

Facial Feature-Based Attention Tracking System for Enhanced Online Learning Engagement

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Abstract: Recognizing and enhancing student engagement is crucial for improving learning outcomes, particularly in the context of online classes where monitoring can be challenging. Traditional methods of attendance tracking, such as calling out names, are impractical and susceptible to manipulation in the virtual environment. Students might appear 'online' without actively participating, and the absence of video feeds makes it difficult for teachers to verify attendance and attention. In order to realize a highly efficient and robust attendance management and engagement level prediction system for online learning, In the proposed

System, the learner's face is monitored by a video camera while attending a video lecture. Facial features were analyzed to predict reaction time (RT) to a task-irrelevant stimulus, which was assumed to be an index of the level of attention. Then apply a machine learning method, light Gradient Boosting Machine (LightGBM), to estimate RTs from facial features extracted as action units (AUs) corresponding to facial muscle movements by an open-source software (OpenFace). This project is to develop a user-friendly system integrated with private online learning and attendance recording system for teachers that can automatically record students' engagement state and attendance then generate attendance reports for online classrooms. It encompasses a novel design using the AI based FFCNN (Face Fiducial Convolution Neural Network) model to capture face biometric randomly from students' video stream and record their attendance automatically. This integrated solution not only streamlines attendance management but also provides valuable insights into students' engagement levels through facial feature analysis.

Keywords: Attendance tracking, Facial feature analysis, Machine learning, Light GBM, OpenFace, AI-based FFCNN model