



THE UNIVERSITY OF CHICAGO

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STATISTICS COLLOQUIUM

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Cracking the Neural Code: A Cryptography Approach to Mind Reading

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Eckhart 133, 5734 S. University Avenue

Refreshments following the seminar in Eckhart 110.

ABSTRACT

Brain decoders use neural recordings to infer what someone is thinking, viewing, or their intended movement. Approaches for brain decoding generally rely on simultaneous measurements of the users' neural activity and the brain state. However, there are many cases where measuring the users' intent or brain state along with neural activity is difficult. Here we introduce a new method for brain decoding that does not require knowledge of the state of brain while the neural activity is recorded. Our approach is inspired by code breaking techniques used in cryptography where it is asked which mapping from encrypted to decrypted text leads to text that most resembles the known structure of language. Here, we ask whether this idea can be used for movement decoding. Our method uses the statistics of movement in the same way as cryptographers use the statistics of language to inform our estimate of the correct mapping between neural activity and movement. We find a transformation of neural data (decoder) that aligns the distribution of the decoder output with the distribution of the user's intended movement. On a standard primate center-out reaching task, we demonstrate that we can obtain similar performance with that of a decoder with access to simultaneous measurements of neural activity and movement. We decode brain activity in the same way as a cryptographer breaks a cypher, using the statistics of movement instead of assuming simultaneous measurements of the state of the user and neural activity.

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