Demixing and visualizing neural population activity in higher cortical areas

ABSTRACT:

Neurons in higher cortical areas, such as the prefrontal cortex, are often tuned to a variety of sensory and motor variables, and are therefore said to display mixed selectivity. This complexity of single neuron responses can obscure what information these areas represent and how it is represented. In this project we developed and demonstrated advantages of a new dimensionality reduction technique, demixed principal component analysis (dPCA) that decomposes population activity into a few components. In addition to systematically capturing the majority of the variance of the data, dPCA also exposes the dependence of the neural representation on task parameters such as stimuli, decisions, or rewards. To illustrate our method we reanalyzed population data from four datasets comprising different species, different cortical areas and different experimental tasks. In each case, dPCA provides a concise way of visualizing the data that summarizes the task-dependent features of the population response in a single figure.
This project also involved some additional work on dimensionality reduction of electrophysiological datasets, including data from auditory cortex and from input areas to dopaminergic system in rats.

Keywords
Population activity, Dimensionality reduction, Prefrontal cortex, Principal component analysis, Auditory cortex

Published Work:

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