Weekly Work Report 10/25/2024

**Response to Last Week’s Feedback:**

* **Applied additional methods, including Neural Networks, and compared the results to other models.**
* **Used the entire sequence as input for a more comprehensive analysis.**

**This Week:**

* **EEGNet is used for classification.**
  + **Classification of Impasse vs. Non-Impasse Moments**
  + **Classification of Aha! vs. Non-Aha! Moments**
* **Finished entire sequence dataset processing**

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**Data:**

* EEG data capturing brain activity during various mental tasks.
* Participants: **12 individuals** performing activities like **math**, reading, and relaxation.
* Preprocessed EEG signals with **metadata** and **task annotations**.
* Ideal for mental state classification, cognitive load analysis, and brain-computer interface studies.
* Dataset link: <https://physionet.org/content/eegmat/1.0.0/>

[*Zyma I, Tukaev S, Seleznov I, Kiyono K, Popov A, Chernykh M, Shpenkov O. Electroencephalograms during Mental Arithmetic Task Performance. Data. 2019; 4(1):14. https://doi.org/10.3390/data4010014*](https://doi.org/10.3390/data4010014)

**Task:** classify EEG signals into different states **(Rest state or Task State)**

**Features**  
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**Modeling and Classification**

* **EEGNet:** A compact convolutional neural network tailored for EEG signal classification.
* **Tsception:** A temporal convolutional neural network designed for time-series data.
* **ATCNet:** Attention-based Temporal Convolutional Network focusing on important time-series features.
* **LSTM RNN:** A Long Short-Term Memory Recurrent Neural Network to capture temporal dependencies in the EEG signals

**Result**

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EEGNet:

EEGNet is a compact and efficient convolutional neural network (**CNN**) designed specifically for EEG signal classification. It uses depthwise and separable convolutions to reduce computational complexity while capturing both spatial and temporal dependencies in EEG data.

Architecture:

Input -> Temporal Convolution -> Depthwise Convolution -> Separable Convolution -> BatchNorm -> Activation -> MaxPooling -> Dropout -> Dense (Classification)

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**Impasse vs non-impasse**

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**Aha vs non-aha**

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**Impasse vs Aha**

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**Compare to them**

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Result of EEGNet:

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Result last week: Impasse vs non-impasse



Result last week: Impasse (1) vs Aha (0)



**Others:**

I am exploring a new feature extraction approach using a **sliding window** technique.

**Next Week:**

* Conduct a literature review on labeling, brain structure, and functionality.
* Finish processing additional signals, including EDA and pupil data.
* Explore results using different models.

**Next Month:**

* Compare Aha!/Impasse classification using
  + physiology signals
  + EEG
  + physiology signals + EEG

**Final Goal:**

* Explore the dynamics of **Attention**, **Impasse**, and the **"Aha!"** moment.