Neuroscience Term Project

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We use the data used in the "Reach to Grasp" experiment, taken using LFP from the Motor Cortex of a Macaque. We hypothesize that one event has a dominant role in changing the firing rate of the neurons. Noting that the data was taken from the motor cortex, that event would be when the monkey start lifting its (left) hand.

Keyword 1 | Keyword 2 | Keyword 3 | ...

In this paper we have used the electrophysiological dataset recorded in motor cortex of two macaque monkey(N) during an instructed delayed reach-to-grasp task to create numerous plots. Meanwhile the data is recorded with a 10×10 electrode array. The area under control includes: central sulcus, M1, Premotor Cortex Dorsal (PMD) and Premotor Cortex Ventral (PMV). 96 electrodes out of 100 have the data we need. We'll be clarifying the type of the process, whether the neurons are sensitive to a particle event or not, studying the firing rate based on different events, and etc. (1)

Behavioural Task

The task is done by Monkey (N) and recorded during the trials. TS_ON set signals when the task begins. After 400 ms, the yellow LED turns on, a signal that the start of the trial (WS_ON). CUE_ON set is the representation of how the monkey should grasp the object; Whether it is a side grip (SG) and the two left LEDs turn on, or it's a precision grip (PG) and the two right LEDs turn on. After 300 ms CUE_OFF happens and the LEDs turn off. During the following 1000 ms, if something out of order happens, the trial leads to an error; and if not, at GO_ON set, signal to the monkey to move its hand and grip the object divides into two kinds: Low force (LF) and high force (HF). After some delay, depending on the monkey's own behaviour, SR_ON signals the start of the monkey's hand's motion. If no error happens, it should hold on the object for 500 ms, and then it receives the reward (RW_ON). At last, WS_OFF signals the end of the trial. These events are saved as bit numbers in dataset.

Results

Go over your analysis/experiments step by step and describe what is shown in each figure then make a case to go to the next analysis.

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Discussion

Should be at least three paragraphs: first paragraph says what was the main results you showed, second paragraph says what was the relationship of what you showed to what was previously shown in other papers and what might be the shortcomings of your approach, third paragraph gives a short summary of significance of what you found and future directions.

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Materials and Methods

We used the data associated with the neurons' spike trains and the events during the trials. In order to have the raster plot, each trial has been separated from other trials, and its starting time shifted to zero. This way the behavior of neurons can be seen during each trial. PSTH figure is the density

Significance Statement

You are encouraged to submit a 120-word maximum statement about the significance of your paper written at a level understandable to an undergraduate educated scientist outside their field of speciality. The primary goal of the Significance Statement is to explain the relevance of the work in broad context to a broad readership. The Significance Statement appears in the paper itself and is required for all research papers in some journals.

Please provide details of author contributions here.

[1]A.O.(Author One) and A.T. (Author Two) contributed equally to this work (remove if not applicable).

Fig. 1. Placeholder image of a frog with a long example caption to show justification setting.

of spikes over time, and is plotted with the same data sorting procedure (Fig. 1(b)). Because the events were not altogether ordered and collected over time, showing the events as vertical line in Fig. 1(a) would cause unnecessary confusion. So, instead, a histogram of events for all the trials is provided, implementing which events have happened at which time during the trial (Fig. 2).

Manuscript Length. Less than ten pages using a two-column format.

References. References should be cited in numerical order as they appear in text; this will be done automatically via bibtex, e.g. (2) and (1, 3).

Single column equations. You may use 1- or 2-column equations in your article, according to your preference.

To allow an equation to span both columns, use the `\begin{figure*}...\end{figure*}` environment mentioned above for figures.

Note that the use of the `widetext` environment for equations is not recommended, and should not be used.

References

1. Yaoyao Hao Margaux Duret Julia Sprenger Michael Denker Sonja Grün & Alexa Riehle1 Thomas Brochier1, Lyuba Zehl. Massively parallel recordings in macaque motor cortex during an instructed delayed reach-to-grasp task. *Proceedings of the National Academy of Sciences of the United States of America*, 2018.
2. Matthew T. Kaufman Justin D. Foster Paul Nuyujukian Stephen I. Ryu & Krishna V. Shenoy Mark M. Churchland1, John P. Cunningham. Neural population dynamics during reaching. 487, 2012.
3. Mark M. Churchland and Krishna V. Shenoy. Temporal complexity and heterogeneity of single-neuron activity in premotor and motor cortex. 97, 2007.

Fig. 2. This caption would be placed at the side of the figure, rather than below it.

$$\begin{aligned}(x+y)^3 &= (x+y)(x+y)^2 \\ &= (x+y)(x^2+2xy+y^2) \\ &= x^3+3x^2y+3xy^3+x^3.\end{aligned} \quad [1]$$