Ranking Function for Dirichlet Prior Smoothing

$$f(q,d) = \sum_{\substack{w_i \in d \\ w_i \in q}} c(w,q)[\log \frac{p_{Seen}(w_i \mid d)}{\alpha_d \, p(w_i \mid C)}] + n \log \alpha_d$$

$$p(w \mid d) = \frac{c(w;d) + \mu \, p(w \mid C)}{d \mid + \mu} = \frac{\mid d \mid}{\mid d \mid + \mu} \frac{c(w,d)}{\mid d \mid} + \frac{\mu}{\mid d \mid + \mu} p(w \mid C)$$

$$\mu \in [0, +\infty)$$

$$\frac{p_{seen}(w \mid d)}{\alpha_d p(w \mid C)} = \frac{\frac{c(w,d) + \mu p(w \mid C)}{\mid d \mid + \mu}}{\frac{\mu p(w \mid C)}{\mid d \mid + \mu}} = 1 + \frac{c(w,d)}{\mu p(w \mid C)} \qquad \alpha_d = \frac{\mu}{\mid d \mid + \mu}$$

$$f_{DIR}(q,d) = [\sum_{\substack{w \in d \\ w \in q}} c(w,q) \log[1 + \frac{c(w,d)}{\mu p(w \mid C)}]] + n \log \frac{\mu}{\mu + \mid d \mid}$$