Capturing spike train pairwise correlations across cells and time

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We introduce a model of joint spike train statistics which can capture pairwise correlations across cells and across many time bins. The number of spikes in a given time bin is not limited to being binary, it is an integer. Fitting model parameters is as fast as diagonalizing the data’s covariance matrix, thus making it useable for large numbers of cells and large numbers of time bins. In particular, fitting a time-shift invariant covariance matrix will yield a time-shift invariant model. The model is defined in Fourier space by its characteristic functional, which can be quickly inverted using a fast fourier transform to yield probabilities of events. As a property of this representation, marginal distributions are in the same family of models, and are straightforward to calculate. We fit the model to several multi-cell recordings to show goodness of fit and usage.

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