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Poster Presentation

Speech Recognition Based on Bbrain Signals by the Quantum Support Vector Machine for Inflammatory Patient ALS

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Abstract

People communicate with each other by exchanging verbal and visual expressions. However, paralyzed patients with various neurological diseases such as amyotrophic lateral sclerosis and cerebral ischemia have difficulties in daily communications because they cannot control their body voluntarily. In this context, brain-computer interface (BCI) has been studied as a tool of communication for these types of patients. In this study, the reliability of electroencephalography (EEG) signals in discriminating between different covert speech tasks is investigated. Twelve participants, across two sessions each, were asked to perform multiple iterations of three differing mental tasks for 10 s each: unconstrained rest or the mental repetition of the words “no”, “yes” and “rest” A Quantum Support Vector Machine was used to classify all three pairwise combinations of “no” or “yes” and “rest” trials and also for ternary classification. In Results An average accuracy of 0.94% ± 2.6 was reached in the classification of covert speech trials versus rest, with all participants exceeding chance level (0.95%). The classification of “no” versus “yes” yielded an average accuracy of 0.93 ± 0.6 with ten participants surpassing chance level (0.95). Finally, the ternary classification yielded an average accuracy of 0.93% ± 0.4. with all participants exceeding chance level (0.96%). The proposed QSVM algorithm provided significantly higher accuracies compared to some of the most common classification techniques in BCI. To our knowledge, this is the first report of using QSVM for the classification of EEG covert speech across multiple sessions. Our results support further study of covert speech as a BCI activation task, potentially leading to the development of more intuitive BCIs for communication.

Keywords: Inflammatory Patient Als, Brain Signal, Silent Speech Persian, Quantum Support Vector Machine

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