Wearable Machine Interface System for Tracking and Controlling Mental Stress using Wrist-Worn Wearable Devices

Summary

Wrist-worn wearable devices provide rich sets of pulsatile physiological data under various modalities and circumstances. An unexploited capability is that the pulsatile physiological time series collected by wrist-worn wearable devices can be used for recovering internal brain dynamics. Inferring the underlying neural mechanisms and reconstruction of the mental-stress-related brain dynamics could potentially be accomplished entirely through wrist-worn wearable devices. The method is validated by analyzing electrodermal activity (EDA) pulsatile data in the context of mental-stress-related arousal, and can be extended to other pulsatile physiological signals (e.g. cortisol, heartbeat data). This proposal's outcomes will be (1) a portfolio of wrist-worn wearable-device-based brain decoders that can be optimized to exploit the constraints of a given clinical application and wrist-worn wearable device data collection capabilities; (2) a toolbox of bio-inspired controllers that can have inhibitory and excitatory effects for maintaining a neural state within a desired range.

Competitive Advantages

- Seamless recovery of neural stimuli from non-brain signals using wristband-like wearables
- Capable of being integrated into existing devices (e.g. smartwatch, fitness tracker) or standalone functionality
- Dynamic tracking of neural states from non-brain physiological signals in real-world environments (e.g. stress and fatigue)
- Control mechanism for maintaining a neural state within a desired range

Meet the Inventors

Rose T. Faghih, PhD, Assistant Professor

Md. Rafiul Amin, Dilranjan S. Wickramasuriya, Hamid F. Azgomi
Electrical and Computer Engineering

Problem Addressed

- Cumbersome nature of day-to-day neural state monitoring with EEG headsets (e.g. in social settings)
- Need for automated stress management (stress increases cardiovascular disease risk)
- Inability to acquire real-time neural state feedback from loved ones (e.g. elderly parents, young children), students and employees (e.g. optimize work schedules)

Applications

- Wearable electronics
- Detect and manage human stress and anxiety automatically (e.g. workplace, piloting, driving)
- Learning experience evaluation including e-learning
- Remote elderly person or care-recipient monitoring

Patents

- US 62614070-Provisional US Application

Contact

George Gillespie.
Technology Transfer Associate
oipm@Central.uh.edu | 713-743-1053
Case ID: 2018-021

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