

4. coin flip Bayesian.

$$X_i \sim \{0, 1\}$$

likelihood

$$X_i | \theta \sim \text{Bernoulli} = p(x|\theta)$$

$$\theta \sim \text{beta}(\alpha, \beta) = p(\theta)$$

$$p(\theta|x) = \frac{p(x|\theta) p(\theta)}{\int p(x|\theta) p(\theta) d\theta}$$

$$\hat{\theta}_{\text{MAP}} = \underset{\theta}{\text{argmax}} p(x|\theta) p(\theta)$$

$$\hat{\theta}_{\text{MAP II}} = \underset{\theta}{\text{argmax}} p(x|\theta) \underbrace{p(\theta|\alpha, \beta) p(\alpha) p(\beta)}_{\text{assume distribution}}$$

assume distribution $\alpha \sim p(\alpha)$
 $\beta \sim p(\beta)$