A Related Works

Model Architecture Design Within the domain of EEG classification, significant research efforts have centered on optimizing established models like Recurrent Neural Networks (RNNs) and Convolutional Neural Networks (CNNs) for enhanced performance [11]. [24] explored the potential of Long Short-Term Memory (LSTM) networks and their stacked variants, while [28] focused specifically on LSTMs-B with Swish activation and bagging ensembles. Further investigations by [9] and [27] extended to BiLSTMs and attention-based models for visual object classification based on EEG signals. While RNNs excel at capturing temporal dynamics, concerns regarding potential overfitting due to limited spatial information extraction remain. This contrasts with CNNs, which demonstrate strong efficacy in EEG classification by effectively extracting relevant brain activity features. [14] solidified the value of CNNs in this domain through their compact EEGNet architecture specifically designed for EEG-based brain-computer interfaces. Further emphasizing the versatility of CNNs for EEG data, [21] proposed EEGChannelNet, employing 1D CNNs for robust feature extraction. These advancements reflect the ongoing pursuit of improved performance and adaptability in EEG classification through continued model optimization and innovation.

Feature Enhancement Prior research has significantly improved EEG feature data for better classification accuracy. [21] and [24], [10] pioneered the use of a Siamese network architecture to learn a joint embedding between EEG signals and images. This approach maximizes the similarity between embeddings from both modalities, thereby enhancing the model's representational power for EEG-based visual classification tasks. Further advancing EEG data utilization, [19] introduced an innovative approach to transforming EEG signals into grayscale heatmap representations. This conversion from 1D signals to a 2D image format leverages the strengths of Convolutional Neural Networks (CNNs) by making relevant features more readily extractable for classification tasks. These advancements demonstrate the ongoing focus on enriching EEG feature data to unlock its full potential for accurate and reliable brain-computer interaction.