Program Overview

8:00 am – 5:00 pm	Pre-conference workshop: Beyond Brain-Machine Interface	Room 201 A & B
Noon – 4:00 pm	Exhibitor Setup	Exhibit Hall B
Noon – 4:00 pm	Registration Open	Lobby

Day 1: Monday, June 21, 2010

7:00 am – 6:00 pm	Registration Open	Lobby
7:00 am – 9:00 am	Poster and Exhibits Setup	Exhibit Hall B
7:00 am – 9:00 am	Continental Breakfast	2nd Floor Lobby
7:45 am – 9:00 am	DBS Consortium Meeting	Room 202 B & C
9:00 am – Noon	Morning Sessions	Grand Ballroom
11:30 am – Noon	Poster Blitz	Grand Ballroom
Noon – 2:00 pm	Lunch on your own. Posters and Exhibits open	Exhibit Hall B
1:00 pm – 2:00 pm	Poster Session 1 (all presenters please be by your posters	Exhibit Hall B
2:00 pm – 5:30 pm	Afternoon Session	Grand Ballroom
3:30 pm – 4:00 pm	Afternoon Break in Posters, Exhibit Area	Exhibit Hall B
5:30 pm – 7:00 pm	Welcome Mixer in Posters, Exhibit Area	Exhibit Hall B

Day 2: Tuesday, June 22, 2010

7:00 am – 4:30 pm	Registration Open	Lobby
7:00 am – 8:30 am	Continental Breakfast	Exhibit Hall B
7:30 am – 8:30 am	Breakout Sessions	Room 201 A & B Room 202 A, B & C
8:30 am – Noon	Morning Session	Grand Ballroom
10:00 am – 10:30 am	Morning Break in Posters, Exhibits Area	Exhibit Hall B
Noon – 12:30 pm	Poster Blitz	Grand Ballroom
12:30 pm – 2:30 pm	Lunch on your own. Exhibits and Posters open	Exhibit Hall B
1:30 pm -2:30 pm	Poster Session 2 (all presenters please be by your posters)	Exhibit Hall B
2:30 pm – 4:00 pm	Afternoon Session	Grand Ballroom
4:00 pm – 5:00 pm	Special Session for Students	Rooms 202 A, B & C
7:00 pm – 10:00 pm	Aquarium of the Pacific Event	Aquarium of the Pacific

Day 3: Wednesday, June 23, 2010

7:00 am – 1:00 pm	Registration Open	Lobby
7:00 am – 8:30 am	Continental Breakfast	Exhibit Hall B
7:30 am – 8:30 am	Special Session: Future of NIC	Room 202 A, B & C
8:30 am – 12:30 pm	Morning Session	Grand Ballroom
10:00 am – 10:30 am	Morning Session	Exhibit Hall B
12:30 pm – 2:00 pm	Box Lunch Provided	Exhibit Hall B
12:30 pm – 2:00 pm	Breakout Sessions	Room 201 A & B Room 202 A, B & C
2:00 pm	Posters and Exhibits Area Closes to Attendees	
2:00 pm – 6:00 pm	Poster and Exhibit take down	Exhibit Hall B
2:00 pm – 5:30 pm	Afternoon Session	
3:30 pm – 4:00 pm	Afternoon Break in 2nd Floor Lobby	Exhibit Hall B
5:30 pm	Meeting Adjourned – Thank you for your participation	

A High-Performance Cortically-Controlled Motor Prosthesis Enabled by a Feedback Control Perspective

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Neural prostheses, or brain-computer interfaces (BCIs), translate recorded neural signals into control signals that can guide a paralyzed arm, artificial limb, or computer cursor. Although current laboratory demonstrations provide a compelling proof-of-concept, clinical viability is impeded by limited performance. BCIs can be viewed from a feedback control perspective: the brain is the controller of a new plant, defined by the BCI. This perspective leads us to two advances that result in significant qualitative and quantitative performance improvements.

We tested these advances in closed loop with two rhesus macaques. On each trial, subjects used a cursor, controlled by the native contralateral limb or a BCI, to acquire a 2D target within an allotted time period. Neural data were recorded from a 96-electrode array (Blackrock) implanted spanning PMd and M1.

By applying the assumptions of a simple feedback model, we augment a position/velocity Kalman filter that is commonly used in the literature (e.g., Kim et al., 2008). All experiments used spike counts generated by a threshold detector without spike sorting. Such a system has clinical appeal, particularly for arrays with potentially decreased SNR (these experiments were 22-26 months and 4-7 months post implantation for monkeys L & J, respectively).

In the first advance, using a standard Kalman filter, we fit neural data to a "guess" of the desired volitional control signal, instead of observed or instructed kinematics. In the second advance, we developed a modified velocity-only Kalman filter, whose observation model incorporates cursor position as feedback. The new BCI appears more controllable and produces straighter reaches and crisper stops. Compared to the standard Kalman BCI, mean time to target is reduced from 1200-1300ms to 650-700ms for both monkeys L & J. This system can run freely for hundreds to thousands of trials, making point-to-point reaches to targets randomly placed across the workspace without performance degradation. These feedback-perspective based algorithmic innovations, together with experimental verification, suggest significant performance advances are possible, thereby increasing clinical viability.

Support: NSF, NDSEG, Soros Fndn, HHMI, SGF, JHU APL under DARPA RP2009: N66001-06-C-8005, CDRF, BWF, NIH-NINDS-CRCNS-RO1, NIH Pioneer Award 1DP1OD006409