⬚ Automated School Attendance and Uniform Detection System Using Computer Vision

This document outlines a proposal for a real-time system designed to automate school attendance and verify student uniform compliance through the use of computer vision technologies. The proposed system aims to enhance administrative efficiency, reduce manual errors, and facilitate real-time monitoring of student presence and attire. By leveraging facial recognition and object detection techniques, the system is expected to operate effectively in various lighting conditions, providing a comprehensive solution for educational institutions.

1. Introduction

Manual attendance and uniform inspection processes in schools are often inefficient and error-prone. This research outlines a proposed system that aims to automate these tasks using computer vision. The proposed system will utilize real-time face recognition and uniform detection, offering reliable operation across varying lighting environments. The overall goal is to streamline administrative workflows through a centralized dashboard.

2. Literature Review

Several studies have examined automated attendance systems using computer vision. For example, Shehu and Dika (2010) implemented real-time attendance with OpenCV, while Arya et al. (2020) used CNNs for face recognition. However, limited research addresses uniform detection in academic contexts. This proposal builds upon previous work by combining attendance and attire monitoring, using modern tools like YOLOv8 and MongoDB.

3. Proposed Methodology

3.1 System Design Overview

- **Camera: A day/night vision camera will be used to capture images in both high and low lighting conditions.**
- **Face Data Management: Student face vectors will be pre-stored in a MongoDB database.**
- **Recognition Pipeline: Face recognition will be achieved using Haar Cascade detection and vector comparison for identity verification.**
- **Uniform Detection: A YOLOv8 model will be trained on school-specific uniform images to classify compliance.**
- **Dashboard Interface: A web-based dashboard will display live student data including name, section, and attire status.**

Student Monitoring System Process

Face Data Management
Storing student face vectors in database

Recognition Pipeline
Verifying identity using Haar Cascade

Uniform Detection
Classifying uniform compliance with YOLOv8

Dashboard Display
Presenting live student data on dashboard

3.2 Development Plan

- Capture student images under various lighting scenarios.
- Preprocess and encode facial features into vectors.
- Store and retrieve facial data from MongoDB.
- Train YOLOv8 model using labeled uniform data.
- Integrate both components into a responsive UI.

3.3 Tools & Technologies (Planned)

- **Languages**: Python, JavaScript
- **Libraries**: OpenCV, PyTorch, face_recognition, Ultralytics YOLO
- **Database**: MongoDB
- **Frameworks**: Flask/Django

4. Expected Results and Discussion

It is anticipated that the system will achieve high accuracy in facial recognition across varied lighting environments, with a face matching accuracy above 95% and uniform detection precision over 90%. Real-time operation is a core focus, with response times estimated to remain under one second. Potential challenges include lighting variance, partial occlusion of uniforms, and facial obstructions, which will be addressed iteratively during development.

5. Conclusion and Future Work

This paper presents a blueprint for developing a school attendance and uniform detection system based on computer vision. The system is currently under development, with core components such as dataset creation, face vector storage, and YOLOv8 training in progress. Future enhancements will include mobile compatibility, advanced behavior analysis, and cloud-based reporting tools.

References

- Shehu, V., & Dika, A. [2010]. Using Real-Time Computer Vision Algorithms in Automatic Attendance Management Systems. IEEE ITI.
- Arya, S., Mesariya, H., & Parekh, V. [2020]. Smart Attendance System Using CNN. arXiv:2004.14289.
- Sarkar, P. R., Mishra, D., & Subhramanyam, G. R. K. S. [2018]. Automatic Attendance System Using Deep Learning Framework. Springer.
- Ultralytics. [2023]. YOLOv8 Documentation. https://docs.ultralytics.com
- OpenCV Team. [2023]. OpenCV Documentation. https://docs.opencv.org
- Ageitgey, A. [2023]. face_recognition GitHub Repository. https://github.com/ageitgey/face_recognition

Appendix (To be Added During Implementation)

- Planned system architecture diagrams
- Example MongoDB schema
- YOLOv8 training logs and accuracy charts
- Dashboard design wireframes and mockups