$Topics\colon\ \beta_t \sim Dirichlet(\alpha_1, \dots, \alpha_{20000}), which\ is\ a\ prob\ over\ words\ for\ topics$

eg: $[1/4 \quad 1/4 \quad 1/2]$

w$_1$ w$_2$ w$_3$ ... w$_{50}$

Documents:

1. $\theta_d \sim Dirichlet(\gamma_1, \dots, \gamma_{50})$, which is distribution over topics

   eg: $[1/4 \quad 1/2 \quad 1/4]$

   t$_1$ t$_2$ t$_3$ ... t$_{50}$
2. $Each\ word\ is\ assigned\ to\ topic\ Z_{id}$ (topic for word i in doc d)

   $Z_{id} \sim Multi(\theta_d), which\ means\ prob(word\ i = topic\ 1) = \ \theta_{d,1}$

3. Each word is drawn from topic prob vertor ω_{id}

   $\omega_{id} \sim Multi\left(\beta_{Z_{id}}\right)$

Then we can find:

$$\beta_1, \dots, \beta_{50}$$
$$\theta_1, \dots, \theta_N$$
$$Z_{i,1}, \dots, Z_{i,n_d}\ (i = 1, \dots N)$$

$\boldsymbol{word\ distribution\ for\ each\ topic}$:

$$\begin{array}{llcccccccc} & & & \text{city} & \text{town} & & \text{Seattle} & & \text{zoology} & \\ topic\ 1 & \beta_1 & = [& 0.1 & 0.08 & \ldots & 0.02 & \ldots & 10^{-12} &] \end{array}$$

$$\begin{array}{llccccccccc} & & & \text{cow} & \text{sheep} & & & & \text{zoology} & \\ topic\ 50 & \beta_{50} & = [& 0.01 & 0.009 & \ldots & \ldots & \ldots & 10^{-13} &] \end{array}$$

$\boldsymbol{topic\ distribution\ for\ each\ document}$:

$$\begin{array}{llccccccc} & & & \text{topic 27} & \text{topic 43} & & & \text{topic 2} & \\ doc\ 1: & \theta_1 & = [& 0.35 & 0.21 & \ldots & \ldots & 0.01 &] \end{array}$$

$$\begin{array}{llccccccc} & & & \text{topic 5} & & & & \text{topic 6} & \\ doc\ 3721: & \theta_{3721} & = [& 0.21 & \ldots & \ldots & \ldots & \ldots.\,0.01 &] \end{array}$$