

# **EpiMuse: A machine-learning system for customized music therapy for epileptic patients**

*Aarush Vir Banerjee Kharbanda<sup>1</sup>*

*<sup>1</sup> Dubai College, United Arab Emirates (UAE)*

## **Abstract**

In this paper I introduce EpiMuse, a system that integrates real-time electroencephalogram (EEG) monitoring with music therapy to deliver personalized music therapy for epileptic patients. Using the Muse 2, a wearable brain-computer-interface headband, the EEG of a user is recorded as they listen to a piece of classical music from the EpiMuse dataset. To assess whether this musical excerpt elicits a calming effect, the EEG signals recorded by the Muse 2 are processed using Welch's method to obtain the Power Spectral Density (PSD). The theta/beta ratio (TBR) of this signal is then calculated for short time windows and compared to a subject specific baseline – the TBR of an EEG signal recorded prior to listening to the piece of music. A piece is classified as calming if the TBR exceeds the baseline mean TBR by at least one standard deviation for a sustained period of over 20 seconds. A K-Nearest Neighbours (KNN) algorithm is then used to identify similar pieces of classical music from the EpiMuse dataset based on the tempo, dynamics, instrumentation, and type of each piece. After completing several sessions, a user has a personalized playlist of several classical music pieces. EpiMuse was conceived following an empirical EEG study conducted at Neuropedia Dubai which demonstrated that listening to Mozart's K.448 during an EEG improved collected EEG data quality by reducing artifact load and improving sleep onset latency of participants. Whilst EpiMuse is designed as a non-invasive therapeutic tool for patients of epilepsy, it may have broader applications for patients with other mental conditions.

Keywords: epilepsy, Mozart effect, electroencephalography (EEG), theta/beta ratio, Power Spectral Density (PSD), Welch's Method, brain-computer-interface, k-Nearest-Neighbours (KNN), machine learning.