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NEUROSCIENCE 2014

Presentation Abstract

Program#/Poster#:	252.01/KK4
Presentation Title:	Advancing stability and performance of point-and-click cursor control by people with tetraplegia using an intracortical brain-computer interface
Location:	WCC Hall A-C
Presentation time:	Sunday, Nov 16, 2014, 1:00 PM - 5:00 PM
Presenter at Poster:	Sun, Nov. 16, 2014, 1:00 PM - 2:00 PM
Topic:	++D.18.d. Neuroprosthetics: Control of real and artificial arm, hand, other grasping devices

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Abstract: Point-and-click control of a computer could restore independence and communication for people who are unable to move or speak. Our ongoing BrainGate pilot clinical trial has previously reported accurate real-time decoding

of motor intent in people with tetraplegia. We have previously demonstrated target acquisition times of 5-8s in a standardized task, and continue to pursue faster and more reliable control to create a practical assistive technology. Here, we report methods that have yielded a substantial improvement in speed (2-3s acquisition times) while maintaining the same target acquisition rate. Furthermore, they reduce the need for supervised recalibration tasks with explicitly defined targets, which take time away from practical BCI use. [[unable to display character:  ]] [[unable to display character:  ]] One challenge for point-and-click control using an intracortical BCI is nonstationarity in the recorded neural signals. Without recalibration, this can cause neural control to degrade over the course of minutes or hours. Continuously- and recursively-computed normalization of firing rate means and variances, particularly during periods of rest (between "blocks"), improves control by increasing the stationarity of neural features extracted from nonstationary recordings. In an online comparison of cursor control with a fixed Kalman filter, adaptive normalization outperformed fixed normalization by a difference of 1.7s per target acquisition (35.7% improvement, $p<0.001$). Importantly, this method stabilizes extracted signals even in periods of rest, during which calibration data cannot be collected. This suggests that underlying neural information about movement intent recorded from intracortical arrays may be more stable than previously reported once we account for drift in mean and variance. When combined with unsupervised recalibration of the Kalman filter during practical BCI use (see Jarosiewicz, et al, SFN 2014), these and other adaptive approaches may allow for long-term use of a BCI without the need for disruptive supervised calibration tasks. [[unable to display character:  ]] [[unable to display character:  ]] Related work by Nuyujukian, et al, and Pandarinath, et al, SFN 2014, discusses progress towards high-performance communication using point-and-click typing.

Disclosures: **A.A. Sarma:** None. **D. Bacher:** None. **C. Blabe:** None. **M.L. Homer:** None. **B. Jarosiewicz:** None. **E. Matteson:** None. **T. Milekovic:** None. **C. Pandarinath:** None. **J. Saab:** None. **J.D. Simeral:** None. **B. Sorice:** None. **K.V. Shenoy:** None. **J.M. Henderson:** None. **J.P. Donoghue:** None. **L.R. Hochberg:** None.

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