1 Probability distributions

1.1 Beta distribution

1.2 Binomial distribution

2 Bayesian parameter estimation

2.1 Beta-Bernoulli model

2.1.1 Summary

The model

$$X_i \sim \text{Ber}(\theta), \text{for } i \in \{1, \ldots, N\} \tag{2.1}$$

$$\mathcal{D} = \{x_1, \ldots, x_N\} \tag{2.2}$$

$$N_1 = \sum_{i=1}^{N} \mathbb{I}(x_i = 1) \tag{2.3}$$

$$N_0 = \sum_{i=1}^{N} \mathbb{I}(x_i = 0) \tag{2.4}$$

Likelihood

$$p(\mathcal{D}|\theta) = \theta^{N_1}(1-\theta)^{N_0} \tag{2.5}$$

Prior

$$p(\theta) = \text{Beta}(\theta|a, b) \tag{2.6}$$

Posterior

$$p(\theta|\mathcal{D}) = \text{Beta}(\theta|N_1 + a, N_0 + b) \tag{2.7}$$

Posterior predictive

$$p(x|\mathcal{D}) = \frac{a}{a+b} \tag{2.8}$$

2.1.2 Derivations