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REAL-TIME CLASSROOM CHEATING DETECTION SYSTEM USING OPENCV

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ABSTRACT :

This paper presents a real-time classroom cheating detection system developed using OpenCV, without relying on artificial intelligence (AI) or machine learning (ML). The system monitors students during exams by detecting facial orientation, eye movement, and hand gestures to identify suspicious behaviour such as looking around or attempting to use unauthorized items. It runs offline, ensuring data privacy, and generates audio-visual alerts while logging incidents with timestamps for post-exam review. Preliminary tests showed reliable performance in well-lit, controlled environments using standard hardware. While minor false positives and lighting-related issues were noted, the system proves to be a cost-effective, privacy-conscious alternative to AI-based proctoring.

Keywords: OpenCV, Cheating Detection, Real-Time Monitoring, Privacy, Computer Vision

INTRODUCTION

Academic integrity is a cornerstone of educational institutions, ensuring that assessments reflect genuine student understanding. However, the increasing number of students and the limitations of manual invigilation have led to a rise in examination malpractice. Traditional methods often fail to monitor every student effectively, especially in larger classrooms or during remote exams. Although AI-based solutions provide enhanced detection, they also come with drawbacks such as high implementation costs, complex infrastructure, and privacy concerns. Therefore, there is a pressing need for a more accessible, cost-effective, and privacy-respecting approach to exam surveillance. This research focuses on leveraging OpenCV, an open-source computer vision library, to develop a real-time cheating detection system that does not rely on internet connectivity or machine learning models. The goal is to ensure academic honesty through a system that is both efficient and respectful of student privacy.

METHODOLOGY

The cheating detection system was implemented using Python in conjunction with OpenCV due to its simplicity and powerful image processing capabilities. The architecture consists of four core modules that work in tandem to detect and report suspicious activities during examinations.

1. Input Module: Utilizes a webcam to stream real-time video of the examination room. This module continuously feeds frames into the processing pipeline.
2. Processing Module: Applies Haar Cascade Classifiers to detect faces. It tracks facial orientation and eye movement by analyzing relative positions. Hand gestures are identified through motion detection, flagging gestures that may correspond to unauthorized material handling.
3. Action Module: Converts flagged events into audio-visual alerts using the pyttsx3 text-to-speech engine. Additionally, SQLite is used to log each incident with timestamps and details of the detected anomaly.
4. Output Module: Compiles and displays the incident logs in a user-friendly dashboard, enabling faculty to review alerts post-exam.

This modular approach allows scalability and customization based on classroom size and institutional requirements.

Input Module: Captures real-time video feeds through a webcam to act as the primary data input.

Processing Module: Uses Haar Cascade Classifiers to detect faces and monitor their movement.

Action Module: Generates real-time audio-visual alerts using pyttsx3 and logs incidents with timestamps in a SQLite database.

Output Module: Provides a dashboard interface to review logged incidents post-examination.

Hardware Requirements: Webcam, 4GB RAM, Intel Core i3 or above

RESULTS AND DISCUSSION

Upon deployment in a controlled classroom setting, the system demonstrated promising results in identifying abnormal behavior. The face tracking algorithm successfully identified rapid or repeated head turns, which can indicate attempts to view another student's paper. Eye movement tracking helped in detecting downward glances not associated with reading or writing. Hand gesture detection was particularly useful in highlighting activities such as

reaching into pockets or handling objects not allowed during exams.

Testing across different lighting conditions revealed that adequate brightness is critical for optimal performance. Low-light scenarios resulted in reduced accuracy, suggesting the need for integrated lighting enhancement techniques. False positives were observed in cases where students adjusted their glasses or posture. These challenges highlight the need for further tuning of the detection parameters.

The system's offline nature ensures data remains local, reducing risks related to data breaches or unauthorized access. This also makes it suitable for institutions with limited technological infrastructure.

CONCLUSION

The proposed OpenCV-based cheating detection system serves as an effective alternative to both manual and AI-driven proctoring methods. It successfully addresses critical concerns of cost, privacy, and ease of implementation. By avoiding reliance on internet access and cloud-based AI models, the system ensures exam monitoring can be carried out in secure, offline environments.

While the results are encouraging, the current system can benefit from further improvements. Incorporating lightweight AI models can help distinguish between intentional and unintentional movements. The addition of object detection and facial recognition would also enhance monitoring accuracy. Multi-camera support can extend the system’s coverage, enabling its use in larger classrooms. Ultimately, this solution paves the way for broader adoption of non-intrusive, real-time monitoring tools in academic settings.

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