Predicting seizures with artificial spiking neural networks

Design

Problem Statement

We plan to determine whether single-spiking networks, as described in Lee, Delbruck, Pfeiffer (2016), or multiple-spiking neural networks, as described in Ghosh-Dastidar, Adeli (2009), are more effective at predicting seizures based on the previous 10-20 minutes of electroencephalogram activity.

Variables

- Class of network (spiking method)

Constants

- Preprocessing technique
- Amount of preceding time

Control

Using SVM to see if there is a relationship between EEG data and seizures and as a baseline to see if neural networking can predict seizures at a higher accuracy.

Assumptions

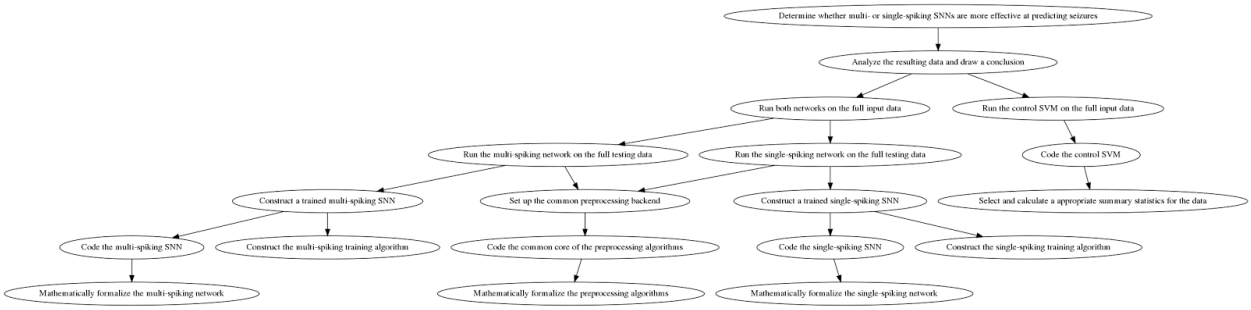
- It is feasible to predict seizures 10-20 minutes beforehand based only on EEGs

Materials

- Programming language: Python
- Tools: BRIAN simulator, Some SVM
- EEG data: University of Pennsylvania and Mayo Clinic (2014)

Procedure

1. Determine and mathematically formalize preprocessing algorithms.
2. Code preprocessing algorithms.
3. Run EEG data through preprocessing algorithms.
4. Run processed data through an SVM to create a control.
5. Construct a multi-spiking neural network training algorithm.
6. Mathematically formalize the multi-spiking neural network.
7. Construct the multi-spiking neural network.
8. Train multi-spiking neural network on snippet of processed EEG data.
9. Run multi-spiking neural network on full processed EEG data.
10. Steps 5-8 will be repeated at DSHS with single-spiking neural networks and their results will be compared to the multi-spiking neural network results using some statistical test.



Model Statistics/Analysis

I have no idea what this means. Maybe this is how we're deciding which model is better? Maybe this is training information? The rubric is pretty clearly designed for differential equation models.

References

Ghosh-Dastidar, S. & Adeli, H. (2009, December). A new supervised learning algorithm for multiple spiking neural networks with application in epilepsy and seizure detection. Neural Networks, 22, 1419–1431. doi:10.1016/j.neunet.2009.04.003

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