ML Parameter Estimation

$$p_d(w) = \lambda_B p(w \mid \theta_B) + (1 - \lambda_B) \sum_{j=1}^{k} \pi_{d,j} p(w \mid \theta_j)$$

$$\log p(d) = \sum_{w \in V} c(w, d) \log[\lambda_B p(w \mid \theta_B) + (1 - \lambda_B) \sum_{j=1}^{k} \pi_{d,j} p(w \mid \theta_j)]$$

$$\log p(C \mid \Lambda) = \sum_{d \in C} \sum_{w \in V} c(w, d) \log[\lambda_B p(w \mid \theta_B) + (1 - \lambda_B) \sum_{j=1}^{k} \pi_{d,j} p(w \mid \theta_j)]$$

Constrained Optimization: $\quad \Lambda^* = \arg\max_\Lambda p(C \mid \Lambda)$

$$\forall j \in [1, k], \sum_{i=1}^{M} p(w_i \mid \theta_j) = 1 \qquad \forall d \in C, \sum_{j=1}^{k} \pi_{d,j} = 1$$