ECG-based Emotion Recognition Project Pipeline

Resource:

DREAMER[[1]](#endnote-1) is a biophysical signal database, composed of both Electrocardiogram (ECG) and Electroencephalogram (EEG) signals recorded during affect elicitation by audio-visual stimuli. 23 participants were recorded along with the participants self-assessment of their affective state. Total 18 different stimuli were done participant-wisely. The signal was recorded by Shimmer, and one lead ECG signal will be applied in this project.

Background:

ECG records the electrical activity of heart over a period of time. Although it is a time-series data, deep learning for ECG is not restricted on RNN. Both 1D CNN[[2]](#endnote-2) and 2D CNN[[3]](#endnote-3) have been reported to be applied for ECG classification. Moreover, CRNN is also used in deep learning classification of ECG with feature extracted by CNN.[[4]](#endnote-4)

Plan:

1. Exploratory Data Analysis

* Data visualization of ECG of different annotations
* Feature Extraction for RNN Model
* Data preprocessing for CNN Model (e.g. transformed into image)
* Data augmentation

1. Building Models

* Implement different architectures and tuning hyperparameters
* Compare different models’ performance
* Model ensembling

1. Conclusion and Insights

Goals:

* Get used to PyTorch and practice more on it.
* Learn how to operate a deep learning project
* Beat the baseline SVM algorithm
* Learn to implement architectures from literatures
* Try to get insights from comparing different architectures of neural network

1. Katsigiannis, S., & Ramzan, N. (2018). DREAMER: a database for emotion recognition through EEG and ECG signals from wireless low-cost off-the-shelf devices. *IEEE journal of biomedical and health informatics*, *22*(1), 98-107. [↑](#endnote-ref-1)
2. Kiranyaz, S., Ince, T., & Gabbouj, M. (2016). Real-time patient-specific ECG classification by 1-D convolutional neural networks. *IEEE Transactions on Biomedical Engineering*, *63*(3), 664-675. [↑](#endnote-ref-2)
3. Rajpurkar, P., Hannun, A. Y., Haghpanahi, M., Bourn, C., & Ng, A. Y. (2017). Cardiologist-level arrhythmia detection with convolutional neural networks. *arXiv preprint arXiv:1707.01836*. [↑](#endnote-ref-3)
4. Zihlmann, M., Perekrestenko, D., & Tschannen, M. (2017). Convolutional recurrent neural networks for electrocardiogram classification. *Computing*, *44*, 1. [↑](#endnote-ref-4)