

Mental Depression Detection from EEG Signals





Content Synopsis

OVERVIEW OF KEY IDEAS

How EEG and Mental Depression is related??

Some Statistics

Literature Review

Proposed Solution

How We Do?

Challenges

How EEG and Mental Depression is related??

EEG - ELECTROENCEPHALOGRAPHY

EEG is a neuro - imaging technique that measures the electrical activity of brain by placing electrodes in scalp. In context with mental depression, EEG can be used to gain valuable insights and depressive symptoms. Individuals with depression often exhibit abnormal changes in EEG patterns. To measure the EEG, we use delta, theta ,alpha , beta , gamma frequencies. The patterns in this frequencies directly correlates to mental depression.





300 million

People of all age categories suffers depression globally in 2017, provided by WHO.

280 million

People of all age categories suffers depression globally, provided by WHO.



\$1 Trillion

economic burden due to
depression per year as per 2017



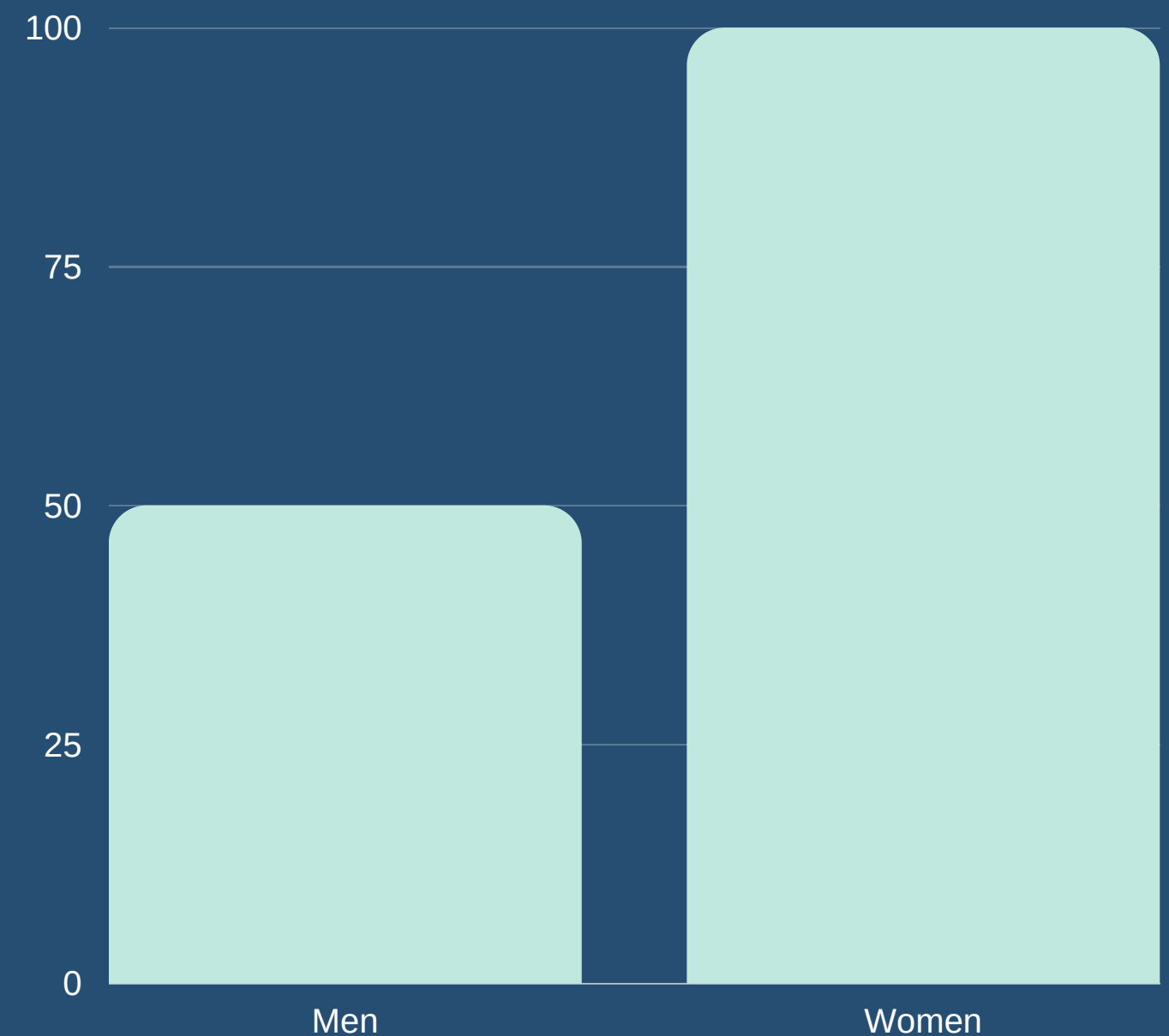
3.8 percent

of population experiences
depression

50%

COMMON AMONG WOMEN THAN MEN

Depression is 50% common among women than men.
More than 10% of pregnant women and women who just gave birth experience depression.



Literature Review



Depression diagnosis by deep learning using EEG signals

This paper proposed a three dimensional convolutional neural network architecture to using effective connectivity inside the brain DNN(Default Mode Network) region. It employed some new features like PDC and DMN connectivity. But the achieved accuracy is doubtful and requires more assessment.

Dep-HNN : A novel hybrid neural network for EEG based screening of depression

This paper proposed a computer-aided (CAD) for depression analysis i.e.Dep-HNN which stands for Depression Hybrid Neural Network and LSTM to capture temporal dependencies in time-series EEG input signals and process the sequence learning respectively. It provides a combined model for feature extraction. It reduces the time and computation complexity and provides us a simple architecture, but it has a high probability of overfitting.

Literature Review

Hybrid Deep shallow Networks for Assessment of depression using Electroencephalogram signals

This paper suggested two deep neural network based models which were 1DCNN-GRU and 1DCNN-LSTM on two eye open and eye close datasets. It exhibited that 1DCNN-GRU performed better than 1DCNN-LSTM in short sequence. This itself is both its advantage and disadvantage as there comes a problem in time window segmentation.

Low Channel electroencephalogram based deep learning method to pre-screening depression

This paper offered a two dimensional convolutional layer based model using recorded signals of both eye opened and closed dataset. It performed better than previous models on the same dataset. But it lacks data and has noise removal issues.



Proposed Solution

HYBRID-EEGNET WITH ALPHA BAND/CNN WITH BRAIN NETWORKS

To address this, we provide a deep learning solution using Hybrid-EEGNet with alpha band or CNN with brain networks to analyze and predict the appropriate state of a person (either normal state or depressed state) and provide the result in a web page.



How We Do?

DATA

Data is collected from MODMA(Multi-Modal Open Dataset). It contains two major files which are Eye opened and closed state. It also contains a audio data.

Processing the Data

This data contains 128-channels of 53 subjects. This data is flattened and then one hot encode the labels.

Model Training and Evaluation

The appropriate architectures are build and then trained with the preprocessed data. After training it is evaluated and further optimized.

Webpage

The model is deployed in a web page and is used to assess the mental state and provide diagnostic results for the provided EEG signals of a patient.

Challenges



- **Limited Research Data**
A scarcity of comprehensive research data for depression detection models can limit the development and validation of effective tools.
- **Subjectivity**
Mental depression is often characterized by subjective experiences, such as mood and emotional changes, which can be challenging to quantify objectively. It relies on self-reporting, making it susceptible to underreporting or misrepresentation.
- **Heterogeneity**
Depression manifests differently in individuals, with a wide range of symptoms and severity levels. This heterogeneity makes it difficult to establish a one-size-fits-all detection approach.

References

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Thank You

Rohit Kanna PR - Team Leader

Adarsh MS

Andrea Shiny JA

Arun Balaji DN

Vidya Sagar M