

# Uniform AI Detection System

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**Abstract:** *Maintaining school uniforms is very important for discipline, safety and an efficient academic environment. This work proposes an AI driven system that enables automatic determination of student dress adherence to institution specific dress codes. A convolutional neural network (CNN) trained on a variety of compliant and non-compliant clothes images is employed in the proposed solution. The trained model is embedded in a web-based framework rich with functionality that supports real-time monitoring and digital records. Experimental results show that the CNN yields above 90 test accuracy, performing similar to the current state-of-the-art methods. The final solution provides an end-to-end working prototype with accurate image classification capabilities and a web-based dashboard. The experimental results demonstrate that our deep learning method can automate the checker verification process for uniform compliance evaluation, which would effectively reduce a lot of manual works and human errors. The paper ends by discussing their current limitations and possible future improvements.*

**Keywords:** *school uniforms*

## I. INTRODUCTION

So, school uniform and dress code are most essential in a discipline, unity and institutional identity of students.. Particular clothing is worn in the interest of embodying a certain set of values espoused by the school, and can also aid in keeping outside MacDonalD's-loving folks from entering campus buildings. As great as these advantages are, enforcement of dress codes by hand takes time and energy, and may not be implemented consistently. As noted in earlier work, manual dress code checks are time-consuming and prone to errors. Supervision by humans may bring subjectivity and non-uniform enforcement.

Newer techniques with computer vision and deep learning have become mainstream in the past few years to address these challenges. Several state of the art object detection and image classification models are capable of recognizing clothing patterns and attributes with high accuracy Leveraging these technological developments, this paper proposes a unified deep learning-based compliance detection system. The paper summarizes relevant research, highlights gaps that exist in the literature, presents our proposed methodology, experimental findings and finally we will conclude with insights and future recommendations.

## II. LITERATURE REVIEW

Sangavi et al., 2024, Dress Code Detection with YOLOv4 -- introduces a method of detecting paragraphs of clothing types by continuously passing the video streams through YOLOv4. This system cross compares if any item detected from the customer is matching with the dress code database and when it gets failed to comply, alerts are raised like in case of missing accessories or inappropriate dressed up.. The authors do focus on real-time performance and add facial anonymization for privacy reasons.

Ajmi et al. (2024) Aligned YOLOv8 for the United States of America—a security-driven YOLOv8 variant that classifies authorized individuals based on attire uniforms rather than specific features. The system flags uniform related anomalies by training a YOLOv8 model on approved attire. Incorporating soft computing approaches enables better performance under different illumination settings.



Industrial Dress Monitoring (Zou et al., 2024) on YOLOv8n Improved for Safety in factories. In particular, Hoang and Nguyen (2024) present a student uniform verification method through CNN that builds upon YOLOv8n with more sophisticated feature-fusion techniques and attention mechanisms for the detection of objects through the application. The study builds a CNN that can accurately classify uniforms as compliant and non-compliant, achieving about 91% accuracy on a dataset of labelled images.

Uniform Compliance in Culinary Training (CastilloOrtiz et al., 2024) concerns about the chef uniforms in gastronomy schools monitoring using computer vision, representing a concerted approach with a positive deployability of AI-based compliance monitoring.

Machine Learning also detailed and laid out the proposed design for a real-time monitoring system that captures school uniforms using CNNs on video streams with GPU acceleration (IJISRT, 2025); web-based dashboards are deployed as well.

By extending the use of cameras and incorporating UNOBCOM-based detection along with facial recognition technology, Automated Real-Time Dress Code Violation Detector (Yammala et al., 2025) proposes an automation methodology for real-time supervision.

The consensus across these studies demonstrates that deep learning models, such as CNN and YOLO, are extremely efficient when it comes to detecting uniform compliance.

### **III. RESEARCH GAP**

Despite previous studies also showing high technical feasibility, there are still some limitations that should be addressed. Most systems only look at partial compliance detection rather than full dress requirements.

At the same time these existing detectors are still prone to false positives and missed detections for example under difficult visual conditions, e.g., poor illumination or occlusion.

In addition, very few studies provide fully integrated solutions to detection, database storage and dashboards. Often under-explored are: privacy protection; data security; and feedback mechanisms to enhance the behaviour of a system.

This work intends to fill in these gaps by developing a high-accuracy CNN model and an accessible, secure web platform that can perform extensive uniform-compliance monitoring.

### **IV. METHODOLOGY**

The suggested approach comprises two key parts: a deep learning classification model and a web-based application.

We created a dataset of student images including proper and improper uniforms taken in varying lighting conditions and backgrounds. We performed data augmentation with random rotation, horizontal flip and color adjustments.

The CNN comprises several convolutional layers, interleaved with ReLU activation functions and max-pooling operations before the fully connected layers, which is then followed by a softmax output appropriately suited to classifying binary events.

The data set was split into two sets for training and validation in an 80/20 ratio. The model was trained with categorical cross-entropy loss function and using Adam optimizer.

The trained model was integrated into a web app developed using Node.js and Express.js. Frontend which is constructed with HTML, CSS and EJS templates where the users are uploading images.

A Python microservice with the CNN model to communicate with the backend. All prediction results with metadata are stored in a MongoDB database.

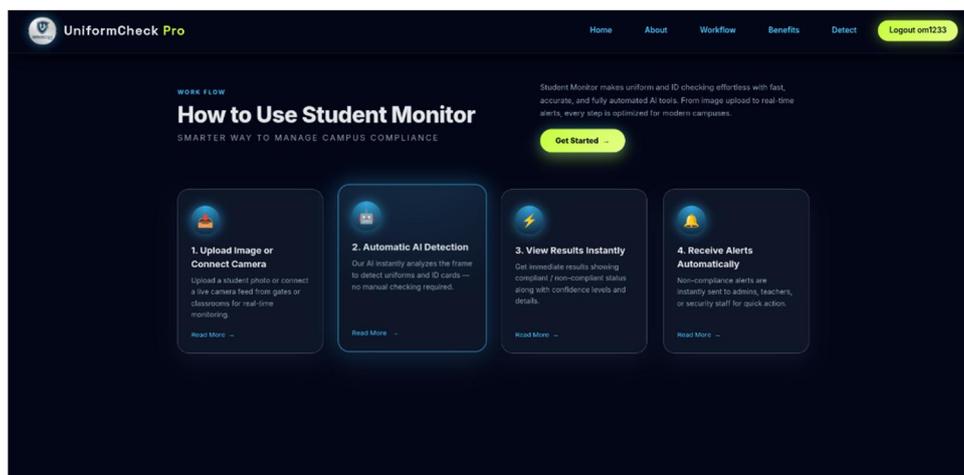
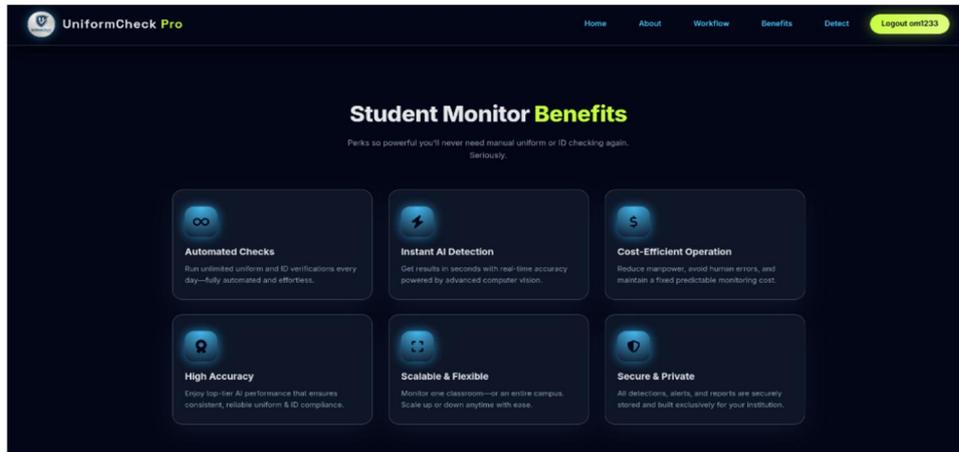
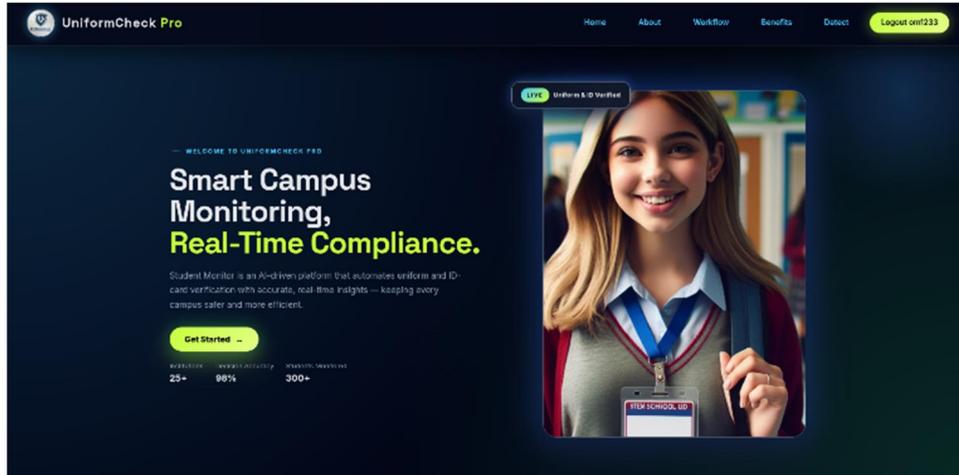
### **V. RESULTS AND DISCUSSION:**

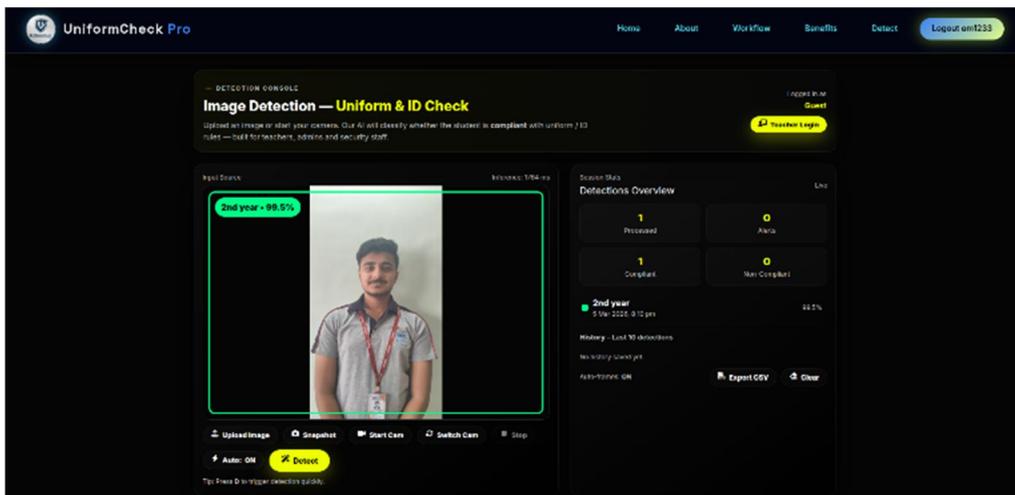
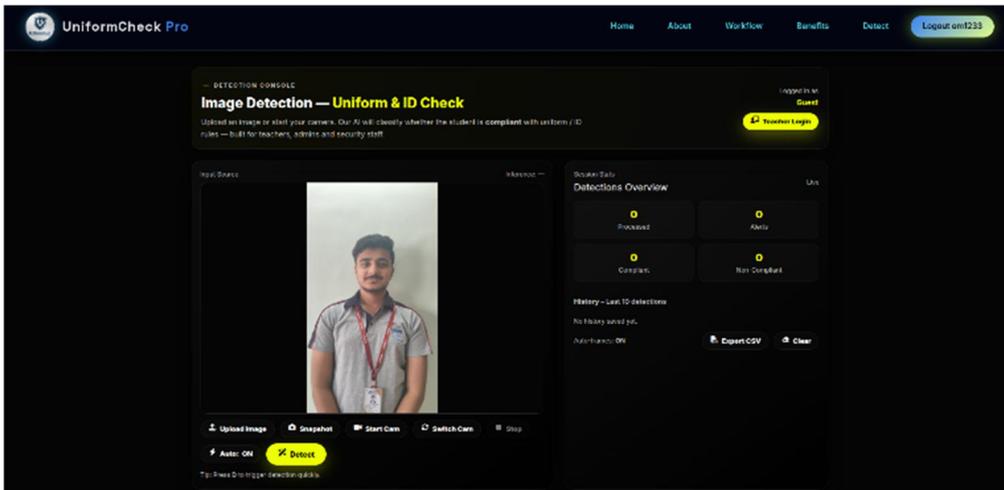
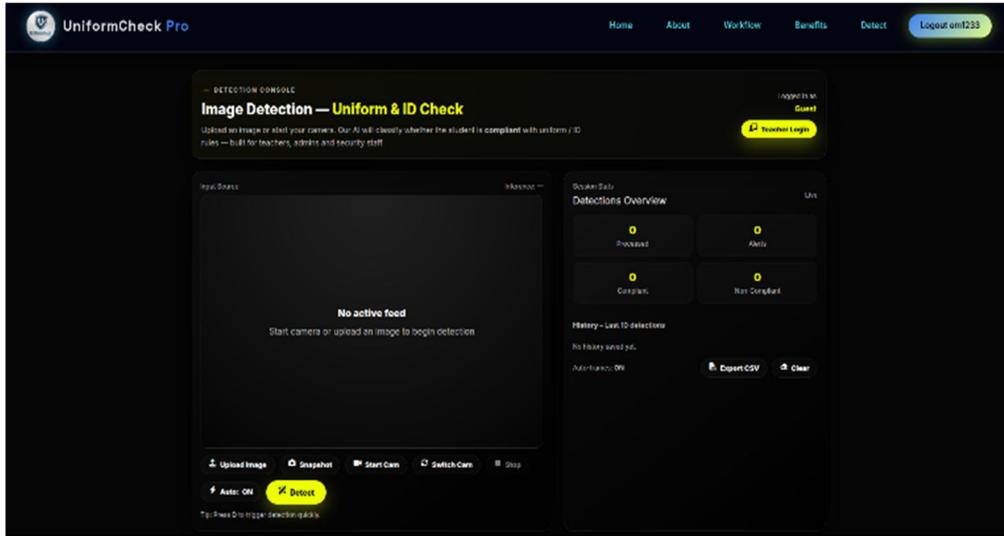
A test population of 200 student images comprising equal parts of compliant and non-compliant categories was used to evaluate the system.

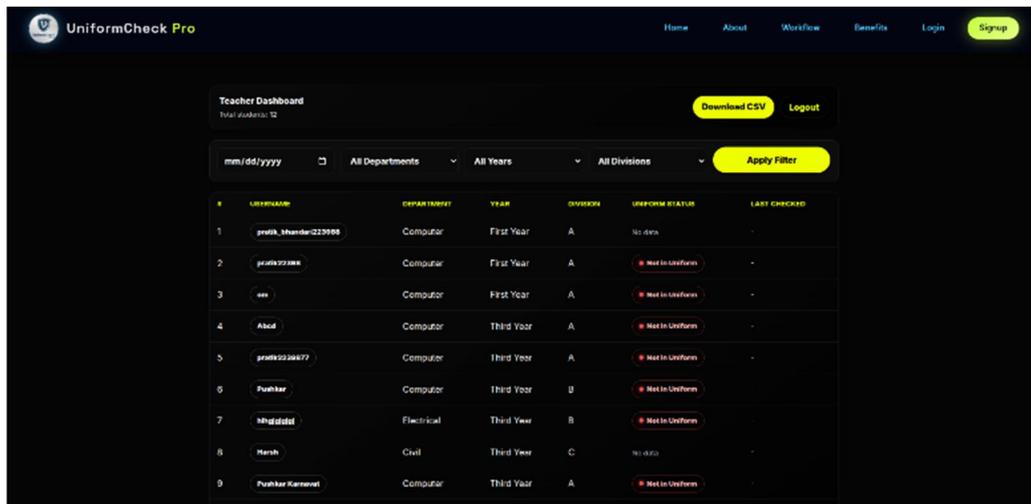
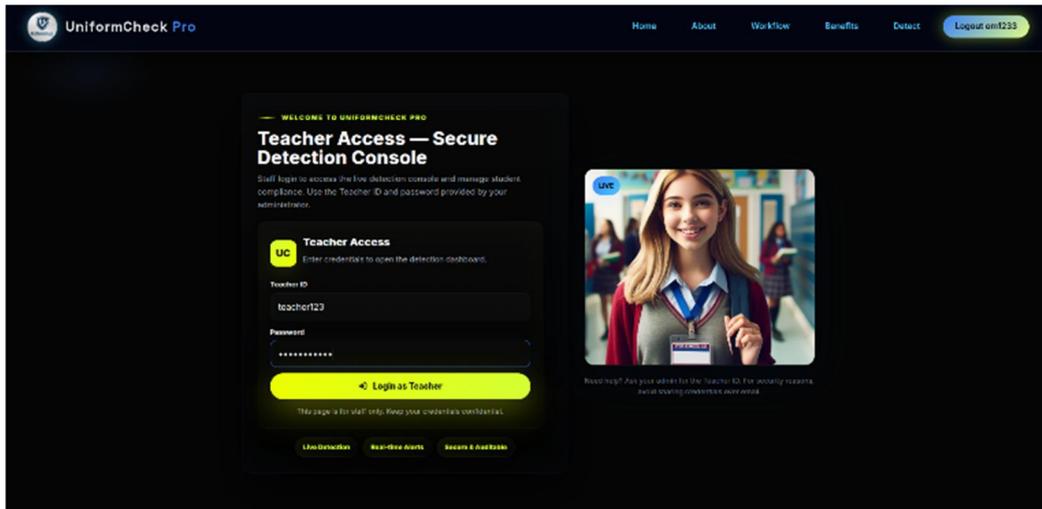
The CNN reached around 92% overall accuracy. Both precision and recall were above 0.90, suggesting a reliable classification with few false alarms. Most of the misclassifications happened in images with low light or partial occlusion.



The CNN showed slight accuracy improvement over the modified YOLOv4 baseline, but did require marginally more computation time. Teachers said they liked the automatic logging and time stamping.







## VI. CONCLUSION

We develop the AI-based system with a web platform for secure uniform compliance monitoring. The system provides over 90% accuracy, has a working dashboard integrated into it and fills in many of the gaps found in previous research. The approach shows how Intelligent Automation can elevate the human experience, minimizing manual oversight while achieving standards governing the institution.

Future approaches could be multi-class detection of individual uniform components, real-time video analysis in addition to cloud-based infrastructure to allow for multi-campus deployments.

## VII. ACKNOWLEDGMENT

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