Camera-Based Detection of the Early Stages of Fatigue: Validation with Meg and Self-Assessment Data

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Presentation Abstract Summary The early stages of fatigue are associated with a transient, subconscious decrease in cognitive ability, which can influence decision making. Here, we present a camera-based method that detects the early stages of fatigue. From a 3-hour long experiment conducted on 12 subjects, we acquired synchronous camera (visual) and Magnetoencephalography - MEG (brain) data. We extracted eyelids and head-movement related features and trained Random Forest, K Nearest Neighbor and Support Vector Machine classifiers to distinguish between Non-Fatigue and Fatigue classes, achieving test accuracies of 98%, 97% and 92%, respectively. We then introduced a temporal sliding window method where the binary classification error is used as a metric of the gradual change in fatigue levels, leveraging a progressive increment in detection of Fatigue classes as the window slides towards the later stages of the experiment. For validation, we performed regression between our model's predictions and fatigue-induced alpha band (8-12Hz) power increases in MEG, yielding an average $\rho^2=0.6$. Our results also correlated well with a self-reported behavioral metric. This work describes our ongoing effort to develop a real-time vision-based early fatigue detection system.

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