$$1_{[0,1]}(x) = \begin{cases} 1 & 0 \le x \le 1 \\ 0 & \text{otherwise} \end{cases}$$

$$P(\theta \mid y) \propto P(y,\theta) \propto \theta^{s}(1-\theta)^{n-s} \cdot \frac{1}{B(\alpha,\beta)}\,\theta^{\alpha-1}(1-\theta)^{\beta-1}\,1_{[0,1]}(\theta)$$

$$\propto \cancel{\frac{1}{B(\alpha,\beta)}}\;\theta^{(s+\alpha)-1}(1-\theta)^{(n-s+\beta)-1}\,1_{[0,1]}(\theta)$$

$$\propto \frac{1}{B(s+\alpha,\,n-s+\beta)}\;\theta^{(s+\alpha)-1}(1-\theta)^{(n-s+\beta)-1}\,1_{[0,1]}(\theta)$$

Conjugate prior

$$\log\left(\frac{\theta}{1-\theta}\right) = z \qquad \text{natural logarithm}$$

$$\frac{\theta}{1-\theta} = \exp(z)$$

$$\theta = \exp(z) - \exp(z)\,\theta$$

$$\theta = \frac{e^z}{1+e^z} \qquad f: z \longmapsto \frac{e^z}{1+e^z} = \frac{1}{1+e^{-z}}$$

$$f: \mathbb{R} \to (0,1)$$

$$\theta_{ij} = f(\alpha_i + \beta_i x_{ij})$$

$$f_x(x, \eta) = \int f(x \mid \theta)\, p(\theta, \eta)\, d\theta$$

$$\hat{\eta} = \underset{\eta}{\operatorname{argmax}}\ f_x(x, \eta)$$

$$y_{new} = x_{new}^T \theta + \varepsilon_{new}$$