theories of neural computation propose specific patterns of neural connectivity tied to the tuning properties of neurons. We propose an extension to traditional latent space models to uncover continuous hidden structure in these connectomes, such as the neural tuning property of a neuron and the function that determines neural connectivity. Our scalable model provides the flexibility to recover structure in both directed and undirected graphs. We demonstrate our model on synthetic connectomes and on the recently published mouse retinal connectome .

II-102. Sortfree: Using threshold crossings to evaluate scientific hypotheses in population analyses.

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In this work, we aim to address a major challenge facing systems neurophysiological experiments. How can we cope with the challenge of spike sorting datasets as the number of recorded channels increases from roughly 100 up to many hundreds or thousands? For a typical experiment, it currently takes approximately 8-16 hours to hand sort spikes on 100 channels. Hand-sorting all datasets may not be necessary, however. The highest performance brain machine interfaces demonstrated to date in primates and humans use threshold crossings instead of tracking neurons (e.g: Gilja 2012). Why is it reasonable to use threshold crossings instead of carefully isolated single units? In many brain areas, the recorded dimensionality of neural activity is lower than number of neurons. If the network activity is low dimensional relative to the number of recorded units, then it is reasonable to expect that combining several single units into multiunit channels will not introduce large distortions when estimating the dynamical activity at the level of the population. To investigate this, we reprocessed and re-analyzed data collected by Ames and Shenoy 2014 and Churchland et al. 2012, substituting electrical threshold crossings for hand sorted units. In both experiments, we found that the analyses reached significance and supported the hypothesis and conclusions presented, closely recapitulating both qualitative and quantitative features in the original datasets. This approach is most suitable for analyses that rely on linear readouts of population activity. We anticipate that using threshold crossings in place of spike sorting will become increasingly important and relevant for population analyses in order to address the deluge of data created by new recording technologies, as this method is theoretically justified, empirically supported, and simple.

II-103. Bayesian targeted dimensionality reduction for neural population activity

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A growing body of evidence indicates that neural population activity during perceptual, motor, and decision-making