INSTITUTO TECNOLÓGICO AUTÓNOMO DE MÉXICO

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Seminario Aleatorio

Sesión 391

Clustering activation patterns of spatially-referenced neurons

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Abstract

In some areas of the brain, neighboring neurons are known to be organized in groups with a highly correlated pattern of activity. However, this hypothesis is still discussed for other regions, for example, the hippocampus. The technique of calcium imaging allows for visualization of the activity of populations of neurons over long periods of time. Transient spikes in the observed calcium level indicate the neurons' firing events (activations). However, estimation of groups of co-activating neurons in calcium imaging studies is a challenging problem due to the need to deconvolve the activations and, then, cluster the latent binary time series of activity. These time series describe, at each time point, the presence or absence of a spike, which corresponds to the active or resting state of neurons, respectively.

We describe a nonparametric mixture model that allows for simultaneous deconvolution and clustering of binary time series based on common patterns of activity. A biophysical model describes the calcium dynamics and how it relates with the underlying neuronal activity; then, a mixture prior on the signal induces a partition of neurons.The model makes use of a latent continuous process for the spike probabilities to identify groups of co-activating cells. Not only the introduction of this process allows us to exploit well-established mixtures for continuous processes, but it also improves identification of co-activating neurons in the presence of isolated or erratic spikes, which make the observed series somehow different, even if the overall patterns match.

Finally, neurons' spatial dependence is introduced by informing the mixture weights with their location, following the common neuroscience assumption that neighboring neurons often activate together. The model's performance is illustrated on simulated data and on a real dataset of hippocampal neurons.

Viernes 02 de septiembre de 2022,
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https://itam.zoom.us/j/92963936644?pwd=dE5sbEdSUjhDV0F0MHBtOFRQYTk1dz09
ID de reunión: 929 6393 6644
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