Combating fatigue with a smartwatch application

Scientists from EPFL, UNIL and local startup be.care have developed a system that uses heart rate variability to detect fatigue and identify what kind it is. The system then uses the results to suggest lifestyle changes that can make a difference. An initial test has been carried out on university students under real-world conditions.

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Stress and fatigue have major health consequences and generate substantial costs for society. However, fatigue levels among individuals are rarely measured. That's why scientists from EPFL's Embedded Systems Laboratory (ESL), the Lausanne University Institute of Sport Sciences (ISSUL), the Lausanne University Sports Center and be.care have developed a system for easily measuring those levels and determining what kind of fatigue patients are suffering from in order to provide targeted recommendations.

We often speak of fatigue in the singular, but there are actually different kinds. Which one you suffer from can be identified by monitoring heart rate variability – that is, the number of milliseconds between two heart beats. "If your sympathetic nervous system is affected, then you suffer from what we could call agitated fatigue, like when you're so tired that you can't sleep," says Grégoire Millet, an ISSUL professor and co-founder of be.care. "But if your parasympathetic nervous system is affected, then you suffer from what we could call lethargic fatigue, where you don't want to do anything."

The treatments for these two types of fatigue are very different, whether in terms of how much exercise you should get or the kinds of foods should you eat, especially amino acids. In fact, getting these things wrong could make your condition worse.

A field study on university students

The scientists' application connects to an Android smartwatch and chest-strap heart-rate monitor and measures the user's heart rate variability. They tested it on university students by taking two sets of measurements daily: one during their regular physical activity; and the other during an orthostatic test (which is a special kind of test used for measuring heart rate variability). "Students had to lie down for five minutes and then stand up suddenly and remain standing for five minutes. That told us whether their central nervous system had been affected by fatigue," says Elisabetta de Giovanni, a PhD student at ESL investigating the design of next-generation multi-parametric smart wearables under the supervision of David Atienza, a professor at the EPFL School of Engineering. The study was carried out on around 70 students over three months.

The data collected during the study was processed so that they could be analyzed using the algorithms developed by be.care. This Lausanne-based firm has come up with a unique method for measuring, classifying and treating fatigue. The recommendations given to patients depend on the results of the algorithms' analysis, and include suggestions for both diet and exercise. In addition to Professor Millet, other be.care experts who worked on the study are Dr. Nicolas Bourdillon; Dr. Pascal Zellner, a specialist in connected healthcare; and Dr. Laurent Schmitt, a specialist in sports physiology.

Even better results thanks to a questionnaire

To make their system even more effective, the scientists asked the students to fill out a questionnaire indicating their sleeping patterns, any pain they experience, how heavy their workload is, how much stress they are under and how much exercise they get. Then the scientists matched the students' responses with their heart rate variability data, and used these pairings to train the algorithms to recognize what heart-rate measurements correspond to which symptoms – and therefore what kind of fatigue. The goal is to enable the algorithms to correctly detect and identify the kind of fatigue a patient is experiencing.

The scientists are still developing their application

and will use it in a second phase of the study, to determine whether there is a positive or negative correlation between physical activity and fatigue.

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Funding

- Wellness Monitoring Project financed by the Fondation pour les Etudiants de l'EPFL (FEE).

- PhD Research Grant from Inter-University Micro-Electronics Center (IMEC), Belgium, titled "Resilient Design of Ultra-Low Power and Inexactness-Based Cyber Physical Systems".

References

Elisabetta De Giovanni, David Atienza, Srinivasan Murali, Francisco Rincon, "Ultra-Low Power Estimation of Heart Rate Under Physical Activity Using a Wearable Photoplethysmographic System", Proc. of the 19th IEEE DSD Conference, Sep. 2016.

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Source: Mediacom