

Title: MindWatch – AI Surveillance of Classroom Engagement & Distraction [Emotion Vs Performance]

Abstract:

This project aims to develop an intelligent classroom monitoring system that integrates computer vision and AI to track students' emotional engagement and correlate it with academic performance. Using CCTV footage and advanced image analysis, the system detects emotions such as attentiveness, distraction, and behavioral anomalies (e.g., phone usage). It calculates per-student and class-level attentiveness percentages and compares them with academic performance data. The final output provides actionable insights and suggestions to improve teaching strategies and student focus.

1. Introduction:

Smart classrooms generate a massive amount of passive visual data that is currently underutilized. This project utilizes AI-based computer vision to turn CCTV streams into real-time engagement metrics. With increasing digital education, there's a need for scalable, non-intrusive methods to measure student behavior and connect it with academic performance.

2. Objectives:

- Detect real-time emotional states (attentive, distracted, disinterested, illegal activity) of students in a classroom.
- Record and classify behavioral patterns for each student per subject period.
- Generate analytics showing the correlation between student engagement and academic performance.
- Provide suggestions to teachers/administrators based on analysis.

3. Methodology:

3.1 Data Collection:

- Classroom CCTV footage (static camera with full view).

- Academic performance data (monthly/subject-wise marks).

3.2 Preprocessing & Annotation:

- Annotate video frames using tools like CVAT or Roboflow.
- Label 4 behaviors: Attentive, Distracted, Viewing Outside, Illegal Activity (e.g., phone usage).

3.3 Model Implementation:

- Emotion Detection: Use CNN-based models trained on FER-2013.
- Head Pose/Gaze Tracking: MediaPipe + OpenCV.
- Activity Recognition: YOLOv8 for phone/talking detection.
- Period-wise student tracking and result logging.

3.4 Performance Mapping:

- Compare each student's engagement log with their academic marks.
- Use statistical methods (Pearson correlation, linear regression) for behavior vs. performance trends.

3.5 Dashboard Interface:

- Developed using Streamlit or Flask.
- Shows per-class and per-student attention metrics, charts, and correlation results.

4. Modules:

- 1. Face & Emotion Detection**
- 2. Behavior Labeling & Tracking**
- 3. Database & Result Storage**
- 4. Performance Comparison Engine**
- 5. Insight & Recommendation Generator**
- 6. Teacher Dashboard & Reports**

5. Tools & Technologies:

- Python, OpenCV, TensorFlow/Keras
- MediaPipe, DeepFace, YOLOv8
- CVAT, Label Studio
- Flask / Streamlit
- PostgreSQL / CSV

6. Expected Output:

- Real-time student engagement analytics per period.
- Correlation chart between behavior and marks.
- Insight reports for each student and class.
- Teacher suggestions to improve engagement.

7. Future Scope:

- Extend to online classes with webcam integration.
- Include more emotion types (confusion, frustration).
- Use reinforcement learning for self-improvement feedback loops.

8. Conclusion:

This project empowers teachers with AI-driven feedback about student engagement. By identifying how attention patterns affect academic performance, it fosters smarter classrooms and personalized education strategies.