Journal of Neuroscience and Neuropharmacology



Vol.6 No.2

Clustering Approach of EEG Powers for Neuropsychiatric Symptoms among Patients with Alzheimer's Disease

Friedrich Liu,^{1,2} Chung-Kang Peng,² Albert C. Yang^{2,3}

¹Boston University Academy, Boston, Massachusetts, USA

²Center for Dynamical Biomarkers, Beth Israel Deaconess Medical Center/Harvard Medical School, Boston, Massachusetts, USA

³Institute of Brain Sciences/Digital Medicine Center, National Yang-Ming University, Taipei, Taiwan

Abstract

Despite the increasing interests in utilizing electroencephalogram (EEG) as a biomarker for Alzheimer's disease, the relationship between EEG signals and neuropsychiatric symptoms remains unclear. We studied EEG signals of Alzheimer's patients to explore the association between patients' neuropsychiatric symptoms and clusters of patients based on their EEG powers. Sixty-nine patients with mild Alzheimer's disease (Clinical Dementia Rating = 1) were enrolled and their EEG signals from 19 channels/electrodes were recorded in three sessions for each patient. The Fourier transform was performed on the EEG data as a function of voltage over time to yield the Welch's periodogram of the power spectral density versus frequency. The EEG power was then calculated by integrating the power spectral density with respect to frequency for the four frequency bands (delta/theta/alpha/beta). We performed K-means cluster analysis to classify the 69 patients into two distinct groups by the log-transformed EEG powers (4 frequency bands x 19 channels) for the three EEG segments. In each segment, both clusters were compared with each other to assess the differences in their cognitive and neuropsychiatric symptoms. EEG band powers were different between the two clusters in each of the three segments, especially for the delta waves. The delta band powers differed significantly between the two clusters in most channels across the three segments. Patients' demographics and cognitive function were not different between both clusters. However, their behavioral/psychological symptoms were different between the two clusters classified based on EEG powers. A higher Neuropsychiatric Inventory (NPI) score was associated with the clustering of higher EEG powers. The results suggest that EEG delta band power correlates to behavioral symptoms amongst patients with mild Alzheimer's disease. The clustering approach of EEG signals may provide a novel and effective method to differentiate the severity of neuropsychiatric symptoms and/or predict the prognosis for Alzheimer's patients.

Keywords—*Cluster* analysis; Dementia; Electroencephalogram (EEG); Neuropsychiatric

Biography:

Friedrich Liu is a senior at Boston University Academy (BUA) and he has been conducting an original research on Alzheimer's disease as a research intern at the Center for Dynamical Biomarkers of Beth Israel Deaconess Medical Center/Harvard



Medical School under the supervision of Dr. Albert C. Yang and Professor Chung-Kang Peng. With his deceased greatgrandfather and other family members who were affected by Alzheimer's disease in mind, he chose the topic of electroencephalography (EEG) signals for Alzheimer's patients to start his journey of scientific exploration. Friedrich and his colleagues found that the clustering approach of EEG signals may provide a novel and cost-effective method to differentiate the severity of neuropsychiatric symptoms and/or predict the prognosis for Alzheimer's patients. Friedrich feels excited that he can apply what he learned from school and his internship to resolve a critical research question about Alzheimer's disease, on which future studies–potentially with the capacities to change lives of Alzheimer's patients and their family–can expand.

ISSN 2155-9562

<u>14th International Online Congress on Alzheimers &</u> Dementia ; October 05, 2020.