Using Neural Input to Control Google Glass

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Over half a million people in the world who are living locked into their bodies may significantly improve their quality of life through the use of a mobile, non-invasive, brain-computer interface (BCI). Such a breakthrough has recently been made possible through the advanced release of Google Glass, a light-weight, head-mounted display (HMD) unit that contains its own computer processor and allows interactions similar to that of a smart phone (http://www.google.com/glass). The Kennesaw State University (KSU) BrainLab is working to pair neural input with Google Glass in the form of a non-traditional assistive technology (AT) device.

Assistive technology augments a person's functional capabilities. Traditional computer applications and AT devices require muscle movement for input, such as needed to manipulate a mouse and keyboard or a sip-and-puff switch. Brain-computer interfaces, a subset of Neuro-Information Systems, use neurophysiological inputs for non-muscularly controlled computer applications (Wolpaw, Birbaumer et al. 2002) and can therefore be considered non-traditional ATs.

Although they offer significant improvements to the quality of life for individuals with severe motor disabilities, BCIs have their challenges. These challenges range from considerations for the innate abilities of the user to capabilities of the technology, itself (Randolph and Moore Jackson 2010). In fact, interactions are often arduous in nature and mentally fatiguing for users, and the system cannot be fitted without extensive training by the caregiver who is often not a trained technician. To overcome these challenges, this work presents an approach for developing a mobile, light-weight BCI that can easily be fitted by a non-specialized caregiver.

Google Glass is a wearable technology that sits on the user's face. As needed, the user views a screen that is projected on a prism. To activate the interface, the user nods his/her head up or taps a touchpad located along the right side of the unit. He/she may then use touch, wink, or voice commands to interact with applications loaded on the system, conduct searches, take pictures and video, or scroll through saved content.

The director of the KSU BrainLab obtained a unit as one of 10,000 original Google Glass Explorers worldwide. She envisioned that someone with severe motor disabilities would be able to wear this light-weight device to access an assistive interface. Because Google Glass can be paired with an external mobile device, caregivers would have easy-access to support the user.

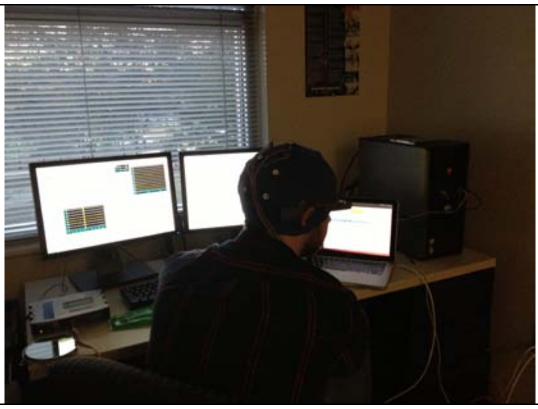

Figure 1. Researcher testing neural interface to Google Glass.

The KSU BrainLab has developed a working prototype that takes input from an evoked brain response to trigger the four basic interface commands for Google Glass: swipe left, swipe right, swipe down, and tap to select. Using open source software and a web interface, brain signals are recorded non-invasively and relayed through the computer to the Google Glass unit where the interface is displayed to the user. Currently, the user is presented with a string of characters from which he/she must select and attend to one. The characters flash in a randomized pattern. When the character the user desires flashes, he/she elicits a neural response approximately 300 milliseconds later, called a P300. This response is noted by the computer and a selection made. This interface is currently working with an artificially-generated brain signal.

The KSU BrainLab is in the process of testing with human participants and streamlining the interface design. The system will be significantly enhanced with a wireless design that allows greater mobility by users. Through the use of neural input to Google Glass, a person with severe motor disabilities may have continuous access to their non-traditional AT and achieve greater independence.

References

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