Deep Learning Based Brain-Computer Interface for Motor Actions

Patil, Aryan (School: Lincoln Community School)
De, Samaira (School: Lincoln Community School)

Brain-computer interface (BCI) enables direct communication between the brain and external devices, with applications ranging from the rehabilitation of motor disabilities to enhance human-computer interaction. Given the complexity, high dimensionality, and noise inherent in the brain signals, we employed advanced machine learning techniques, specifically deep convolutional neural networks, to interpret these signals for control purposes. Our methodology included collecting, cleaning, and preprocessing EEG data for motor imagery using a Muse-2 headset, followed by training a model to predict imagined movements (left or right). The performance of this model was rigorously evaluated and fine-tuned for optimal accuracy. We successfully deployed the model in a real-time system, where live EEG data, steered a game of pong, thereby demonstrating the practical viability of EEG-based BCIs for motor control. This prototype serves as a proof of concept, highlighting the potential of such systems in rehabilitation and paving the way for further research and development in the field of assistive technologies.