Exploring Machine Learning Approach for Attention Detection Using Public EEG Datasets

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Abstract

Brain Computer Interface (BCI) technology provides new opportunities for objectively assessing cognitive states such as attention, which plays a critical role in effective learning. In today's digital and hybrid classrooms, students often encounter distractions that hinder their engagement and performance. Meanwhile, conventional assessment methods rely heavily on subjective observations or self-reports, which limit real-time accuracy. This preliminary study examines the feasibility of predicting attention levels using electroencephalography (EEG) signals and machine learning techniques. A publicly available Kaggle EEG dataset, recorded from four electrodes (AF7, AF8, TP9, TP10), was preprocessed through feature extraction, normalisation, and partitioning into training and testing sets. An XGBoost regression model was trained to predict continuous concentration

scores from multichannel EEG features. The model achieved a high performance with a Mean Squared Error (MSE) of 0.0031 and a coefficient of determination (R2) of 0.9764. These results demonstrate the potential of regression-based EEG analysis for real-time, continuous attention monitoring, offering finer granularity compared to traditional categorical approaches. The findings serve as an initial step toward developing TARKEEZ, a real-time EEG-based brainwave monitoring system designed to enhance student engagement and learning efficiency. © 2025 IEEE.

Author keywords

Attention Monitoring; BCI; Concentration Prediction; Educational Technology; EEG; XGBoost Regression

Indexed keywords

Engineering controlled terms

Biomedical signal processing; Brain computer interface; Educational technology; Electrophysiology; Engineering education; Forecasting; Learning algorithms; Learning systems; Machine learning; Mean square error; Regression analysis; Statistical tests; Students

Engineering uncontrolled terms

Attention detection; Attention monitoring; Cognitive state; Concentration prediction; Effective learning; Interface technology; Machine learning approaches; Performance; Real- time; Xgboost regression

Engineering main heading

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