

Online Exam Proctoring Tool – A Technical Survey

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Abstract—The creation of AI-based test proctoring systems has become essential, given the rise in demand for remote learning and online education. The important role that AI-based test proctoring systems play is examined in this survey study in light of the rising popularity of online and remote learning. The research project's objective is to find solutions for the intricate problems that arise while keeping an eye on students when they take online exams and maintaining academic integrity. The research explores state-of-the-art deep learning methods, emphasizing the use of technologies such as face recognition using OpenCV and HOG algorithms and eye-blinking detection. These methods make it possible to continuously observe the physical surroundings of students, doing away with the requirement for human proctoring. The technology also claims to be able to identify devices that are not permitted, which improves security and impartiality throughout the evaluation procedure. In the field of AI-assisted online proctoring, the survey provides a thorough review of significant developments. The underlying approaches are covered in the paper, with special attention paid to the possibility of automated proctoring systems operating in real-time and the function of convolutional neural networks (CNNs) in facial recognition. The study emphasizes how crucial it is to foster confidence in AI-based proctoring systems. It carefully takes into account all the important factors, such as emerging technological trends in online proctoring systems, security, privacy, ethics, and financial implications.

Keywords: AI-based proctoring, Face recognition, Deep learning, Online examination, Privacy, Ethical concerns, Convolutional Neural Networks.

I. INTRODUCTION

The academic world has moved online. This presents a significant difficulty from both the standpoint of learning and exams. Performing exams without any misconduct is a significant challenge that has to be overcome. In the last six years, the quantity of internet users in India has almost doubled. Academics benefited greatly from this since many students were able to pursue further education. This made it easier for exams to be taken online, which introduced the idea of online monitoring to the academic setting. Web-based administering refers to an electronic form of monitoring that makes use of state-of-the-art observation software. The invigilators can invigilate remotely with a proctored exam. To keep the exam

credible, they employ audio, video, and a number of anti-cheating features. It is challenging to manually oversee online exams when many students cannot be invigilated concurrently. For some time now, interest in online education has been growing, and it has accelerated due to the corona virus pandemic of 2019. Online assessment activities are a common feature of these online courses, which presents a number of problems and concerns regarding academic integrity and plagiarism. integrity throughout. Adopting is one tactic to get beyond some of these challenges. Tools for proctoring online exams are available. Using virtual tools to keep an eye on students' actions during assessments is known as online proctoring. As these tools continue to grow beyond their current constraints, students could be able to take an online test while positioned remotely, making sure that the security and reliability as well as the online exam's dependability is in order to protect and preserve the integrity of an exam and its administration, it is necessary to authenticate the student's identity. Online proctoring consists of two basic components. In order to record the student during the exam period, the webcam on the student's computer device must first be turned on. The proctor or the examiner can see this recorded footage remotely. Potential cheating, questionable posture, and actions like speaking to someone or gazing at a book, mobile device, or other printed material for answers can all be detected by the proctor or examiner. Lockdown is the second measure, which prohibits pupils from utilizing any other computer programs or user computing activities (like copying, pasting, or printing), which may encourage exam cheating, which is frequently mentioned as "computer or browser lockdown." Throughout the exam, the proctoring system logs every action a student takes on the Internet, including any websites they attempt to visit. The entire exam video recording is provided for examiners or instructors, either in real time or after to review.

Online proctoring systems have four main characteristics:

- **Authentication:** Ensuring that the student registering for an online supervised exam is the actual student.
- **Browsing capacity:** Setting a limit on students' use of their computers for other purposes is known as "browsing

tolerance."

- **Authorizing and controlling remotely:** This allows the proctor to flag any questionable student behavior in addition to initiating, pausing, and ending an online supervised exam.
- **Report writing:** This entails compiling a record of a student's actions throughout a proctored examination

A. Different kinds of proctoring services

- **Offline Proctoring:** This proctoring is traditional invigilation, meaning that the test taker must physically arrive at the dispersed location. The examination could be an optical check acknowledgment (OMR) test, a computer-based test, or a standard test. An ardent supervisor or evaluator is tasked with screening the applicants to ensure they do not engage in any carelessness or use any unethical methods when taking the test. This process is prohibitive because it necessitates the candidates and invigilators to physically attend a designated review, in addition to being expensive and uncomfortable. The innovative approach has altered the way assessments and tests are administered, and it is now flexible enough to allow candidates to request assessments that are not readily available. Proctoring administrations have undergone significant change as a result of this.
- **Live proctoring:** A combination of human and vehicle proctoring can be used in live proctoring. An AI-powered proctoring computer program and a certified human proctor verify the take-a-look-at taker(s) in real-time. The qualified delegate uses stay audio- video and screen-percentage bolsters to maintain watch over the examiner(s) from an inaccessible location. Proctors have the option to either end the assessment in the allotted time or postpone the take-a-look while they notice something strange and converse with the take-a-look-attacker. In order to support the individual delegating, auto-proctoring operates by default.
- **Image Proctoring:** Proctoring in this way makes the most sense when the web network is sluggish. The framework would take pictures of the candidates at predetermined intervals during the exam, when the test is over, at the conclusion of each question, every thirty or forty-five seconds, etc. then can verify those images to ensure that a serious applicant has attempted an online exam and that no improper behavior is taking place.
- **Auto Proctoring:** Auto proctoring, the standard option for large-scale exams, employs AI to predict instances of cheating. The software checks the real-time boost for any unusual activity. AI proctoring, powered by advanced analytics, may be a reasonably priced means of overseeing online evaluations for more number of

applicants. The software uses facial recognition, device location, the discovery of other people, and other distractions to verify the test-taker. Lastly, it generates an extensive report at the end, which ends with the validity index

B. Key components of online proctoring

When taking the online proctored exam, candidates must either download the program application onto the device (desktop or portable workstation) or connect via an internet link. The application surveys the candidate's computer and webcam when they begin the test, and a lockdown feature keeps them from opening any web browsers. The applicant should use one of the several techniques specified by the application to reaffirm their character.

- **Face recognition:** Face popularity, which is supported by machine learning (ML)-driven biometrics, can be used for a number of things, such as recruiting college students for the test and assessing their morality to guaranteeing their presence during the test. System learning has made it possible for face popularity to carry out more than merely verify that test takers are humans. The innovation can detect facial expressions before along time and is safe from any evil character. Modern hairstyles, glasses, and photos of peopl rather than people will no longer confound the system. This eliminates some common deceptive tactics, such as requesting that someone else require the test. The face detection workflow is illustrated in Figure 1.

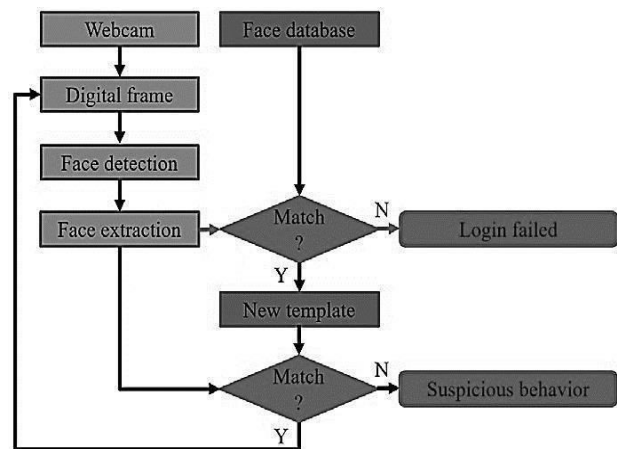


Fig 1. Workflow of face detection

- **Activity monitoring:** Exam taker behavior is viewed by an AI-enabled delegate as a collection of behavior scenarios, including body language, eye and head movements, and discourse. Some students view this kind of approach as outright hostile because it reduces a person to a number of algorithms. Because biometrics calculates responses and environment rather than developments, such as a change in lighting, computer vision becomes less versatile and mechanic-centered. Computer vision can inspect a stand-in for hidden

devices such as radio waves from any transmitting device or a camera focal point in a button. It is not necessary to watch the entire recording again to receive a penalty point for each instance of abnormal behavior; however, the proctor has the final say over the survey.

- **Few other features:**
 - **Pattern Recognition:** Artificial Intelligence is capable at identifying a pattern of particular actions that indicate dishonesty. The human brain is incapable of recognizing the designs, but they can.
 - **Voice Recognition:** By identifying speech patterns, this invention will help with sound selection and background noise synchronization to eliminate instances of cheating.
 - **Object Recognition:** Listing the objects that are permitted in the testing environment is different as an outcome of this innovation.
 - **Eye Movement Detection:** It is possible to identify eye development designs with this AI that coordinates innovation. This will help to demonstrate any wrongdoing.

II. LITERATURE SURVEY

[1] Istiak Ahmad, Fahad AlQurashi, Ehab Abozinadah, and Rashid Mehmood's literature review in their paper discusses the growing difficulties in maintaining academic integrity in online learning, particularly during exams. Their research highlights the need for creative solutions and presents a cutting-edge deep learning-based online proctoring system that includes object and face detection. With astounding accuracy rates of up to 97% for face detection and 99.3% for face recognition, the survey highlights the potential of these technologies to meet the demands of online learning while maintaining security and fairness in online assessments.

[2] The literature review in this paper by Sarthak Maniar, Sudhir Dhage, Krish Sukhani, and Krushna Shah discusses the difficulties that the COVID-19 pandemic has caused for online exams and distance learning. To stop unfair practices during online exams, the authors stress the necessity for a comprehensive multi-modal system that employs computer vision and audio capabilities. With features like mouth open or close detection, object identification, eye gaze tracking, and voice-to-text conversion, their suggested system offers a reliable way to stop cheating and guarantee the accuracy of online tests.

[3] Exam integrity is a necessity in online learning environments, and Jiyou Jia and Yunfan He address this need in their study by introducing Exam integrity is a necessity in online learning environments, and Jiyou Jia and Yunfan He address this need in their study by introducing an intelligent online proctoring system (IOPS) that makes use of technology for artificial intelligence to monitor online exams. The IOPS is a

useful addition to the area of online learning and distance education since it was created with a lightweight and useful approach, addressing the difficulties in preventing exam cheating.

[4] Sagaya Aurelia, R. Thanuja, Subrata Chowdhury, and Yu-Chen Hu discuss the pandemic's effects on the education system and the growing popularity of online tests in their literature review. They discuss the benefits of AI-based online proctoring, emphasizing its affordability and adaptability, as well as the drawbacks and restrictions of different web-based inspection systems. This survey sheds light on the most recent methods and unresolved issues in the domain of artificial intelligence-based online proctoring.

[5] Anastasiia A. Breskina draws attention to the shortcomings of the automated online proctoring systems currently in use for evaluating student behavior and emotional states in her literature review. It suggests new functional specifications for contemporary online proctoring systems, focusing on data protection protocols, hygiene practice monitoring, and physical activity assessment. In an attempt to offer a comprehensive resolution, the survey addresses the development of a prototype system that conforms with these standards to the problems associated with online proctoring.

[6] Chirag S. Indi, KCS Varun Pritham, Vasundhara Acharya, and Krishna Prakasha address the difficulties associated with online education by proposing a novel method for identifying malpractice in e-exams. Through head pose and eye gaze estimates, their technology makes use of machine learning methods to capture and analyze the student's visual focus of attention (VFOA). The attention metric is classified with a high accuracy of 96.04% by the system, which presents a viable way to improve the reliability of online tests.

[7] The authors of the study, J. Manikandan, S. Lakshmi Prathyusha, P. Sai Kumar, Y. Jaya Chandra, and M. Umaditya Hanuman, concentrate on using OpenCV and computer vision to develop a facial recognition system based on the Fisher Faces algorithm. In order to improve identity recognition and surveillance applications by developing a comprehensive facial recognition system, this research investigates the difficulties associated with face detection in complex scenarios.

[8] The authors of the study, Saad Hameed Abid and Muhanad Abdul Elah Alkhalisy, discuss the growing need to uphold exam integrity in online education, especially in light of the popularity of distance learning and massive open online courses (MOOCs). It makes use of Dlib facial landmarks and YOLO models. As a promising solution to guarantee the fairness of online assessments, the system's deep learning models, trained on their dataset "StudentBehavioralIDS," exhibit strong detection accuracy.

[9] Dr. A. Gnanabaskaran, S. Sunil Kumar, and A. Shri Nishanth's project addresses the critical need for online student identity verification and proctoring of online education through

the employment of biometrics. The project prioritizes automation, scalability, affordability, and user-friendliness. It provides students with a dependable and passive method while successfully addressing the issues related to online learning and test integrity.

[10] The authors of the research by Mohammed Juned Hussein, Javed Yusuf, Naidu discuss the difficulties in maintaining academic integrity when administering remote, closed-book exams in the COVID-19-accelerated online learning environment. They use a four-phase approach to evaluate a variety of online proctoring tools, including expert and student pilot testing and desk research.

[11] In their project, Mr. Vidhya SG and a group of Indian BGSIT students discuss the difficulties associated with proctoring online tests, particularly in light of the COVID-19 pandemic. They suggest an AI-powered integrated system that uses methods and instruments to identify unfair practices in order to stop exam cheating.

[12] Abdul Cader Mohamed Nafrees, Bharathi B, Durgaprasad Sasubilli, and Siva Saikumar Reddy Komma address fraudulent activities in online examinations within the framework of e-learning in their systematic review. With specific reference to the CK+ dataset, they validate the viability of using facial recognition and Convolutional Neural Networks (CNN) as a successful method to identify students during online exams.

[13] Dr. K. Gopalakrishnan, N. Dhiyaneshwaran, and P. Yugesh present a system in their paper that attempts to solve the difficulties associated with proctoring online exams in relation to distance learning and massively open online courses. They put forth a plan that makes use of different biometric technologies for proctoring and authentication, with an emphasis on improving the accuracy of the system's operation.

[14] Tejaswi Potluri, Venkatramaphanikumar S, and Venkata Krishna Kishore K address the drawbacks of conventional proctoring techniques and improve online evaluation in their study by introducing the "Attentive system," an automated AI-based proctoring system. The comprehensive experimental findings show that the suggested approach, which combines head pose estimation, attentive net, and liveness net, achieves a noticeably higher accuracy of 0.87, making it a dependable and strong automated proctoring system for realistic real-time deployment.

[15] Adiy Tweissi, Wael Al Etaiwi, and Dalia Al Eisawi evaluated the accuracy of AI-based Auto Proctoring (AiAP) in online exams through a technical analysis. The study examined how well AiAP performed in monitoring different aspects of online exam conditions in comparison to human proctors. Their results showed that AiAP's decision accuracy differed significantly from human proctoring, indicating the need for AiAP technology updates and enhancements.

[16] EEG signals are used by Hussein M. Mohammed and Qutaiba I. Ali of the University of Mosul, Iraq, to identify

possible cheating in semi-automated, online based e-proctoring exams. They monitored the examinee's physiological state using IoT and Muse2 devices, differentiating between "Normal" and "Abnormal" states to spot possible cheating. Muse2 devices are a dependable tool for recording EEG data, as their research demonstrated high accuracy rates and demonstrated that EEG signals contain valuable information for detecting examinee states.

[17] The goal of the AI-based automated exam proctoring system (AEPS) created by Vishesh Khanna, Sahil Brodiya, and Deepesh Chaudhary of the Maharaja Agrasen Institute of Technology in New Delhi, India, is to preserve the credibility of online tests. The system uses automated proctoring to keep an eye on candidates during exams and stop them from misusing their authority. It also uses face recognition to verify candidates and stores their images in a database.

[18] Using the Eigenface approach, Arief Agus Sukmandhani and Indrajani Sutedja of Bina Nusantara University in Jakarta, Indonesia, have created a prototype for a face-based online exam application. The study focuses on identifying student attendance in an online exam environment using facial recognition technology.

[19] In their discussion of the significance and developments in face detection, Dr. Piyush Pratap Singh and Kapil Vilasrao Gawande emphasized the use of various algorithms to increase the technology's potency and versatility.

[20] Utilizing Artificial intelligence by Divya Agrawal, Shachi Chaware, Prof. K. P. Sable, Suved Bhagwat, Radhika Maloo, and Tanishq Nanda to produce an online exam proctoring system. To maintain exam integrity and reduce the requirement of human proctors, their system tracks different types of student behaviors during online exams, such as lip and eye movements, audio, phone detection, and person counting. The ultimate goal of this approach is to automate the proctoring process.

[21] ProctorEx is an automated online exam proctoring system created by Vinothini Kasinathan, Choi Ee Yan, Aida Mustapha, Vazeerudeen Abdul Hameed, Tham Hoong Ching, and Vinesh Thiruchelvam. During online exams, this system keeps an eye on students' browser activity and camera usage. It uses sophisticated face detection algorithms to spot any unusual movements or activity.

[22] I Wayan Suardinata and Vivien Arief Wardhany address the problem of exam cheating in this paper by suggesting a unique method that uses two cameras—one on a laptop for the examinee's front view and one on a cellphone for their side view. They use Faster-RCNN to detect objects from the side camera with an average bbox-AP of 59.169. With an accuracy of 88.46% and a recall of 82.14%, the fraud detection process offers a viable way to improve the integrity of online proctoring in light of the COVID-19 pandemic.

[23] Youssef Atoum, Liping Chen, Alex X. Liu, Stephen D. H. Hsu, and Xiaoming Liu discuss the difficulties in effectively supervising remote online exams in this paper. This is a crucial step towards the scalability of online learning. They suggest a multimedia analytics system that uses hardware, such as webcams and microphones, to monitor the testing environment in order to automatically proctor online exams. A promising solution for remote education proctoring, the system integrates multiple components to continuously estimate key behavior cues and detect cheating during online exams. It has proven accurate, robust, and efficient in experimental evaluations.

[24] In this paper, Basavaraj N Hiremath, Anushree Mitra, Aman Thapa, Amoolya S, and Tameen A discuss the difficulties the COVID-19 pandemic has caused in the area of education and suggest an artificial intelligence-based smart exam monitoring system. With the potential to improve online education evaluation, they seek to address the shortcomings of current online exam proctoring solutions and offer a more potent way to stop test-related misconduct.

[25] The authors of this paper, Chakali Nethravathi, Mangali Thulasi, Nutiki Anjinamma, P Sana Kouser, and G S Udaya Kiran Babu, address the difficulties associated with online assessments in the post-COVID-19 educational environment by introducing a Smart Artificial Intelligence-based Online Proctoring System. Their system creates an intelligent rule-based inference system by combining video capture, facial emotion analysis, head pose detection, and the identification of unauthorized materials or persons during exams. Without a proctor present in person, this method presents a viable means of preserving the integrity of online exams.

[26] A new online exam management system that employs face recognition for student authentication and predefined parameters to identify any fraudulent activity during the exam is presented in the paper "A New Model of Automatic and Continuous Online Exam Monitoring" by Moukhliiss Ghizlane, Filali Hilali Reda, and Belhadaoui Hicham. The automated and ongoing monitoring offered by the suggested system guarantees the security of the assessment procedure.

[27] Shashikala H. K., Abhinav Singh Upreti, Shreya Nupur Shakya, Shaik Dadapeer, and Pooja Panjiyar's paper "Attendance Monitoring System Using Face Recognition" suggests an automated attendance monitoring system for academic institutions that makes use of face recognition technology. The system allows students to access their timetable, college information, and attendance status while replacing manual procedures and giving professors real-time monitoring. In comparison to other solutions, the system's accuracy and efficiency are improved by implementing deep learning concepts.

[28] Keerthanam Amkamaran, Intan Farahana Kamsin, Zety Marlia Zainal Abidin, and Hemalata Vasudavan's paper "Secured E- Examination System with Continuous Authentication to Prevent Cheating" offers a strategy that incorporates artificial intelligence and continuous authentication

to stop cheating during e-examinations. To produce findings that are supported by science, the authors polled 200 lecturers and proctors as part of their sample. They come to the conclusion that, particularly in light of the COVID-19 pandemic, e-examinations are a good substitute for in-person exams.

[29] The authors of this paper, Ahmed T. Resha, Mohammed A. Azize A. Razek, and Eslam E. El maghraby, discuss the difficulties in preserving the credibility of online tests in light of the COVID-19 pandemic. They recommend a system that automatically keeps an eye on students taking online tests by applying machine learning algorithms for speech and face recognition. With maximum accuracy of 98.3% in order to recognize faces and 97.6% for unexpected behavior detection, the system provides an economical and effective way to improve authentication and stop misconduct in online remote exams.

[30] The facial recognition system that is utilized for automated attendance tracking in educational institutions is presented in the paper "Real-Time Facial Recognition Based Student Proctoring System Using KNN Algorithm" by Varalakshmi K, Dharma Prakash V, Noble Lourdhu, and Deepika H. To indicate whether students are present, algorithms for face detection and recognition are used by the system. For machine learning-based classification, the KNN algorithm is used. When one of the faces in the trained model matches the face of a student, the system saves a model that contains the faces of every student in the class and records attendance.

III. EXISTING SYSTEM

Current online proctored exam systems use biometrics or facial recognition to verify an applicant's identity. Test-takers can be observed in real-time to spot signs of cheating thanks to webcam live video monitoring. Browser restrictions stop cheating apps, and screen sharing guarantees they aren't using unapproved materials. An environment check uses webcams to look around and make sure there are no illegal objects or people present. By authenticating identities, keeping an eye on behavior, and prohibiting the use of unauthorized resources, these steps taken together improve the security and integrity of remote exams.

IV. CONCLUSION

AI proctored systems are in high demand because online proctoring is so popular these days. It is feasible to develop a highly accurate AI proctoring system. It's critical to record fraudulent activity in order to resolve disputes. It is imperative to create a mobile-friendly proctoring system because the majority of students do not own computers. We hope to demonstrate with this project that online proctoring is the way of the future and that it can significantly lower exam cheating.

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