

Prior specification for
Dirichlet prior:

Note: $E(p_i) = \frac{\alpha_i}{\sum_{i=1}^k \alpha_i}$

$$\text{Var}(p_i) = \frac{\alpha_i (\sum \alpha_i - \alpha_i)}{(\sum \alpha_i)^2 (\sum \alpha_i + 1)}$$

Posterior means for p_1, \dots, p_k
(point estimates):

$$E(p_i | \underline{x}) = \frac{x_i + \alpha_i}{\sum (x_i + \alpha_i)}$$

Frequentist point estimate of p_i :

$$\frac{x_i}{n} = \frac{x_i}{\sum x_i}$$