Real-Time Analysis of Emotions for Neurological Disorder Patients

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Patients who suffer from Neurological Disorders, such as strokes, experience difficulty when communicating with others due to various factors such as paralysis or the inability to speak. For example, more than 40% of stroke patients have severe impairments, needing special and long-term care with limited ability to communicate. This difficulty in communication makes it harder for doctors and caretakers to effectively treat the patients. Currently, no commercial solutions exist to help patients communicate due to the difficulty of interpreting emotions from EEG waves. This research proposes two novel methods to recognize emotions from EEG waves: Independent Component Analysis (ICA) with baseline component removal and the Frequency Topographic Method. Both methods create EEG images that correspond to eight distinct emotions with varying degrees of valence and arousal using component extractions and power-spectral density maps respectively. The EEG images generated from these two methods were then processed using Machine Learning algorithms to accurately predict emotions. Of the multiple algorithms used, the optimized Neural Network algorithm was able to accurately predict emotions with high accuracy, processing performance, and efficiency, allowing for real-time processing of such data. ICA and Frequency Topographic Method yield high accuracies (92% and 75% respectively), considering that this is an eight-way classification system. Emotions are controlled by complex brain activity, but these novel methods are able to accurately and efficiently predict the emotions of patients. With the expanding field of artificial intelligence and machine learning capabilities, the prospect of accurately predicting emotions and eventually other brain activities can now be a reality.

Awards Won:

Third Award of $1,000

American Psychological Association: Second Award of $1,000