UNIVERSITY OF SOUTH FLORIDA

Defense of a Master's Thesis

Adaptive Mobile EEG Noise Cancellation Using 2D Convolutional Autoencoders for BCI Authentication

by

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For the MSCP degree in Computer Engineering

Electroencephalography (EEG) signals can be used for many purposes and has the potential to be adapted to various systems. When EEG is recorded from users, these studies are performed primarily in an indoor environment, while the user is stationary. This is due to the levels of noise that are experienced when recording EEG data, to minimize errors in the data. This thesis aims to adapt tasks that are performed indoors to an external environment by removing the noise in EEG, using a 2D Convolutional Autoencoder (CAE). The data is recorded from subjects during testing and is passed into the 2D CAE to produce a reconstructed signal that will have the noise removed. The experiment consists of an initial recording, where the subject sits stationary indoors for 60 seconds, to obtain a baseline. Afterwards, they perform movement-based tasks both indoors and outdoors for 60 seconds. The indoor movement recordings are used as the pure signals and the outdoor recordings are the noisy signals. Both are passed into the 2D CAE to produce a reconstructed signal that removes the noise from the outside recorded data. To verify results, a web application was developed to perform authentication. The reconstructed signal is matched against the data recorded while the user is moving in an internal environment, using the cosine similarity. If the two signals are closely related, the user will be able to authenticate into a web application. The accuracies achieved were an average of 90% when performing the cosine similarity with the reconstructed signal to the inside data after preprocessing the data and 80% without preprocessing.

Wednesday, July 7th, 2021
2:00pm
Online (Microsoft Teams)
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THE PUBLIC IS INVITED

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