Development of Artificial Neural Network to Determine Hand Activity Using Real Motor Activity from Electroencephalography Signals

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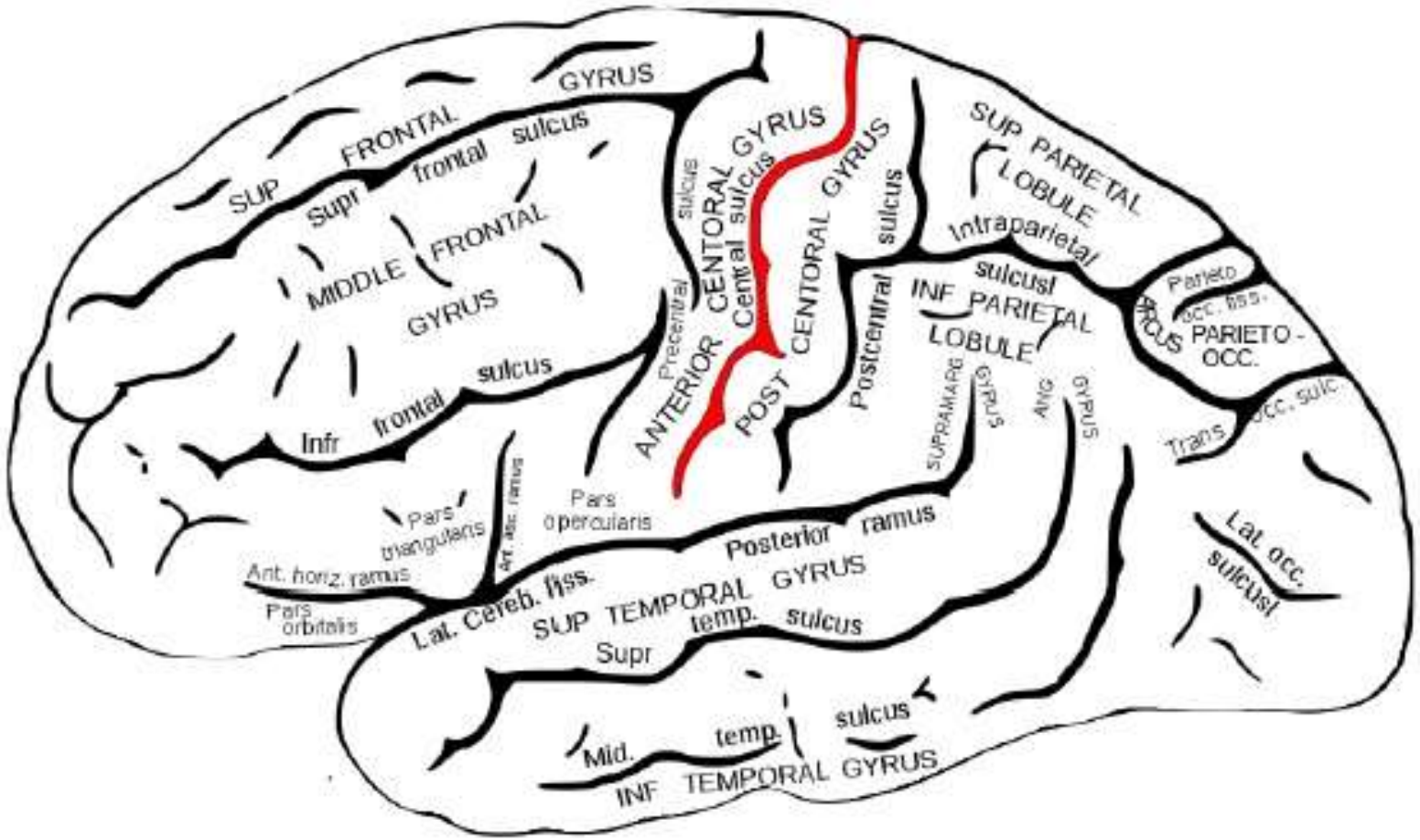
Introduction

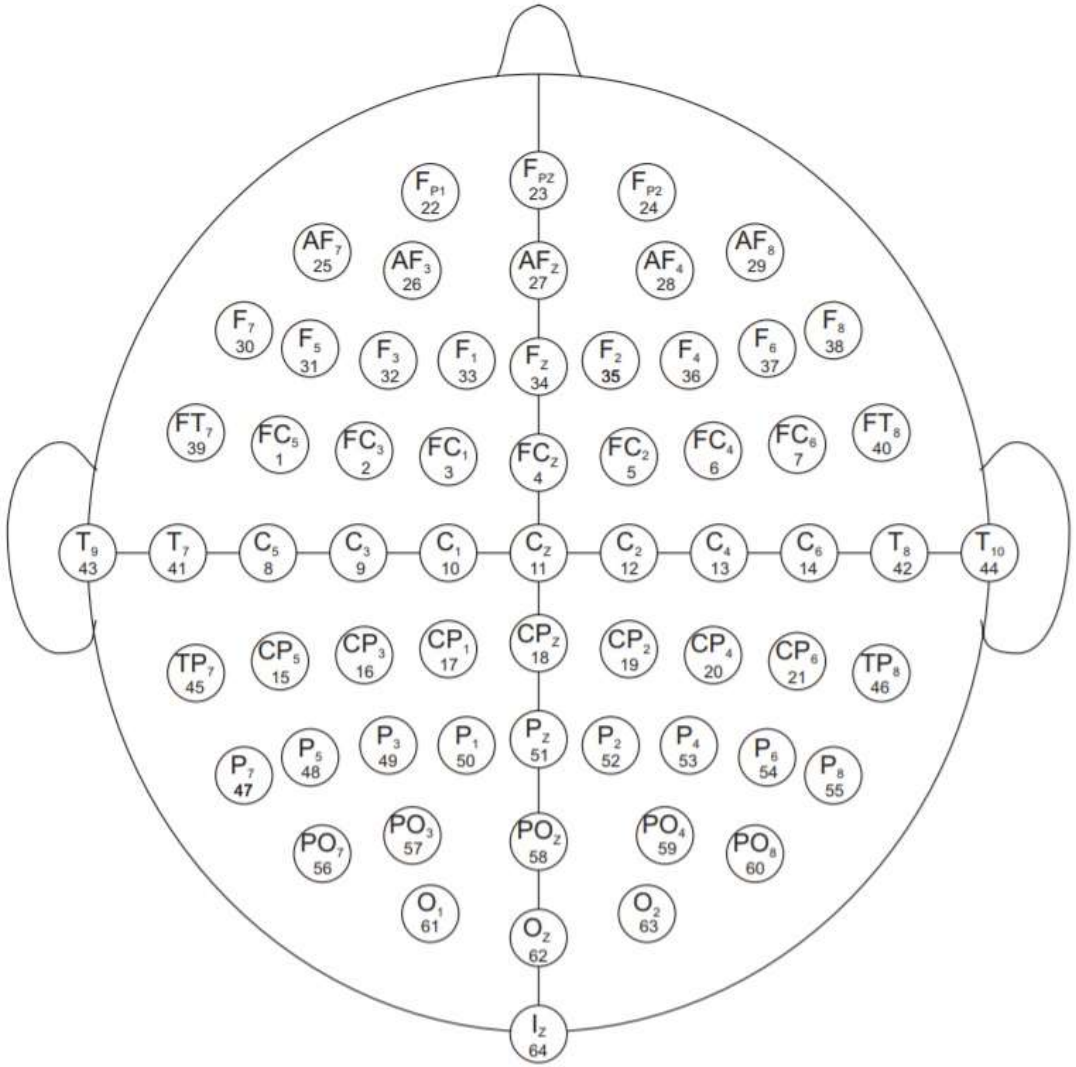
Electroencephalography is becoming increasingly popular to determine brain actions. EEG can be used to understand how the brain works. Different topics have been gone through by many researchers. These are about but not limited to Epilepsy detection, Epilepsy prediction, imaginary motor functions.

Machine learning techniques can be applied to EEG signals to analyse how they work. Afterwards, such systems can be employed in various technological areas. Space technology can be considered as one of these areas.

Central Sulcus



Methods and Materials

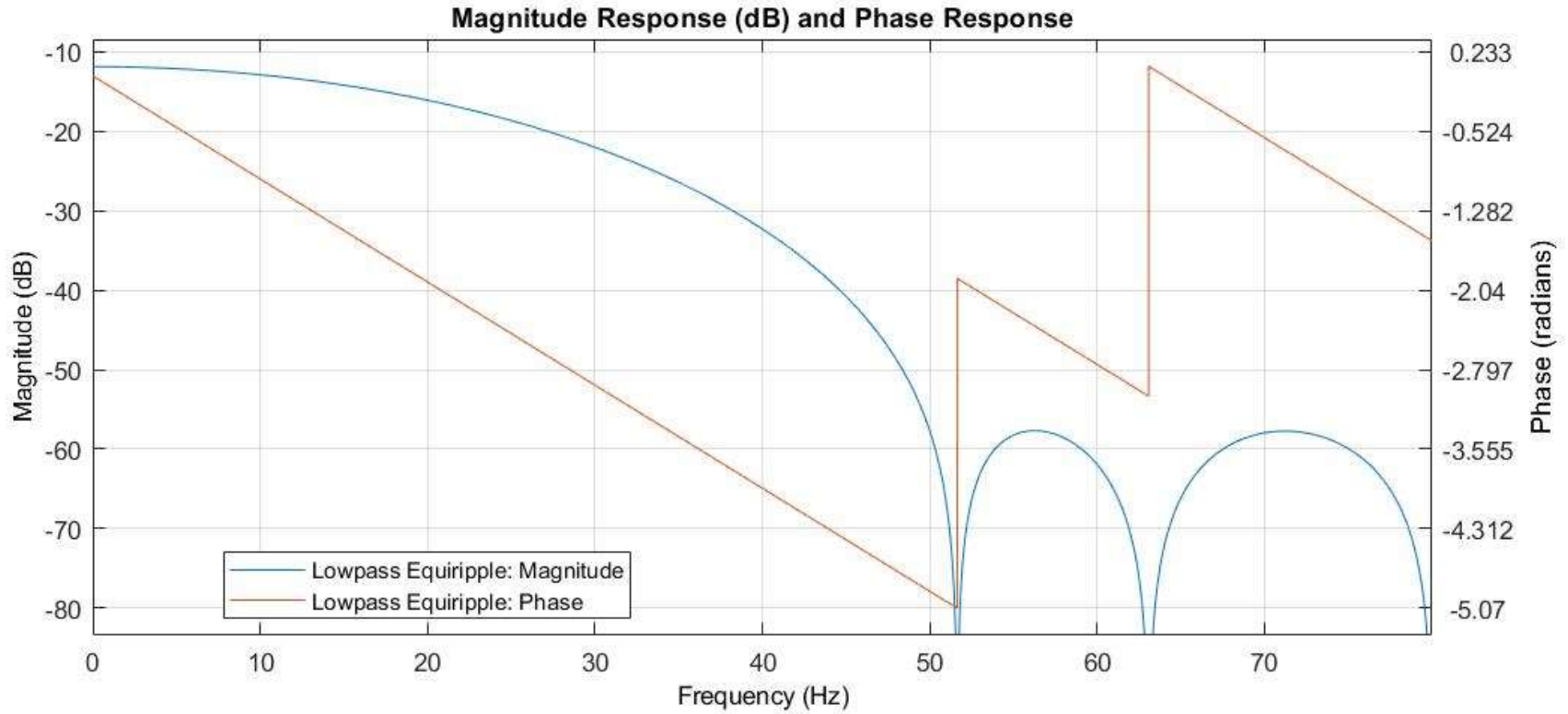


The EEGs were recorded from 64 electrodes as per the international 10-10 system (excluding electrodes Nz, F9, F10, FT9, FT10, A1, A2, TP9, TP10, P9, and P10).

A simple analysis of the action taken can be made by using the signals obtained from task 2, 3, 7 and 11:

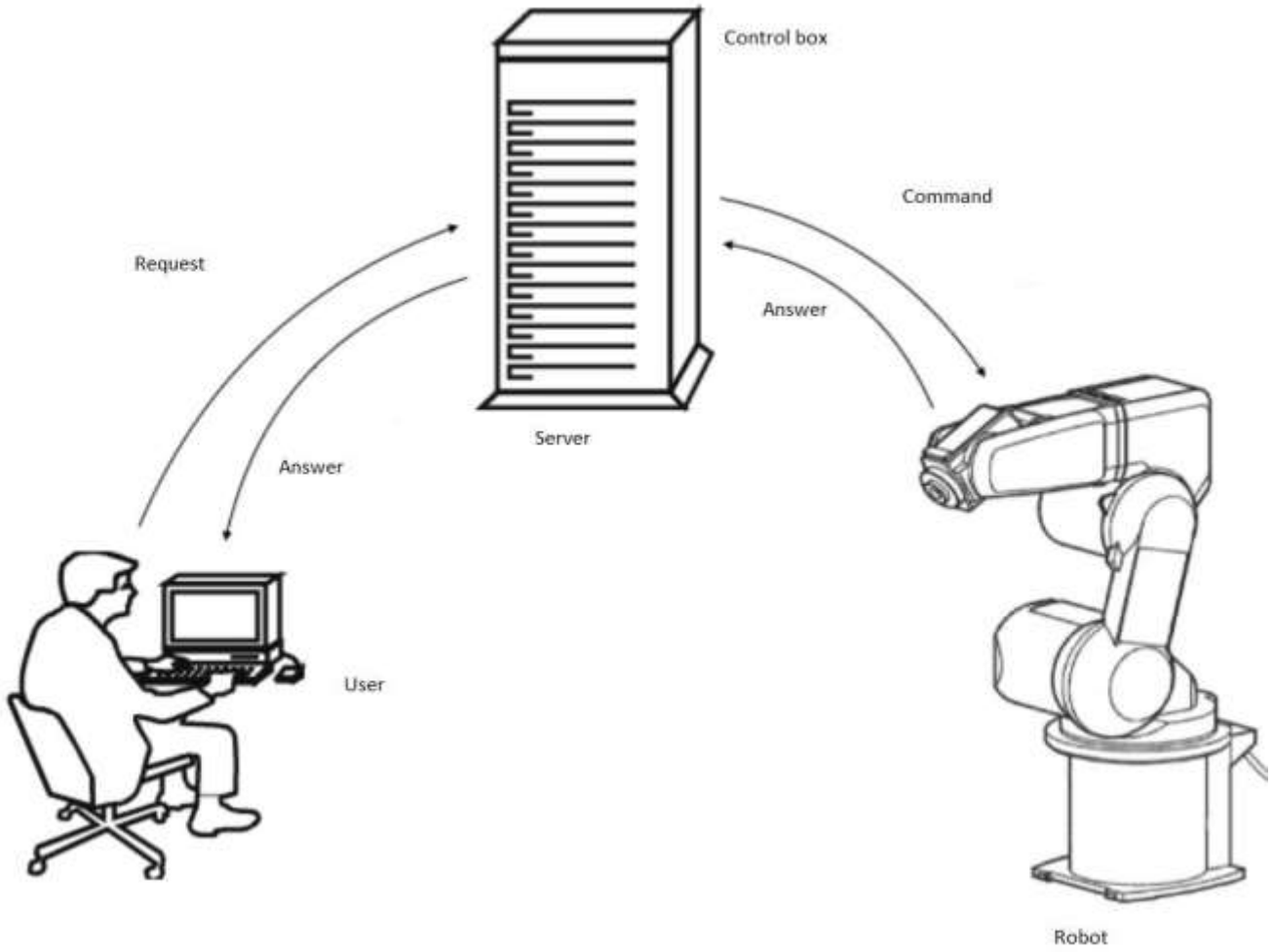
Trial 2 represents no activity with eyes open
Trial 3, 7 and 11 are the repetitions of the same task of where the subjects move either their right or left hands based on given instructions with their eyes open

Methods and Materials

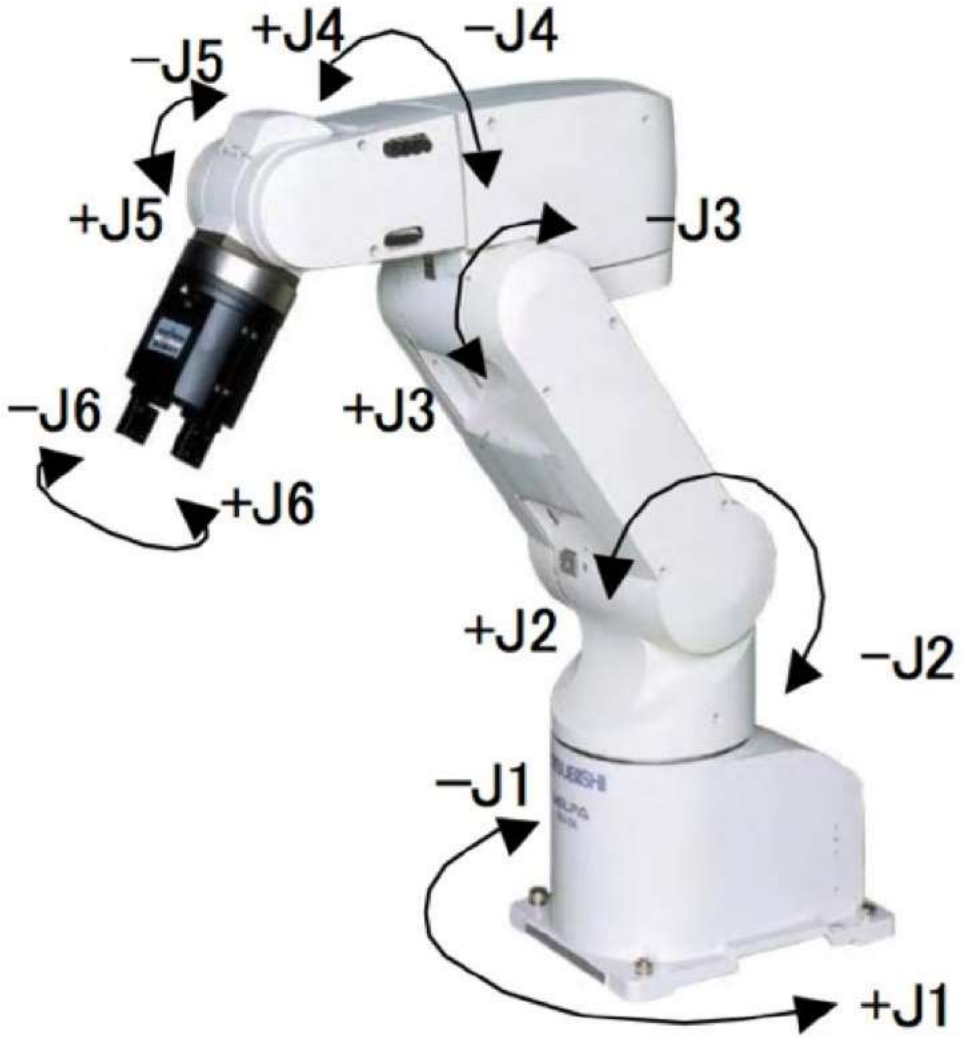


Filter characteristics showing the frequency and phase response of the 50 Hz Equiripple low pass FIR filter with filter order five and stopband attenuation at 80 dB.

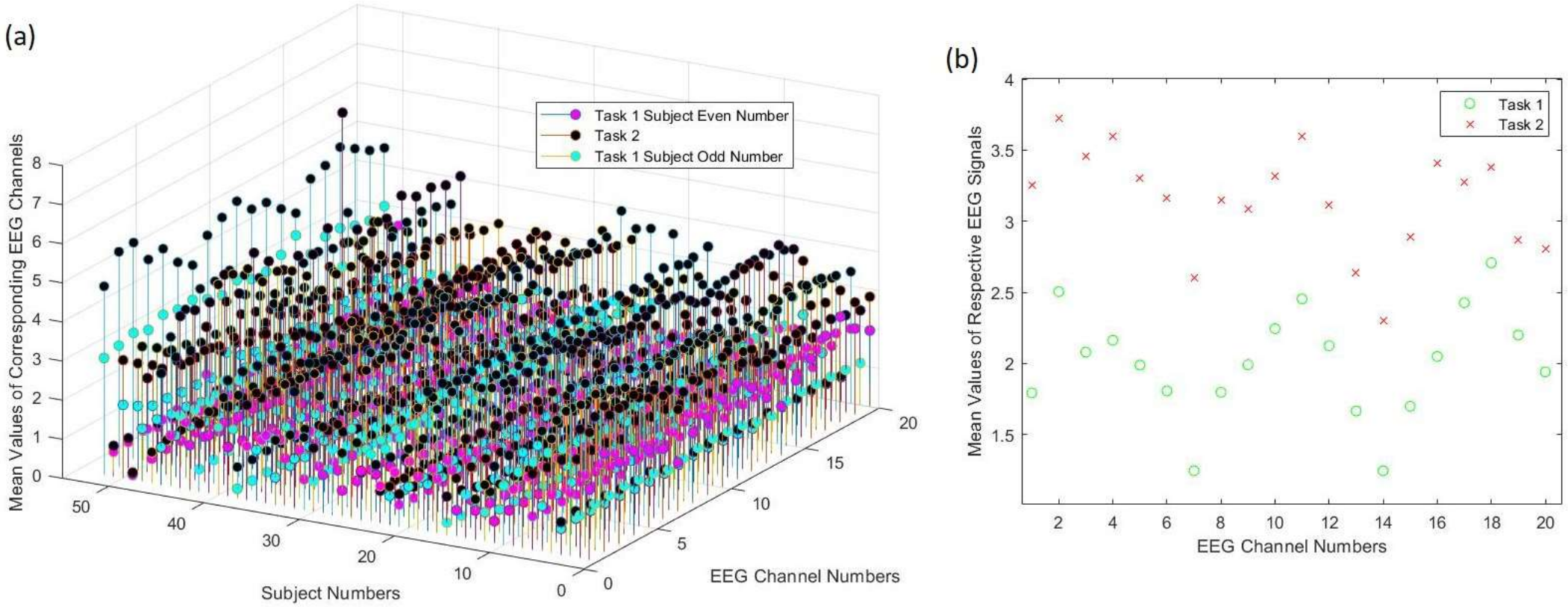
Methods and Materials



Laboratory setup: Mitsubishi Melfa RV-3SDB
with high resolution camera to check on progress from afar

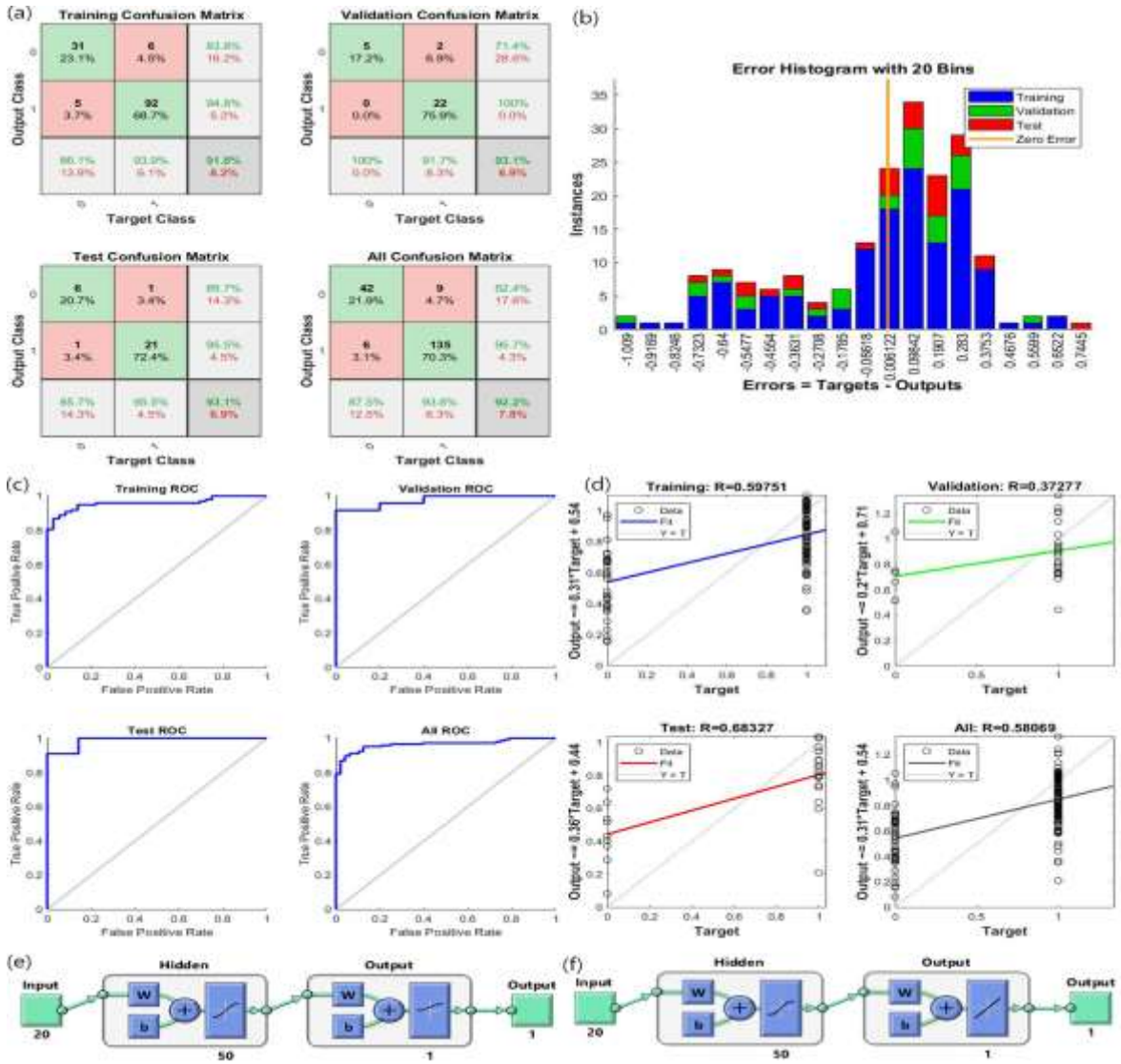


Data and Results



Mean values of tasks 1 and 2 for 20 channels: (a) for all 52 subjects and (b) for subject 5

Data and Results



(a) Confusion matrix of pattern recognition neural network; (b) histogram of error rate of fitting neural network; (c) receiver operating characteristic of pattern recognition neural network; (d) regression of fitting neural network; (e) pattern recognition and (f) fitting neural networks