EEG CORRELATES OF HIGHLY COGNITIVE MENTAL TASKS FOR CLOSED-SET BIOMETRIC AUTHENTICATION

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There is emerging research that has explored signal processing tools in order to quantify bio-electric signals as unique descriptors of human identity. In this regard, using the electroencephalogram (EEG) as a biometric is relatively new and is inspired by Vogel's claim that electrical activity of the brain is genetically determined.
Our work seeks to establish a one-to-one correspondence between identity of a healthy individual and certain features of his/her EEG signal. This task is studied under three paradigms viz. experimental design, signal representation or modeling and pattern classification. In our experiments, EEG recordings are obtained from a closed set of subjects who are asked to perform precise and highly demanding mental activities. The two experiments studied are *Mental Arithmetic* and *Bifoveal Fusion of Cyclopean Stereograms*. This choice of highly cognitive tasks is motivated by the two desired characteristics of repeatability and uniqueness. EEG signal epochs are represented using a linear prediction model, which has been used successfully in the past for signal compression and reconstruction. Both LP co-efficients and LP cepstral co-efficients are used separately as feature vectors during classification, with preference to the latter for reasons of lower dimensionality and higher consistency. A K-Nearest Neighbour classifier is used. Order of the LP model and the classifier are determined empirically (using bootstrapping) for each mental activity. Within class accuracies vary between 87 - 99% for mental arithmetic and between 87 - 100% for binocular fusion, in each case, for a 4 person dataset. Thus, a test for person identification based on features extracted from the EEG is proposed.