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# An improved Brain-Computer Interfacing (BCI) system using intelligent agents

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Recognizing the brain's regional activity is highly beneficial for researchers who develop mind-controlled machines or computers. Electroencephalography (EEG) is a technology capable of detecting the electrical activity of the human brain, which is a result of the neural interactions incurred in performing brain functions. An accurate and efficient EEG data classification algorithm for real-time user intention detection, is the fundamental requirement of any Brain-Computer Interfacing (BCI) system. In this research, a Multi-Agent System (MAS) with Artificial Intelligence (AI), for improved accuracy and minimized computational cost, is employed in real-time EEG data classification. The accuracy of the MAS classifier was confirmed by comparing to different configurations of existing algorithms; Neural Networks, Decision Tree, Discriminant Analysis, Support Vector Machines (SVM) and K-NN using built-in tools available in MATLAB. The existing and MAS classification algorithms were evaluated using over 1,800 EEG data from ten (10) subjects and validated with V-fold cross-validation (MAS performed the best). A five (5) channel (AF3, AF4, T7, T8 & Pz) consumer-grade EEG data acquisition device "Emotiv's Insight" was utilized to acquire EEG data during training and real-time analysis, hence the implementation cost could be further reduced. The BCI system was tested not only for emulating the basic mouse or keyboard functions, but also for advanced computing tasks such as 3D modelling and programming, which is not accomplished by a typical (existing) BCI system. The overall accuracy of the improved BCI system was evaluated as 81.67%, the best reported in the class of BCIs equipped with consumer-grade EEG devices.

**Keywords:** electroencephalography, Brain-Computer Interfacing, multi-agent systems and EEG data Classification

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