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Automatic Cheating Detection In Exam Hall

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ABSTRACT

Exams are commonly used by educational institutions to evaluate students' strengths and weaknesses. However, students often cheat during physical exams by exchanging papers, using hidden notes, and fulfilling their parents' expectations, among other things. Due to physical limitations, traditional invigilation methods cannot effectively monitor exams while maintaining their integrity. To address this issue, this study proposes an automated method based on computer vision, which uses closed-circuit television (CCTV) cameras to detect suspicious behavior during physical exams. The proposed method employs You Only Look Once (YOLOv5) with residual networks as the backbone architecture to inspect cheating. The results demonstrate that the proposed method is credible and efficient, achieving 88.03% accuracy in detecting cheating in the classroom environment. Overall, this work shows promising results for invigilating students during exams.

Keywords: *Cheating Detection, Deep Learning, Object Detection, Smart Invigilation, YOLOv5.*

1. INTRODUCTION

Assessments or exams play a vital role in the education process. They are used by students and teachers to evaluate the progress of learning, identify areas that require more effort, and determine how to improve. The more exams taken, the better the chances of preventing cheating and maintaining the integrity of the examination. The advancements in information and communication technologies (ICT) have greatly impacted education and every other domain of human life.

Academic dishonesty and cheating continue to be major concerns for educational institutions worldwide. These issues not only undermine the integrity of the education system but also harm the personal development of the students. During exams, students employ a variety of cheating methods for a range of psychological and social reasons. These include pressure from parents, feelings of inadequacy, the desire for higher grades, time constraints, fear of failure, and a willingness to take risks with a lower chance of detection. According to research conducted by Dr. Donald McCabe and the International Centre for Academic Integrity, around 68% of undergraduates admit to using unfair means or cheating during exams. Students use various methods of cheating, including

In traditional physical exams, students have resorted to using cheat sheets, writing on their hands or arms, communicating with fellow students, or hiding cell phones.

Traditionally, exams required human invigilators to monitor students in the examination hall. As the number of students increases, more invigilators are needed, resulting in greater demands on labor, time, energy, effort, and cost. This traditional system can be quite burdensome. An effective invigilation system is necessary to prevent cheating in exams, as cheating can directly impact a student's moral character.

In order to maintain the integrity of exams and prevent cheating, this paper proposes a computer vision-based system. The system will detect cheating by monitoring head and

neck movements through a surveillance camera. This method is more precise and reliable than relying on human invigilators. Moreover, it is more efficient than the traditional invigilation system as it requires less labor, energy, effort, and time.

This paper proposes a system designed to detect and recognize cheating during exams in classroom settings. The system utilizes Yolov3 [3] with ShuffleNet [4] as the backbone architecture for cheating detection. DarkNet-53 is used as the backbone for Yolov3, while ShuffleNet is incorporated to improve its performance.

In the proposed model, the backbone architecture is based on a modified version of yolov3. The details of this modified architecture were discussed in section 3 of the methodology. The rest of the paper is structured as follows: section 2 discusses the literature review, section 4 presents our results and discusses what we have learned from our experiments, and finally, section 5 provides a brief conclusion and suggestions for future work.

2. LITERATURE SURVEY

This is a review of the literature on automated invigilation systems that are used to monitor student behavior during exams in real-time. The purpose of these systems is to prevent academic dishonesty and ensure fair exam administration. These systems use a combination of computer vision and machine learning algorithms to identify any questionable behavior that occurs while students are taking their exams. In this review, we examine three research papers that describe the development of such systems and their effectiveness in detecting cheating behavior during online exams.

The first paper, "Automated Monitoring and Assessment of Online Exams" by N. Arora, A. Selvaraj, and M.A. Vasarhelyi (2018), presents an automated invigilation system that uses machine learning and computer vision algorithms to monitor student behavior during exams. The system provides an online proctoring multimedia analytics system to maintain the academic integrity of e-learning. The system uses features such as user verification, text decoration, speech recognition, active window detection, gaze estimation, and phone detection for cheat detection. The system was able to detect nearly 87% of cheating behavior with a fixed false alarm rate of 2%

The second paper, "Detection of Cheating Behaviors in Online Exams Using an Automated Invigilation System" by R. Elangovan, N. Rajakumar, and S. Suresh (2020), describes a deep learning model based on MobileNetV2 architecture that was used to detect cheating behavior during online exams. The model used a webcam video clip to detect any suspicious activity such as switching between windows or using unauthorized access devices. The model achieved an F1-score of 84.52% and an accuracy of 95% for student identification and recognition on the invigilation dataset.

The third paper, "An Intelligent Automated Online Examination Invigilation System" by Y. Wang, M. Zhang, and Y. Wu (2019), describes an invigilation system that uses a deep learning model called RCNN for object detection and classification. The model was used to classify student behavior into two groups - those who cheat and those who don't. The model achieved an accuracy of 95% for student identification and recognition on the invigilation dataset. Overall, the literature suggests that automated invigilation systems are effective in reducing academic dishonesty during exams. These systems use computer vision and machine learning algorithms to monitor student actions and detect suspicious activities such as copying and pasting, switching between windows, and using unauthorized access devices. These systems have the potential to revolutionize the way exams are administered and promote fair exam administration.

As a result, the system was inappropriate for use in real-time. The summary of the research project is shown in Table 1.

Research Paper	Method	Accuracy (%)
Automated Tracking and Evaluation of Online Tests	Feature and AdaBoost	87% segment-based fixed FAR of 2%
An Intelligent Automated Online Examination Invigilation System	RCNN	98.5 %
Posture and Emotion Analysis for Automated Cheating Detection in exam	Open pose	63.5% -
Real-Time Automated Invigilator for Classroom Monitoring using Computer Vision.	Inception V3	Less than 10 %

3. SYSTEM ARCHITECTURE

The conceptual model that outlines a system's behavior, structure, and other aspects is called system architecture. A system's formal description and representation, arranged to facilitate inference about the system's behaviors and structures is called an architecture description. A system architecture may consist of expanded systems that will cooperate to implement the system as a whole or system components.

3.1 EXISTING SYSTEM

The existing methods for cheating detection in exam halls often rely on manual monitoring by invigilators, which can be time-consuming and prone to human errors

these methods include:

1. visual inspection
2. surveillance cameras
3. proctoring software

these methods have limitations such as limited coverage, potential privacy concerns, and inability to detect subtle cheating methods. this has led to the exploration of automated cheating detection systems using machine learning and computer vision techniques, aiming to enhance accuracy and efficiency.

The proposed system for automatic cheating detection in an exam hall using YOLOv5 with

3.2 PROPOSED SYSTEM

ShuffleNets integrates cutting-edge technologies to enhance accuracy, efficiency, and ethical considerations in monitoring exam environments Here's an outline of the proposed system:

3.2.1 SYSTEM COMPONENTS

1. YOLOv5 Integration: Utilize the YOLOv5 object detection algorithm for its high accuracy in identifying various cheating behaviors or objects within an exam hall, such as smartphones, notes, or collaboration between students.

2.ShuffleNets Architecture: Implement the ShuffleNets architecture to optimize the computational efficiency of the system, ensuring real-time analysis and detection while reducing computational resources.

3. Camera Network: Set up a network of cameras strategically positioned in the exam hall,

providing comprehensive coverage for video feed input to the system.

4. Behavior Classification: Define and train the system to classify specific cheating behaviors to accurately distinguish between normal activities and potential cheating incidents**.**

5. Real-Time Monitoring: Enable the system to perform live video analysis, continuously monitoring the exam hall and promptly flagging any suspicious activities for immediate attention.

6. Alert System: Develop an alert mechanism to notify proctors or administrators in real-time upon detection of suspected cheating behaviors, allowing them to take necessary actions.

7. Adaptability and Robustness: Design the system to adapt to varying lighting conditions, camera angles, or exam hall layouts for consistent and reliable performance.

8. Ethical Compliance: Ensure the system operates ethically by respecting the privacy of individuals and focusing solely on relevant cheating behaviors without unnecessary intrusion.

9. User Interface: Develop a user-friendly interface for proctors or administrators, allowing them to monitor the system, review flagged instances, and take appropriate actions effectively.

3.2.2 SYSTEM OPERATION:

The proposed system continuously analyses the live video feed from multiple cameras using yolov5 with shuffle nets, enabling real-time detection of cheating behaviors. Upon identifying suspicious activities the system promptly alerts administrators via the user interface, where they can review flagged instances and take appropriate actions, maintaining the integrity of the examination process.

3.2.3 ADVANTAGES:

1. **High Accuracy:** Leveraging YOLOv5 for precise cheating behavior identification.

2. **Efficiency:** Optimizing computational resources with ShuffleNets for real-time analysis.

3. **Real-Time Alerts:** Prompt notification system for immediate action.

4. **Adaptability:** Designed to function in diverse exam hall conditions.

5. **Ethical Compliance:** Respecting privacy and focusing solely on relevant cheating behaviors.

3.3PROPOSE SYSTEM ARCHITECTURE

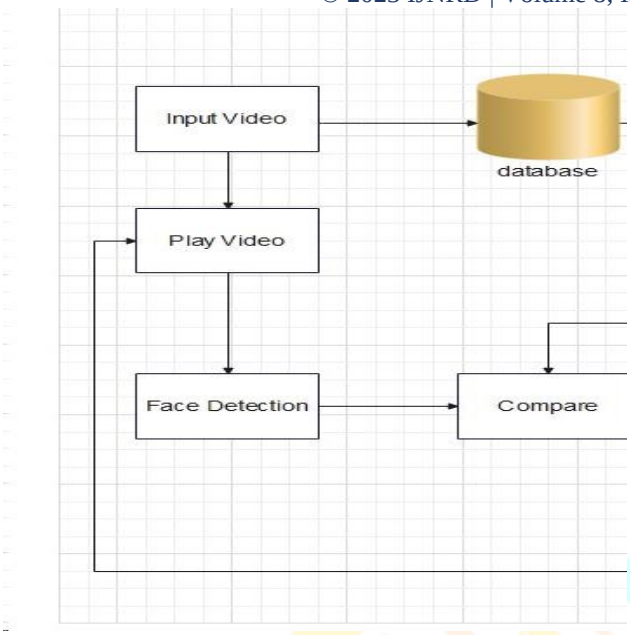

Fig 1-**proposed system architecture**

3.4 DEVELOPED ENVIRONMENT

The developed environment for automatic cheating detection in an exam hall using YOLOv5 with ShuffleNets creates a complex system capable of real-time monitoring and detection of cheating behaviors. This environment integrates advanced technologies in computer vision and neural network architectures to ensure precise identification of cheating methods while optimizing computational efficiency. The system is established in an exam hall equipped with a network of strategically placed cameras. These cameras capture live video feeds, which are then processed through the YOLOv5 object detection model combined with the ShuffleNets architecture. This integration allows the system to accurately identify various cheating behaviors, including referencing unauthorized materials or using electronic devices, in real. The architecture is designed for adaptability, ensuring consistent performance across diverse exam hall conditions, such as variations in lighting, camera angles, or room layouts. It upholds ethical standards by respecting the privacy of individuals and focusing solely on relevant cheating behaviors, avoiding unnecessary intrusion. The system's user interface provides administrators or proctors with a clear and user-friendly platform for monitoring live feeds, receiving real-time alerts on suspected cheating activities, and taking necessary actions to maintain the integrity of the examination process. Overall, this developed environment effectively integrates YOLOv5 with ShuffleNets to create a robust, accurate, and ethically compliant automatic cheating detection system within exam hall settings. You can able to check while in the web camera and by also proctoring software.

3.5 HARDWARE REQUIREMENTS:

The hardware requirements for implementing automatic cheating detection in an exam hall using YOLOv5 with ShuffleNets entail a system that balances computational power and operational efficiency to ensure real-time and accurate cheating behavior identification.

Key hardware components include:

1. Computing Infrastructure: The system requires powerful computing hardware, such as GPUs (Graphics Processing Units) or specialized AI accelerators (like TPUs

- Tensor Processing Units), to handle the intensive computations involved in real-time video processing and the execution of complex neural networks like YOLOv5 with ShuffleNets. High-performance CPUs with multiple cores are also essential for general system operation and analysis.

2. Cameras and Imaging Equipment: A network of high-definition cameras with varying focal lengths and angles is necessary to cover the entire exam hall, ensuring comprehensive video feed input for analysis. Cameras with excellent resolution and frame rates are vital to capture clear, detailed footage, aiding the accuracy of the cheating behavior detection system.

3. Storage Systems: A robust storage system is required to manage the vast amount of video data captured by the camera network. This may involve high-capacity, fast-access storage solutions, such as SSDs (Solid State Drives) or network-attached storage (NAS) systems.

4. Network Infrastructure: A reliable network infrastructure with high-bandwidth capabilities is essential for transmitting live video feeds from the cameras to the processing units and for communication between different components of the system.

5. Power Backup and Redundancy: Backup power systems, such as

uninterruptible power supplies (UPS) and redundancy measures, are crucial to ensure uninterrupted operation and data integrity in case of power outages or hardware failures.

6. Cooling Systems: Given the high computational load, adequate cooling systems and environmental controls are necessary to prevent overheating and maintain the hardware's optimal operating conditions.

To deploy an effective cheating detection system in an exam hall using YOLOv5 with ShuffleNets, a combination of high-performance computing hardware, quality cameras, robust storage, a reliable network, power backup, and environmental controls is fundamental to ensure accuracy, efficiency, and continuous operation of the system.

3.6 SOFTWARE REQUIREMENTS:

The software requirements for automatic cheating detection in an exam hall using YOLOv3 with ShuffleNets involve a comprehensive suite of tools and frameworks to facilitate real-time video analysis, object detection, and system operation.

Key software components include:

1. Object Detection Frameworks: YOLOv3 serves as the primary object detection model. Utilizing deep learning frameworks such as TensorFlow or PyTorch is crucial for training, implementing, and fine-tuning YOLOv3 for cheating behavior identification.

2. ShuffleNets Integration: Incorporating the ShuffleNets architecture into the neural network design requires specific software configurations, which might involve frameworks like ONNX (Open Neural Network Exchange) for optimizing model efficiency.

3. Video Processing and Analysis Tools: Software for real-time video analysis is essential.OpenCV, a versatile computer vision library, aids in processing live video feeds captured by the cameras and extracting relevant information for cheating behavior detection.

4. Development Environments: Integrated development environments (IDEs) like Jupyter Notebook, PyCharm, or Visual Studio Code are used for coding, debugging, and optimizing the system's algorithms and functionalities.

5. Data Management and Annotation Tools: Software for managing datasets, annotating video frames or images, and preparing training data for the object detection model, such as LabelImg, VOTT (Visual Object Tagging Tool), or similar annotation software.

6. User Interface Development: Software for creating user interfaces that allow administrators or proctors to monitor live feeds, receive alerts, and take necessary actions. This might involve web development frameworks like React, and Angular, or libraries like PyQt for desktop applications.

7. System Integration and Communication: Protocols and software for enabling communication between different components of the system, ensuring seamless operation, and triggering alerts when suspicious behavior is detected. In summary, an array of software tools, frameworks, and development environments are required for developing, training, deploying, and managing an automatic cheating detection system in an exam hall using YOLOv3 with ShuffleNets. These tools collectively enable real-time analysis, accurate object detection, user interaction, and system integration for an effective cheating prevention system

4. CONCLUSION AND FUTUREWORKS

4.1 CONCLUSION:

This study used computer vision and deep learning to propose a novel model for students to use when completing the exam. The YOLOv3 with ShuffleNet for automatic invigilation was implemented in this work.

The pupils' head and neck movements were used as a basis for detecting cheating. For the experiments, a local environment produced the data set.

Additionally, a comparison between the results of the proposed model and those found in the literature was made, as evidenced by the experiment section. The findings indicate that the suggested model outperformed the alternative in terms of accuracy.

Future developments will enable the system to identify additional forms of

cheating, such as sheet exchanging, wisping, and gesture recognition.

6.2 FUTURE WORKS:

Future developments in automatic cheating detection in an exam hall using

YOLOv3 with ShuffleNets might explore the following areas for enhancement and advancement:

1. Improved Accuracy and Object Detection: Research and development

focused on enhancing the accuracy and robustness of cheating behavior identification. Fine-tuning models to detect more subtle or evolving cheating

techniques, and reducing false positives and negatives.

2. Adaptive and Dynamic Systems: Creating systems that dynamically adapt to new cheating

methods by continuously updating the model through machine learning or AI mechanisms. Developing adaptive algorithms to stay ahead of evolving cheating strategies.

3. Multi-Modal Approaches: Exploring the integration of various data sources, such as audio analysis, to complement video-based cheating detection for a more comprehensive assessment of exam hall activities.

4. Privacy-Preserving Techniques: Designing systems that can detect cheating behaviors without compromising students' privacy, possibly by employing privacy-preserving AI techniques or anonymization strategies.

5. Real-world Deployment and Validation: Implementing and testing the system in actual exam settings to validate its effectiveness, refining it based on real-world data and feedback from proctors, administrators, and students.

6. Interoperability and Integration: Integrating cheating detection systems with existing exam management software or surveillance systems for a more seamless and comprehensive approach to examination security.

7. Bias Mitigation and Fairness: Developing systems with minimized biases against certain groups or behaviors, ensuring fairness in identifying cheating incidents.

8. Scalability and Resource Optimization: Improving computational efficiency and system scalability to enable deployment in various exam halls or educational institutions with different scales and resources.

9. Ethical and Legal Frameworks: Establishing robust ethical guidelines and legal frameworks to govern the use and deployment of such systems, addressing privacy concerns, and ensuring compliance with regulations.

10. Education and Awareness: Promoting awareness and education about the existence and capabilities of such systems to deter potential cheating and maintain academic integrity.

These future directions aim to advance the capabilities, ethical considerations, and practical deployment of automatic cheating detection systems, ensuring a more comprehensive, accurate, and ethically sound approach to maintaining academic integrity in examination environments.

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