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CS584 Project Proposal - Application-Oriented
https://github.com/privafuschia/Harmful-Brain-Activity-CNN

Project Title
HMS - Harmful Brain Activity Classification

Description
Train machine learning model to detect and classify seizures and other types of harmful brain activity. Model will be trained on electroencephalography (EEG) signals recorded from critically ill hospital patients.

Brief Survey
This is an ongoing kaggle competition hosted by Harvard 2 months ago, therefore there aren't any official models for this dataset that has been made available as of today. But there are existing models made for detecting specifically epileptic seizures. In the paper '*CNN classification of variance-based selected topo-maps of EEG*' by Simralova et. al, it approaches brain seizure EEG learning by constructing a topological map from the EEG and selecting key time frames to use as data input. This approach is strictly 2D CNN. We intend to take inspiration from this but add our own spin using 1D CNN for temporal features before converting it into a topological image for spatial features and then adding the spectrograms provided by Kaggle as well.

Preliminary Plan
1. Gather data
2. Construct 2D topological image from EEG
3. Train models
    a. 1d convolutional neural network on EEG data
    b. 2d convolutional neural network on topological images
    c. 2d convolutional neural network on spectrogram.
    d. Combine model.
4. Compare models
5. Write project report

References

Kaggle data: https://www.kaggle.com/competitions/hms-harmful-brain-activity-classification
KDD paper: https://dl.acm.org/doi/pdf/10.1145/3569192.3569211

Other:
https://arxiv.org/abs/1611.08024
https://ieeexplore-ieee-org.ezproxy.gl.iit.edu/document/8972542