Development of an EMG Signal Acquisition System for Hand Gesture Classification

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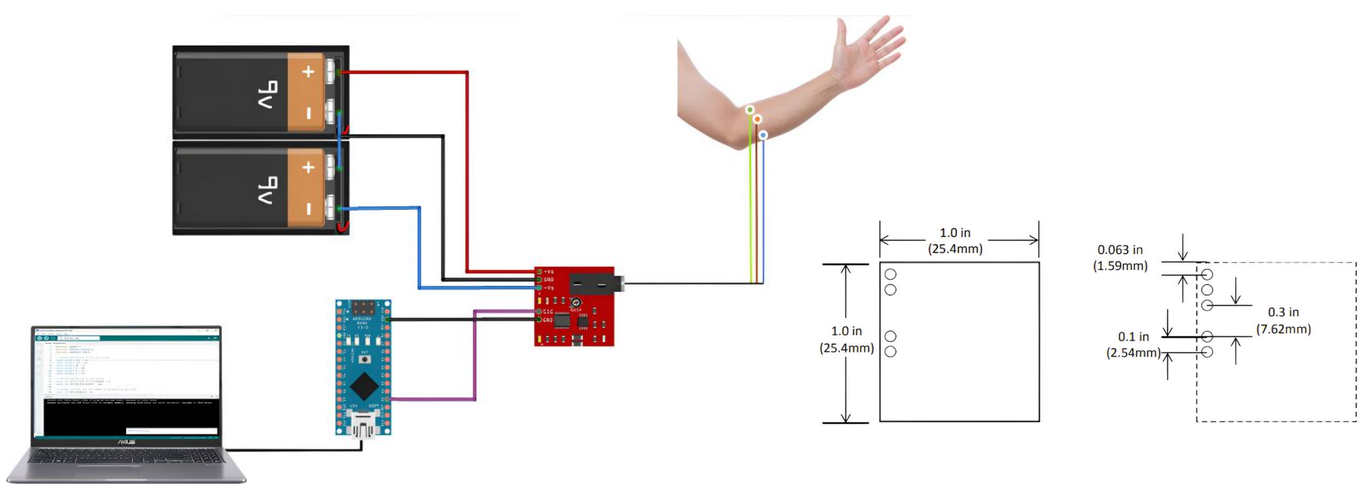
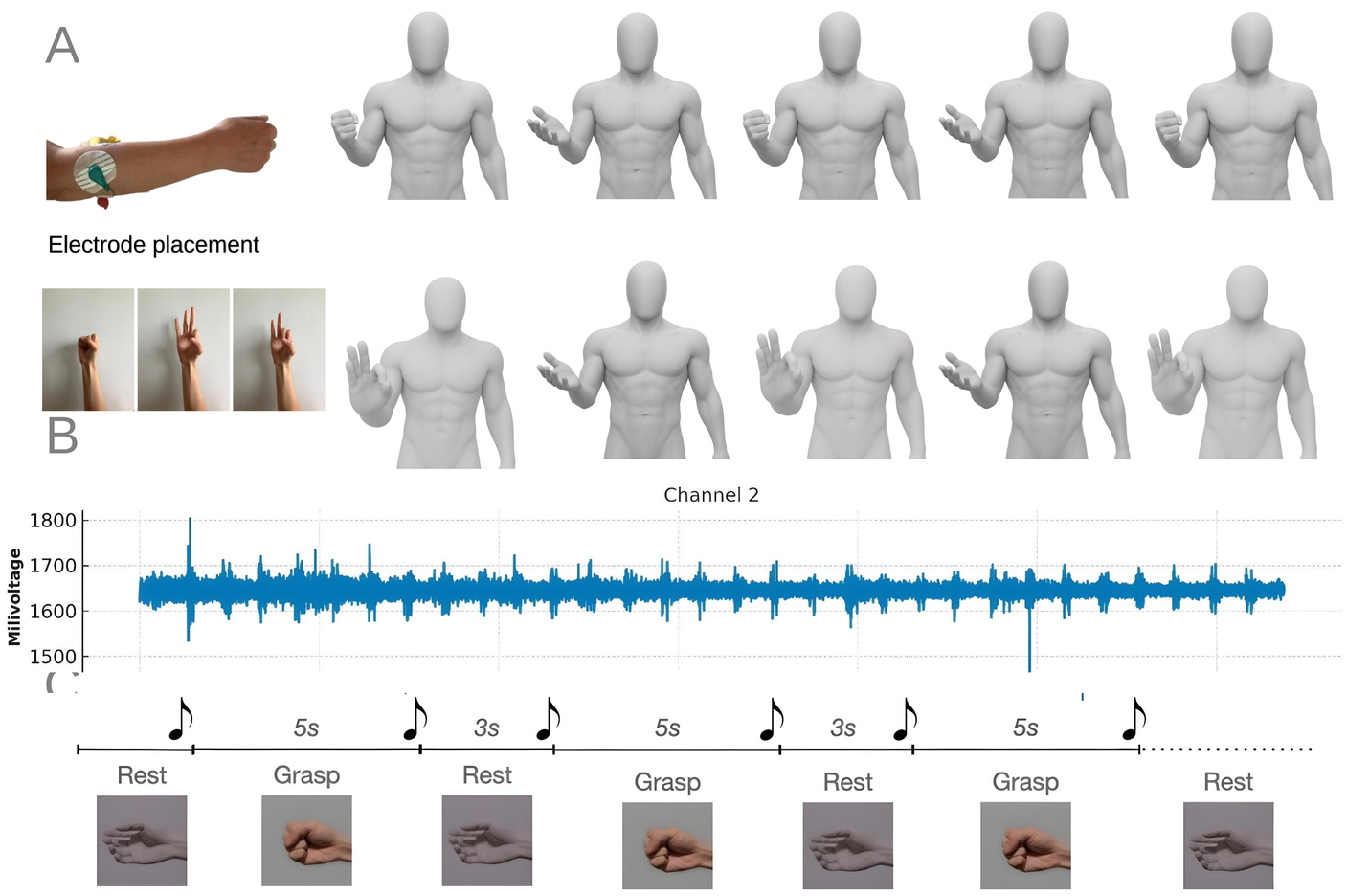
BACKGROUND

Electromyography (EMG) records muscle activity and is widely used for diagnostics, rehabilitation, and controlling prosthetic limbs. Myoelectric prostheses use EMG signals to enable natural hand movement, but accurate movement classification remains challenging due to signal variability and noise. Improving EMG signal acquisition and analysis is essential for developing more effective, user-friendly prosthetic devices. This work Developed a three-channel EMG signal acquisition system with three electrodes and evaluated various machine learning algorithms for classifying three distinct hand movements. SVM with RBF kernel achieved up to 72.6% classification accuracy; increasing electrode channels is recommended for improved precision

METHOD

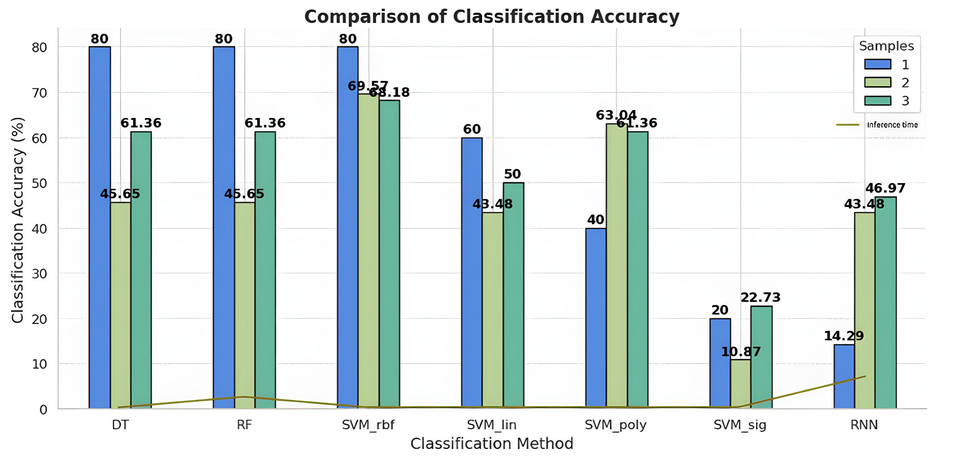


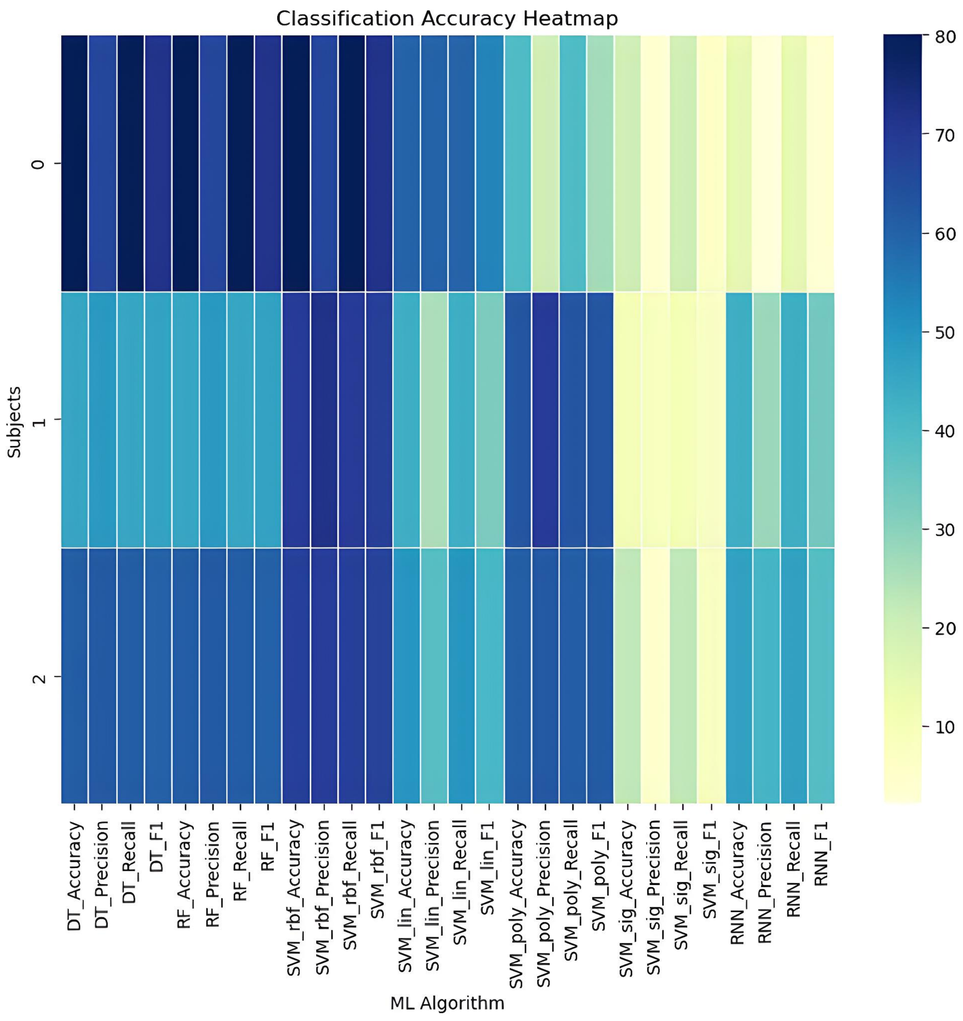
The schematic view of proposed EMG acquisition system.



Three healthy volunteers participated in the study. Surface electrodes were placed on the forearm, and EMG signals were recorded while each subject performed three different hand movements (finger flexion patterns). Each movement was repeated 30 times, with 3s. rest periods in between, and the signals were digitized and labeled for further analysis

RESULTS





Classification accuracy for distinguishing hand movements using various algorithms (SVM, Random Forest, Decision Tree) across three subjects.

CONCLUSIONS

The developed EMG system with three electrodes can classify basic hand movements using machine learning, with SVM (RBF) performing best (72.6%). However, classification accuracy varied between subjects. Increasing the number of electrodes and individual model tuning are needed for better performance in prosthetic control.

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