Presentation Abstract

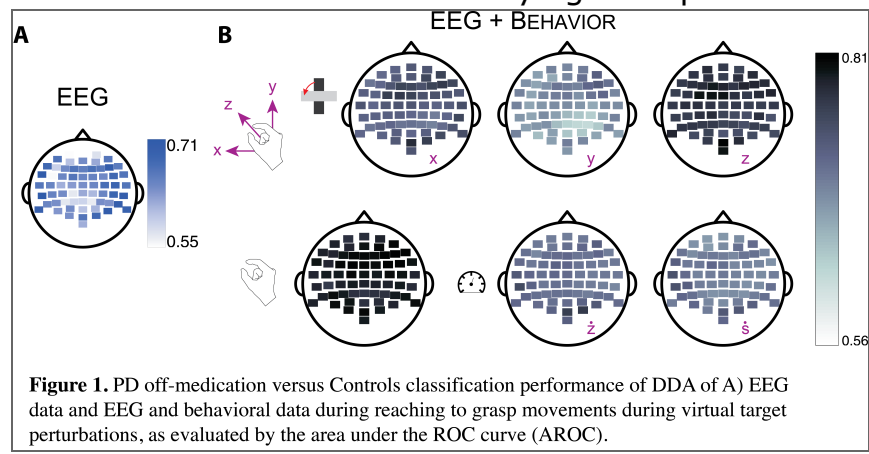|	
Program#/Poster#:	71.11/P23
Presentation Title:	Delay differential analysis: a framework for multimodal non-linear classification of Parkinson's disease
Location:	Hall A
Presentation time:	Saturday, Oct 17, 2015, 1:00 PM - 5:00 PM
Presenter at Poster:	Sat, Oct. 17, 2015, 3:00 PM - 4:00 PM
Topic:	++D.16.c. Posture and gait: Higher order control, multi-task integration, and theory

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Abstract: Parkinson's disease (PD) is the second most prevalent neurodegenerative disorder in the world, yet has no standard diagnostic test. PD is known to lead to marked alterations in cortico-thalamo-basal ganglia activity and subsequent movements, which may provide a biomarker for PD diagnosis. DDA is a time domain analysis

framework based on embedding theory in non-linear dynamics. An embedding reveals the nonlinear invariant properties of an unknown dynamical system (here the brain) from a single time series (EEG or behavioral signals). The DDA embedding serves as a low-dimensional nonlinear functional basis onto which the data are mapped. The combination of behavioral and neurological observations gives rise to a multimodal analysis framework that will improve the understanding and classification of neurological disease. We demonstrate how 750 ms of multimodal data can be used to improve DDA classification performance of PD after an unexpected perturbation of a virtual target during reach to grasp movements. We found that the anteroposterior hand position and hand aperture, in particular, provide improved classification performance in comparison to clean EEG data, as evaluated by the area under the ROC curve (AROC), (AROC increases from 0.71 to 0.81 with the addition of behavioral data). Thus, multimodal DDA may provide a tool for aiding the clinician in the diagnosis of PD and allow for earlier intervention with disease modifying therapeutics.

Figure 1. PD off-medication versus Controls classification performance of DDA of A) EEG data and EEG and behavioral data during reaching to grasp movements during virtual target perturbations, as evaluated by the area under the ROC curve (AROC).

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