

Executive Summary: Classification of Alcoholic EEG Signals

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may22-themis Team: Azeezat Azeez and Miriam Sierra

Background: Electroencephalography

The EEG(Electroencephalography) is a non-invasive neuroimaging technique used to record electrical activity from the scalp, representative of real-time neural activity at high temporal resolution. In a Clinical setting, EEG is primary used to diagnose Epilepsy

Project Description: Predict who is an Alcoholic?

- Data: Open-source EEG data from the UCI Machine Learning Repository
 - <https://archive.ics.uci.edu/ml/datasets/EEG+Database>
- Description: This data arises from a large study to examine EEG correlates of genetic predisposition to alcoholism.
 - It contains measurements from 64 electrodes placed on the subject's scalps which were sampled at 256 Hz (3.9-msec epoch) for 1 second.
- Subjects: Two Groups: Alcoholic & Control
- Data Sets:
 - Training: 20 unique patients (10 control/10 alcoholic) 30 trials per patient
 - Test: 20 unique patients (10 control/10 alcoholic)

Motivation: Preventive Care & Improved Social Welfare

- 14 million people suffer from alcohol use disorder in the US
- The current method of diagnosis is largely qualitative (self-reports) which can introduce bias
- The quantitative ability to diagnose and discover high-risk individuals based on biomarkers of EEG data has real world benefits:

Medical: Identify high risk and vulnerable populations → Preventive Care

Social: Reduce the social burden → Improve Social Welfare

****Financial: Preventive Care + Improve Social Welfare****

<https://www.niaaa.nih.gov/publications/brochures-and-fact-sheets/alcohol-facts-and-statistics>

Approach: Classification Algorithms

1. Exploratory Analysis
2. Preprocessing: EEG data using Literature Standard
3. Feature Extraction and Dimension Reduction
4. Machine Learning Algorithms
5. Supervised Learning (Hyperparameter tuning of best classifier)
 - a. Logistic Regression
 - b. Random Forest
 - c. Support Vector Machine
6. Neural Networks: Classification using deep 1D convolutional Neural Network

Summary

- The intersection of Data Science and Medical Imaging offers a unique opportunity to create clinical biomarkers for Patients
- In this case the potential to offer Preventive Care & Improved Social Welfare for those suffering from Alcohol Use Disorder
- While our current model performance is promising, there is still room to improve the diagnostic utility of the Algorithms.