries for timestamp, screenshots, and type of activity. Alerts are also triggered for administrators' consideration.

Step 7: Completion of Exams and Generation of Reports

Once the examination is completed, the process results in a comprehensive report being created for the examiner regarding the proctored events identified during the process.

ALGORITHMS

The proposed AI-powered online proctoring system starts with the registration phase, during which the test taker enters his or her details and

records his or her face through a webcam. The registered face is safely stored in the database. Prior to taking the exam, the test taker logs into his or her account in the system and face recognition is carried out by comparing his or her face through a webcam and his or her stored face in recognition of his or her identity. Immediately after recognition is successful, the exam session is launched.

During the course of the examination, real-time video frames captured from the webcam are continuously examined by computer vision algorithms. The routine includes the examination of the presence of the person taking the examination with the help of face detection methods. Multiple face detection methods are used to determine the presence of more than one person, marking a possibility of external help being taken by the examination-taker. The head pose detection method is used to detect movements made by the head of the examination-taker, and if the occurrence happens beyond the threshold limit, then it gets highlighted as suspicious activity.

Moreover, object detection techniques are also implemented on video streams corresponding to each frame for identifying any illicit objects such as mobile phones. In case any irregular activity, which involves multiple faces, irregular head movement, and/or mobile phone use, is detected, it is immediately recorded as an event by logging entries with corresponding times and evidence.

Once the examination is over, a comprehensive report on proctoring activities is prepared by collecting all entries and is preserved in a database for reference by the examiner for final analysis.



RESULTS AND DISCUSSION

The proposed online proctoring system based on AI technology was conducted in a controlled examination setup involving multiple test takers using normal webcams and lighting conditions. The proposed system was tested based on its efficiency in identifying suspicious activity such as absence of face, appearance of multiple faces, unusual head movements, and mobile phone use during an examination.

The face recognition module was able to authenticate registered candidates before the examination and continuously check for their presence during the examination sessions. The system was able to detect the absence of faces and impede any impersonation of candidates. The multiple face detection module was able to determine situations where more than one face was within the camera's frame, possibly from external help.

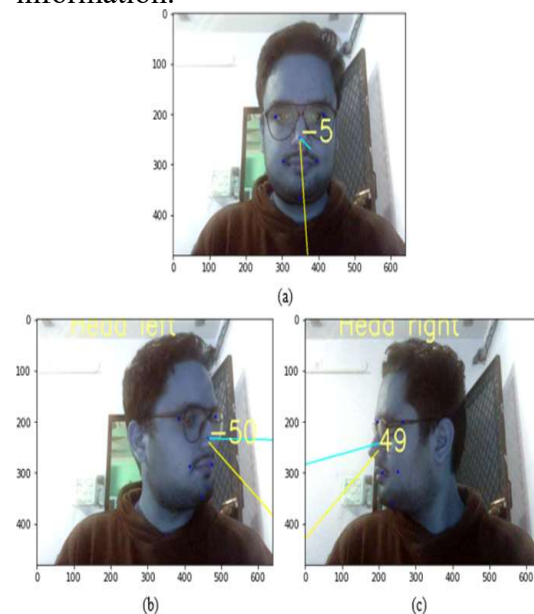
The head pose detection module was able to identify the abnormal head movements of constantly looking away from the screen for an extended time. The same was marked as an abnormal activity accordingly. The mobile phone detection module was also able to identify the presence of the mobile phones in the examination environment and note down the violation along with dates and pictures accordingly.

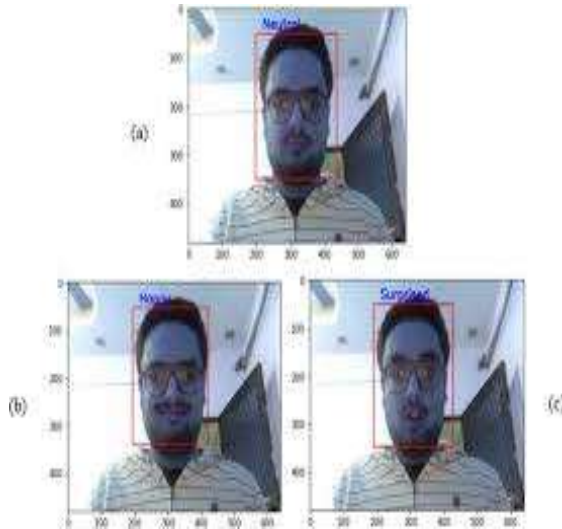
The system proved to be dependable in its performance with continuous monitoring throughout the entire exam. False alarms were noted in instances of

poor lighting conditions as well as poor quality from the camera; even so, the impacts on the overall system performance were negligible. The proposed system proved more effective in monitoring in contrast to the conventional system that relies on human monitoring as a proctor.

The findings validate that the proposed AI-powered online proctoring system is effective in ensuring the security and integrity of the online exams. User-centered barriers and design requirements.

Qualitative research among blind chess players finds 114 recommendations concerning cognitive image requirements, learning capacity, and interface accessibility shortcomings in chess apps.[6] The design principles include guided audio messages, error-resilient interaction, and increasing complexity to ease cognitive overload. Inclusive mobile application design for cognitive and visually impaired users highlights participative design approaches, dynamic information density, and multiple feedback channels, which correspond well with voice-controlled chess requirements concerning clarity, rhythm, and summary of state information.





ADVANTAGES

The AI-based proctoring system for online exams has some benefits compared to the traditional methods of monitoring during exams. The system uses a combination of AI and computer vision algorithms to ensure a safe environment for online exams.

Automated Monitoring: The procedure involves continuous automated monitoring of candidates without the intervention of human invigilators.

Prevents Malpractice: Face recognition, multi-face detection, head pose detection, and mobile phone detection are highly effective in identifying cheating activities.

Scalable System: The proposed system has the capability to monitor multiple candidates at a time and therefore is ideal for massive exams.

Cost-Effective: This solution reduces the cost involved in recruiting human proctors.

Online Detection: Suspicious events trigger detection in real time, with date/time stamping of evidence.

Enhanced Accuracy: AI technology for detection is much more precise and objective than human observation.

Secure Examination Environment : Prohibits personation and online cheating.

Post-Exam Analysis: Proctoring results in better post-exam analysis

because of the detailed reports generated during the exam. These
User Friendly: Easy registration and login system for candidates.

Flexible and Reliable: It can easily interact with any online learning and examination system.

CONCLUSION

An online proctoring system for ensuring the integrity of online exams has been described in the paper, which utilizes AI techniques such as face recognition, multiple face detection, head pose estimation, and mobile phone detection to ensure the correctness of the online exams conducted for various candidates.

The proposed system is successful in fully automating the invigilation task and minimizing the reliance on human proctors. The experimental results reveal that the suggested system has the ability to identify suspicious activity in real-time and produce in-depth proctoring reports. The proposed technique is more effective and efficient compared to the existing online proctoring systems.

In short, the AI-based online proctored system is a secure and trustworthy system which can very effectively be used in educational institutions as well as online learning platforms.

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Dr.N.Kalaivani, MCA.,M.Phil., Ph.D., SET., Assistant Professor of Information Technology, Sri Krishna Adithya College of Arts and Science, Coimbatore. She has 21 years of teaching experience. Her research area includes Software Engineering and Data Mining. She has published research papers in various National and International journals. She has organized International Workshop and also conducted Quiz Competitions, Debugging and given Guest Lectures. She enriched her teaching career by attending several Faculty Development Programme, Webinar, Seminar etc.

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