Mean Connectome HW

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Sample Space

The sample space can be represented by the following $n \times n$ adjacency matrix

$$A = \{0, 1\}^{n \times n}$$

Model

The model used in this case will be the Bernoulli, with a distribution matrix $(0, 1)^{n \times n}$

$$A_{uv} \sim Bernoulli\ (p_{uv})$$

Each element in A_{uv} will have an associated $p_{uv,}$ where p_{uv} is the probability of there being a synapse (edge) between nodes u and v.

Action space

The action space, which gives us the set of possible outcomes, is the also an $n \times n$ adjacency matrix

$$(0, 1)^{n \times n}$$

Decision Rule

The decision rule is given by the following sum.

$$\hat{p} = \sum_{i=1}^{n} A^{(i)}$$

The method of maximum likelihood estimates $\hat{p}$ by finding a value of p_{uv} that maximizes the loss function

Loss Function

The loss function is given by the likelihood function of the Bernoulli distribution

$$l = \prod_{i=1}^{n} P_{uv}^{A_{uv}} (1\text{-}P_{uv})^{(1\text{-}Auv)}$$

Risk Function

The risk function is the expected value of the loss function

$$R=E[l]$$