Abstract

Neuropixel probes have allowed an exponential increase in the number of simultaneous neurons whose activity we can measure. The use of the Steinmetz dataset allows the computational analysis of up to 30.000 neurons in 42 different brain regions of mice, under a visual discrimination task. The broad distribution of neuron spikes enables the grouping of neuron activity by regions throughout time and so, the study of information flow in the brain under very specific conditions. Application of a decoder utilizing a logistic regression model, under the implementation of time binning the input data, outputs the sequence of brain areas involved in the visual discrimination task. This is a promising approach to find differences in brain region activation for two conditions/responses: a left, strong stimulus followed by the correct response and a right, strong stimulus followed by the right response.

Spiking data are to be rearranged into time windows of 50 ms (to be fine-tuned), using the mean activity of the first 500 ms (before the stimulus) as a baseline activity. Spikes are selectively chosen as only under the conditions of strong stimulus, correct response, and further subdivided into left stimulus/response and right stimulus/response. Comparative analysis via logistic regression of baseline activity and 50ms consecutive spike segments provide significant values of activity at certain points in time. These neural activity patterns enable the prediction of behavioral responses before the mouse gives a motor response.

Preliminary results across different brain regions indicate high chance accuracy in regions such as the virtual cortex and low chance in other regions. One possible reason for the aforementioned discrepancy could be technical mishaps in the code and thus further analysis is required. A bottom-up approach - decoding just a single neuron and progressively expanding the analysis to a whole brain region- could provide insightful feedback in resolving the issue.

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Pod name:
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Group name:
Cosmic Neuron

Data type:
Neurons

The specific dataset we are working with:
Steinmetz Dataset