EEG-Based Emotion Recognition and Conversational AI VR Assistant for Personalized Assistance

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Advances in artificial intelligence (AI), electroencephalography (EEG), and virtual reality (VR) have led to new approaches to cognitive enhancement and emotion prediction. This study investigated whether an AI-driven VR assistant powered by EEG-based emotion prediction and user speech could improve cognitive performance over time. It was hypothesized that the system would accurately predict emotion using EEG data and improve cognition through the assistant. A Unity-based VR environment consisted of a ChatGPT API with a rigged model created in Blender that adjusted audio feedback and interaction based on EEG data and user speech. To test the system, eight participants were given word searches and math tests over four weeks. Six participants completed them before and after the VR experience, while two controls did not have any VR interaction. Cognition was evaluated using task completion times, error/skips in the math test, and self-reported difficulty, which all decreased over time. For all experimental participants, Pearson's r was beyond the critical value (-0.707), suggesting improvement. For group analysis, a t-test yielded 10.108 (word search) and 6.897 (math test), which are both above the 2.571 critical value. Both p values were below 0.05, and both Cohen's d values were above an 0.80 effect size, suggesting significant improvement over time. In contrast, the control group's t-tests, p values, and Cohen's d values did not meet the significance thresholds, suggesting less improvement without VR. By combining EEG, VR, and AI, this study provides evidence that AI-powered VR systems can potentially improve cognition beyond practice and time alone.

Awards Won:

NC State College of Engineering: Alternates (not read aloud)