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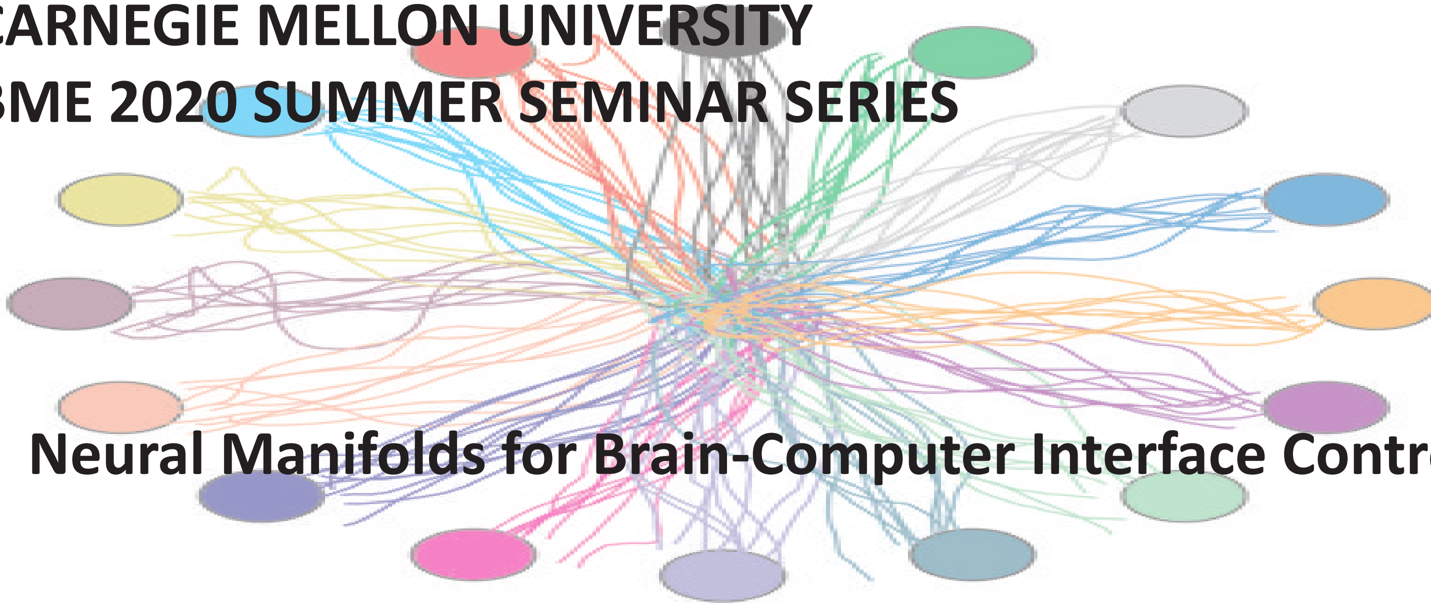
BME 2020 SUMMER SEMINAR SERIES



Neural Manifolds for Brain-Computer Interface Control

PRESENTED BY

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SCHEDULE

Tuesday, June 2, 2020
(9:00 AM-10:00AM)

Populations of neurons are connected into circuits which perform computations. These circuits induce correlations across individual neurons which become apparent when the population is analyzed simultaneously. Using dimensionality reduction techniques applied to multi-electrode array recordings from primary motor cortex (M1), we find that the simultaneous activity of approximately 100 neurons can be accurately described using only about 10 separate latent dimensions. These latent dimensions define a “neural manifold” that describes the underlying correlated action of the neural population.

In the first part of this talk, I will discuss our efforts to probe the nature of these neural manifolds using brain-computer interface (BCI) experiments performed by Rhesus macaques. A BCI creates a mapping between neural activity and the movement of a cursor on a computer screen. By changing this mapping, we create a learning environment that encourages a subject to reorganize his neural activity to regain control of the cursor. We find that the neural manifold is a fixed property of the neural circuit: BCI mappings consistent with the manifold can be learned within minutes using a principle of neural re-association, whereas mappings inconsistent with the manifold take days to learn and require the formation of new population neural activity patterns. In the second part of this talk, I will discuss some practical implications of this work in which we leverage the neural manifold to create a stabilized BCI decoding system that maintains accurate control even in the face of severe recording instabilities.

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