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Neuroscience 2015

Presentation Abstract

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Presentation Title:	Multi-day self-calibration of a point-and-click communication BCI for people with tetraplegia
Location:	Hall A
Presentation time:	Tuesday, Oct 20, 2015, 8:00 AM -12:00 PM
Presenter at Poster:	Tue, Oct. 20, 2015, 10:00 AM - 11:00 AM
Topic:	++D.18.c. Neuroprosthetics: Control of real and artificial arm, hand, other grasping devices

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Abstract: Brain-computer interfaces (BCIs) aim to restore communication and independence to people with severe motor disabilities by translating decoded neural activity directly into control of a computer cursor. However, nonstationarities in recorded brain activity can degrade the quality of neural decoding over time. Periodically interrupting ongoing use of the BCI to perform decoder recalibration tasks would be time-consuming and impractical. Previously, we showed that typing

performance in a self-paced, neurally controlled point-and-click communication interface can be maintained for hours, despite underlying signal nonstationarities, without requiring the user to pause to perform disruptive calibration tasks. This was accomplished by incorporating 3 decoding software innovations that address different aspects of neural signal nonstationarities: feature mean and variance tracking, decoder output bias correction, and retrospective target inference-based (RTI) decoder calibration, which uses data acquired during practical, ongoing BCI use to recalibrate the decoder. The current study extends self-calibration of the BCI to multiple days. On day 1, a participant diagnosed with amyotrophic lateral sclerosis (ALS) in the BrainGate2 clinical trial (participant T6) performed the usual open-loop and closed-loop decoder calibration center-out tasks with presented targets, and then proceeded to self-paced typing. Then, on days 3, 5, 14, 35, and 42, with the aid of feature tracking and bias correction, the participant was able to proceed directly into self-paced typing using the previous session's last directional and click decoders. The decoders were updated periodically over the course of the day using data acquired during typing, without ever requiring the participant to perform explicit calibration tasks again after day 1. Multi-day self-calibration was also replicated in a 2nd participant with ALS (T9). By eliminating the need for the user to perform daily calibration tasks with prescribed targets, despite nonstationarities in the underlying neural signals, this approach advances the potential clinical utility of intracortical BCIs for individuals with severe motor disability.

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