HACKX MUJ 2.0

Round 1 Idea Submission

CodeTrio

Tanmay Talreja, Ananya Sinha, Subhojeet Roy

Healthcare

Brain Signal Analysis for Attention Identification

HACKX MUJ 2.0

CodeTRIO

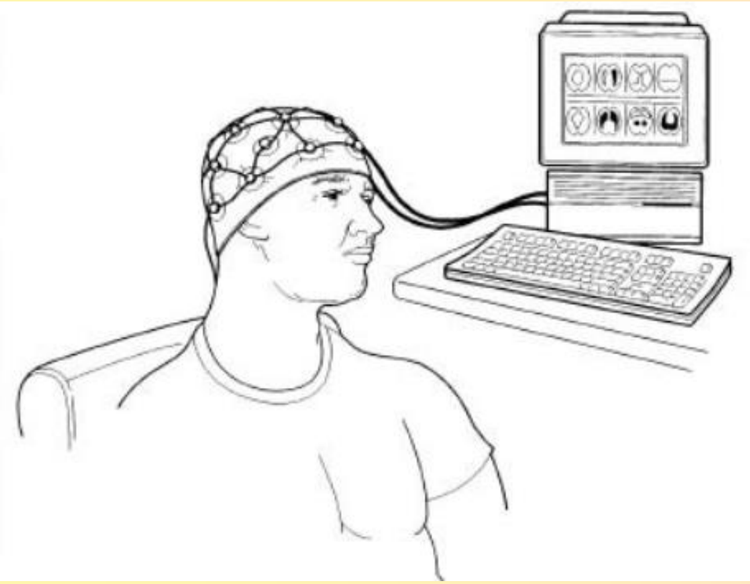
BRAIN SIGNAL ANALYSIS

PROPOSED SOLUTION:Develop a machine learning model that processes EEG data to distinguish between different states of attention.

- The solution involves analyzing EEG signals to detect attention levels by extracting frequency bands and time-frequency features, classifying brain states into focused or unfocused using machine learning algorithms like Random Forest.

Technology used

Key technologies include Python, NumPy, SciPy, and scikit-learn for data processing, RandomForest for classification, EEG hardware for signal collection, and Short-Time Fourier Transform (STFT) for feature extraction from brainwave data.

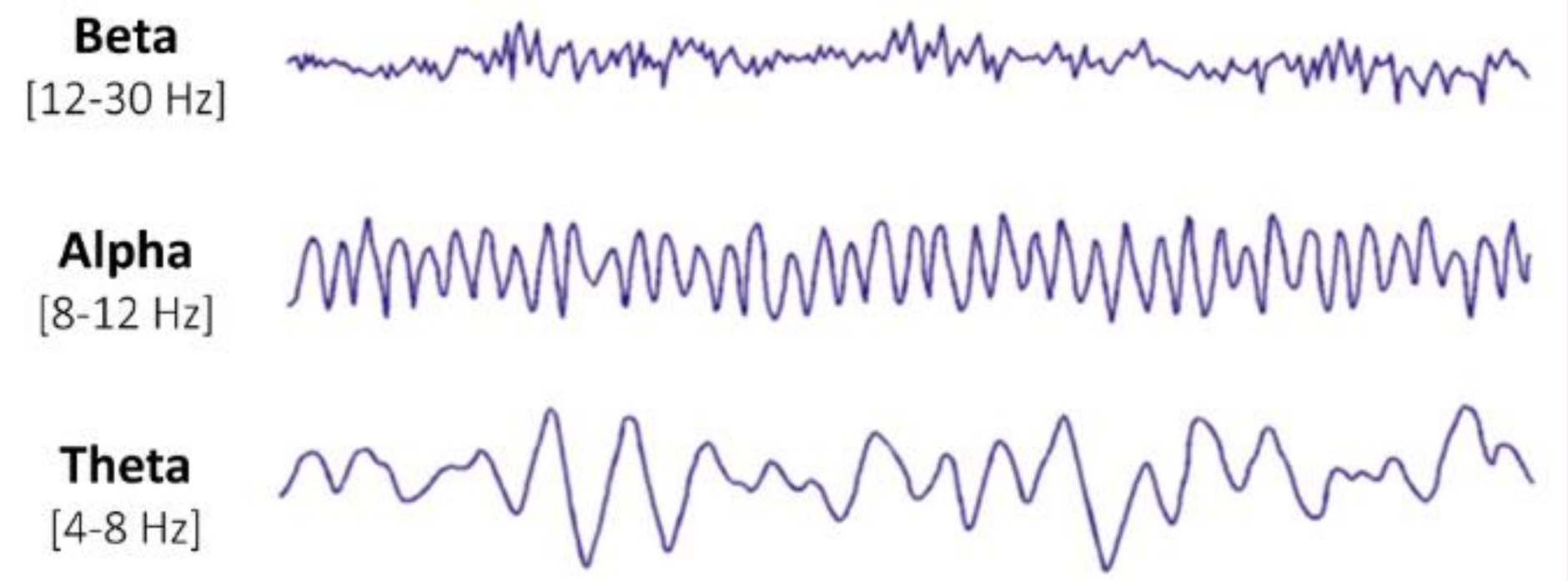


Methodology and Process of Implementation

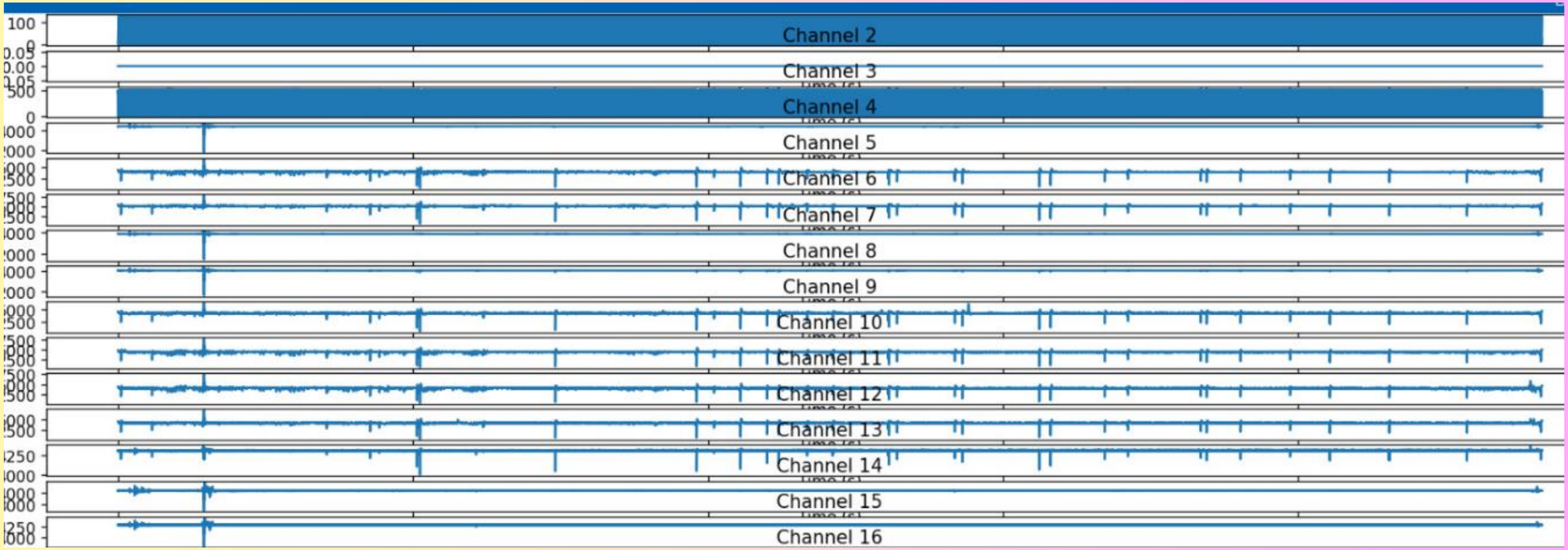
The process includes EEG data acquisition, preprocessing with filtering techniques, feature extraction using STFT

1. **Alpha-Beta Ratio**: The alpha-beta ratio is calculated by dividing the power of the alpha band by the power of the beta band. A higher alpha-beta ratio is typically associated with a more relaxed or unfocused state, while a lower ratio is associated with a more focused state.
2. **Theta-Beta Ratio**: The theta-beta ratio is calculated by dividing the power of the theta band by the power of the beta band. A higher theta-beta ratio is typically associated with a more drowsy or unfocused state, while a lower ratio is associated with a more focused state

Frequencies of EEG Signals



Input data



.mat file containig containing EEG plots

Feasability and Viability

- The solution is technically feasible with current EEG hardware and data processing tools.

Although challenges like noisy data, variability in brainwave patterns, and real-time processing may impact viability and require further research and testing.

- **Potential Challenges and Risks**

Significant challenges include inconsistent EEG signal patterns across individuals, noise and artifacts in the data, and potential difficulties in achieving real-time, high-accuracy classification of attention states, which may impact the model's effectiveness.

- **Strategies for Overcoming These Challenges**

Mitigation strategies include refining data preprocessing steps, implementing advanced filtering techniques, improving feature selection, and tuning model parameters to enhance classification accuracy and robustness against noise and signal variability.

Impacts and Benefits

- The system could enhance focus tracking in educational settings, improve cognitive load monitoring in medical diagnostics, and boost productivity by providing real-time feedback on attention levels, helping users optimize their performance and concentration.

Conclusion

EG-based attention detection systems present a valuable tool for analyzing brain states. With robust signal processing and machine learning models, this approach holds promising potential for diverse applications, from education to healthcare.

THANK YOU