Columbia Technology Ventures

Real-time, unobtrusive correlation of brain activity to environmental stimuli

Technology #cu13178

The advent of smartphones, tablets, and other portable electronics has provided consumers with new, high-tech ways to interact and function within various environments. Most of these portable electronic devices afford a certain degree of user autonomy; a user must consciously decide to interact with a device and physically perform a certain action to operate their device. However, due to advancements in sensor technology and signal processing, passive interaction with these devices can be made possible. This technology is a head-mounted, wearable electronic cap consisting of a variety of electrodes capable of performing EEG measurements of brain activity. When integrated with other sensors providing information about the user, this device can classify a user’s engagement and response to various stimuli. Thus, this technology can serve in the capacity of a “mind-reading” personal assistant by continuously observing and recording a user’s interest level when exposed to various environmental elements.

Integration of multiple biomedical sensors creates a hybrid brain-computing interface

This technology exemplifies a hybrid brain-computer interface by combining traditional EEG recording electrodes with other sensing devices to better capture the subjective interest of a user. Eye position and pupil size are tracked in parallel with brain activity, providing a diverse set of characteristics that can be matched to user engagement using machine learning algorithms. EEG signals are analyzed primarily using amplitude-based characteristics, which are more temporally sensitive than frequency-based changes, allowing for precise registration to specific stimuli in a rapidly changing environment. Furthermore, signal recording and processing may be performed in real-time, allowing for instant feedback to the user in addition to long-term storage for longitudinal analytics or data mining applications.

This technology has been tested in human volunteers subjected to a virtual environment in which various advertising billboards are displayed. Results have showed that the integration of EEG, eye position, and pupil size allows users to more efficiently search for interesting stimuli while requiring very little conscious effort.

Lead Inventor:

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Applications:

• Noninvasive assessment of consumer response to marketing
• Personal assistant application for environment interaction
• Monitoring of mood and temperament for patients with psychological disorders
• Memory assistance for patients with Alzheimer’s or traumatic brain injury
• Stress and threat monitoring for military and security applications

Advantages:

• Unobtrusive operation; does not require user input
• Integrates several characteristics of engagement (EEG, eye position, pupil size)
• Can generate diverse data for personal or consumer habit tracking
• Real-time feedback capabilities

Patent Information:

Patent Pending (WO/2014/116826)
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Related Publications:


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