ABSTRACT

In Indonesia, there are at least 10 million individuals with various forms of disabilities, representing 4.3% of the population based on the latest census. With the advancement of technology, many robots have been developed to make human life easier and more efficient. Brain-computer interfaces (BCIs) are emerging as an alternative to control robots by interpreting human brain signals. MI-BCI systems primarily make use of electroencephalogram (EEG) to measure brain activity.

The system begins with data acquisition, where a series of data is collected to form the dataset. After assembling the dataset, pre-processing is conducted to filter the EEG signals and select appropriate channels using the Band pass filter and Independent Component Analysis (ICA) methods. The EEG signals undergo feature extraction using PSD. Energy calculation and energy selection are performed on each channel in order to obtain the most optimal channels. Subsequently, classification is carried out using the Convolutional Neural Network (CNN) method to determine the robot arm movements. The results of this system are analyzed to draw conclusions from the research.

The result of feature extraction from the EEG signals using the PSD technique is a set of feature values with a dimension of 70 row x 129 columns for each EEG data from the EDF files used in this study. These feature results are then divided into two groups, namely Train Data and Test Data, where the Train Data will be used for the classification process to determine the movement of the right or left hand. The method used for the classification process is the Convolutional Neural Network (CNN) deep learning method. The accuracy of the CNN classification results can be calculated through 30 experiments an average accuracy result of 76% was obtained. This value indicates the system's performance in recognizing right-hand and left-hand motor movements from the processed EEG signal data of each respondent in the study.

Keywords: BCI, EEG signal, ICA, feature extraction, CNN