Statistical Connectomics: Sample space and model parameter assignment for Bock11 dataset

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Overview

As presented last lecture, the Bock11 paper seeks to understand if relationship exists between prefered orientation of V1 neurons and patterning of resulting synapses. Here, our sample space is defined as $\mathscr{G}_n = (V, \mathscr{X}, \mathscr{Y}, \mathscr{Z})$. We define $V = [n]$ as the set of nodes, or neurons, in the graph. $\mathscr{X} = (0,1)^{n \times n}$ is the collection of edges between nodes, and $\mathscr{Y} = (0,1)^n$ describes the polarity (inhibi/excitatory) of the neuron for outgoing synapses. $\mathscr{Z}$ is the prefered orientation angle of a given neuron, and remains to be defined mathetmatically. The model chosen for this statistical theoretic model is $SBM_n^k = (\vec{\rho}(z), \beta(z))$. Here, we are tasked with assigning not only $\mathscr{Z}$, but the block model parameters $\vec{\rho}$, β which act on $z \in \mathscr{Z}$.

Prefered orientation space, $\mathscr{Z}$

The data collected for this study tested prefered orientation of neurons and disretized the results to 8 bins evenly spaced across $0^o, 180^o$ of rotation. In order to achieve a higher resolution, we will instead suggest a space of 16 bins, since [state fancy reason for more bins here].

Block model distribution parameters

For this data, we set $k = 17$: one block for each prefered orientation angle as well as another for inhibitory neurons which showed no preference. Then, $\rho : \mathscr{Z} \rightarrow \Delta_{17}$. The distribution β of edges in this model dependent on z, in the simplest case (which we will go with) is a bernouli distribution independent of z. $\therefore \beta = (0,1)^{k \times k}$.