



APPROXIMATE ENTROPY OF EEG BACKGROUND ACTIVITY IN ALZHEIMER'S DISEASE PATIENTS

D. ABÁSULO¹, R. HORNERO¹, AND P. ESPINO²

¹*Biomedical Engineering Group
E.T.S. Ingenieros de Telecomunicación
University of Valladolid
Camino del Cementerio s/n, 47011, Valladolid (Spain)*

²*Biomedical Engineering Group
Hospital Clínico San Carlos
c/Profesor Martín Lagos s/n, 28040, Madrid (Spain)*

ABSTRACT—Non-linear analysis of the electroencephalogram (EEG) background activity can help to obtain a better understanding of abnormal dynamics in the brain. The aim of this study was to analyze the regularity of the EEG time series of Alzheimer's disease (AD) patients to test the hypothesis that the irregularity of the AD patients' EEG is lower than that of age-matched controls. We recorded the EEG from 19 scalp electrodes in 11 AD patients and 11 age-matched controls and estimated the Approximate Entropy (*ApEn*). *ApEn* is a non-linear method that can be used to quantify the irregularity of a time series. Larger values correspond to more irregularity. We evaluated different values for input parameters m and r to estimate *ApEn* and concluded that $m=1$ and $r=0.25$ times the SD of the time series were the optimum choices. With these parameters, *ApEn* was significantly lower in the AD patients at the P3, P4, O1 and O2 ($p<0.01$) electrodes. The decreased irregularity found in the EEG of AD patients in the parietal and occipital regions leads us to think that regularity analysis of the EEG with *ApEn* could be a useful tool to increase our insight into brain dysfunction in Alzheimer's disease.

Key Words: Alzheimer's disease; EEG; Non-linear analysis; Approximate Entropy; Regularity