

EEG-based monitoring of the focused attention related to athletic performance in shooters

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Electroencephalogram (EEG) signal patterns, differ with level of expertise in rifle shooting due to the level of focused attention and posture control exhibited by variously skilled shooters. The aim of this study is to correlate EEG-based data including the posture control related ones with shooting performance to propose an assistive system for shooters training. 9 rifle shooters including 6 elite shooters participated in the experiment. 2 assessment sessions were carried out at shooting range. Each participant underwent the field-based test of 40 shots at a 10m air rifle range. During the field-based tests, participants' real-time brain activity was recorded via the 14 electrodes of Emotiv EEG device. The pre-shot 4 seconds EEG data of each of the 40 shots was processed and analysed against the shooting performance. To find out the correlation between EEG data and shooting performance, we extracted different types of EEG-based indexes including posture control related ones and recognized the shooters emotion and mental workload levels right before they pulled the trigger. These indexes and emotion/workload levels were correlated with the shooting scores to understand what are the optimal brain states for "good" shots. The following results were reported after the data analyses. According to the results, we confirmed that EEG-based indexes could be used to reflect the shooting performance of the shooters. Mental workload level of shooters (amount of the mental effort to perform the task) has a negative correlation with the shooting score, which means the lower mental workload before the shot release the better shooting performance. Alpha power has a positive correlation with the shooting score that complies with the literature review that alpha power increases before the best shots compared with the worst shots. The difference of beta power between left and right hemisphere has a positive correlation with the shooting performance for the majority of the participants. The results of the experiment would be used to develop the EEG-based assistive system to improve athletic performance in shooters.