Project Report

Group 8

Objective :

Data security and Authentication has become a priority with an increase in cyber attacks and hacking. As Data is of utmost importance it is trivial to implement robust security to authenticate anyone from accessing it. Previously PIN and Password were used and now with the transition from Graphical user Interface to Natural User Interface we are able to use Facial Recognition, Fingerprints etc. However these biological characteristics are dynamic with age and time, and can be forged or stolen easily.

In this project we are trying to implement a **Security Authentication System** based on Brain Signals of a person. As it has been researched that Brain waves are unique to each and every person, they can be used as a distinctive biometric for authorization. This can be used in places where there is a need for a high level authentication process and the accessibility of data is very crucial.

Methodology :

1. **SNN**

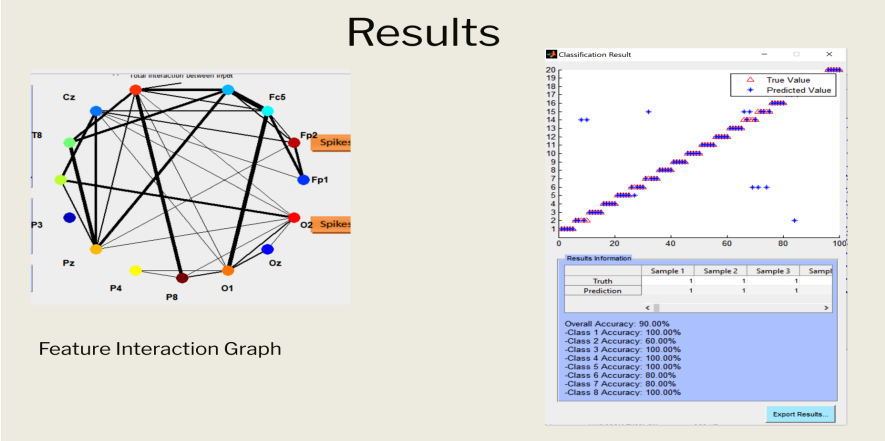
   Spiking Neural Networks closely mimic the Natural Neural Networks in the brain.The inputs consist of a set of spikes and produces a set of spikes.SNNs do not transmit information at the end of each propagation cycle as a typical ANN does but instead it needs to cross the Neuron's threshold.

2. **NeuCube** is the world-first development environment and a computational architecture for the creation of Brain-Like Artificial Intelligence (BLAI), that includes applications across domain areas.

3. **Occipital dominant rhythm** was the signal used. The dataset concerned an experiment carried out at GIPSA-lab in 2017.A total of 20 volunteers participated in the experiment with a median age around 25 years. EEG signals were acquired using a standard research grade amplifier and the EC20 cap equipped with 16 wet electrodes placed according to the 10-20 international system.The data was acquired with no digital filters and a sampling frequency of 512 samples/sec; recording was done in blocks of around 10 seconds.

- NeuCube was used to generate an SNN classifier which was trained and tested on the above mentioned dataset.
- SNN takes in 16 channel spatio-temporal EEG data of a subject recorded for 10 seconds as input and then classifies into one of the 20 output classes ,as there were 20 different subjects in the study.
- The model is essentially trained to recognise a particular subject based on the characteristic features and patterns observed in its Occipital Dominant rhythm signal.

Results :



1. We achieved 90% accuracy while testing but we were limited by the small sample size of the dataset used for training. We believe that if more recordings per subject are available, we can get a model with a higher prediction accuracy.
2. Our model can be used for authentication of a user. As our model can correctly recognise a user based on its EEG data and thus if the user is authorized, he will gain access into the system.

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