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1 Motivation

1.1 Finding highly correlated networks

We wanted to find highly correlated communities among larger ensembles of neurons. In order to do this, we induced an undirected weighted network in the neural ensemble by measuring the spike count correlations between every pair of neurons. We then used a cutting edge community detection method [1] on this network to find any highly correlated communities present in the ensemble.

1.2 Within regions or across regions

Information in the brain is carried in correlated network activity. Correlations can carry sensory information [2]. Recent findings how that spontaneous behaviours explain correlations in parts of the brain not associated with motor control [3]. We wanted to know if the highly correlated communities that we found existed within anatomical regions, or between anatomical regions. That is, did all the members of the community come from one anatomical region, or from many.

1.3 Changing timescales

The time bin width used when binning spikes into spike counts affects spike count correlation measures [4]. We found that spike count correlations increased as the width of the bin width used increased. However, we also found that the difference between *within-region* and *between-region* correlations decreased as the width of the bin width used increased.

2 Data

2.1 Brain regions

We collected from nine different brain regions. They were: ...

3 Methods

3.1 Binning data

The data were divided into time bins of various widths ranging from 0.01s to 4s. If the total length of the recording period was not an integer multiple of the time bin width, we cut off the remaining time at the end of the recording period. This period was at most 3.99s. This is far less than the total recording time of around 1 hour.

References

[1] Mark D. Humphries, Javier A. Caballero, Mat Evans, Silvia Maggi, Abhinav Singh, *Spectral rejection for testing hypotheses of structure in networks*. arXiv:1901.04747, (2019)

[2] Marlene R Cohen, John H R Maunsell, *Attention improves performance primarily by reducing interneuronal correlations*. Nature Neuroscience 12, 1594–1600, (2009)

[3] Carsen Stringer, Marius Pachitariu, Nicholas Steinmetz, Charu Bai Reddy, Matteo Carandini, Kenneth D. Harris, *Spontaneous behaviors drive multidimensional, brain-wide activity*. Science 364, (2019)

[4] Marlene R Cohen, Adam Kohn, *Measuring and interpreting neuronal correlations*. Nature Neuroscience 14, 811-819, (2011)