

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

Submission ID 3000303
Submission Type Poster
Topic Cognitive Science
Status Submitted
Submitter Neelesh Kumar
Affiliation Rutgers University

SUBMISSION DETAILS

Presentation Type Either Poster or Oral Presentation

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 $p^2=0.6$. 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.

Co-author Information

* Presenting Author

First Name	Last Name	Affiliation	E-mail
Neelesh *	Kumar *	Rutgers University	neelesh.kumar@rutgers.edu
Chintan	Trivedi	Dept. of Computer Science, Rutgers University	chintan.trivedi@rutgers.edu

Lezi	Wang	Dept. of Computer Science, Rutgers University	lw462@cs.rutgers.edu
Dimitrios	Pantazis	McGovern Institute for Brain Research, Massachusetts Institute of Technology	pantazis@mit.edu
Dimitris N.	Metaxas	Dept. of Computer Science, Rutgers University	dnm@cs.rutgers.edu
Konstantinos	Michmizos	Computer Science / Rutgers University	konstantinos.michmizos@cs.rutgers.edu

Keywords

Keywords
Computer vision
Magnetoencephalography
machine learning
Fatigue