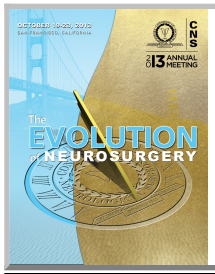

High Performance Computer Cursor Control Using Neuronal Ensemble Recordings From the Motor Cortex of a Person with ALS

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Introduction

Chronically implanted brain-computer interface systems have been demonstrated in several human research participants, with encouraging early results. A major aim of the current project is to provide improved speed and accuracy of computer cursor control for people with paralysis.

Methods

A 50-year-old woman with Amyotrophic Lateral Sclerosis (ALS) and weakness of all 4 limbs (but with some retained upper extremity function) underwent implantation of an array of 100 silicon microelectrodes into the “hand knob” area of the precentral gyrus as part of a multi-site pilot clinical trial (Braingate2, IDE). Beginning one month following implantation, twice-weekly recording sessions were carried out in the participant’s home. A circular cursor and several targets were displayed on a computer monitor. The participant performed a “center-out” cursor task by moving her finger on a trackpad to acquire the targets while neural activity was recorded. This neural activity was correlated with finger movement to produce a velocity-based Kalman filter, which was in turn used to derive on-screen cursor movement from neural activity.

Under neural control, the participant acquired 1 of either 4 or 8 peripheral targets, placed between 150 and 225 pixels from a central target. Each block consisted of 160 consecutive trials. Targets were acquired by touching the target with the neurally controlled cursor, with or without a required dwell time. All targets had a diameter of 100 pixels

Results

Accuracy and acquisition time varied across 36 blocks, with more recent sessions tending toward higher performance. Best performance in the 8 target task with 250 msec dwell was 92% accuracy, with average acquisition time of 1.89 +/- 1.09 seconds.

Conclusions

Our research participant was able to acquire targets using neural control with high speed and accuracy. Optimizations are being explored to increase performance further, with the eventual goal of providing cursor control approaching that achievable by able-bodied computer users.

Learning Objectives

By the conclusion of this session, participants should be able to:

1.) Discuss challenges in performing brain-computer interface research in human participants,

2.) Describe methods for improving BCI performance,

3.) Understand computer cursor control in the broader context of BCI