Collapsed Gibbs for LDA

Model

$$p(\theta_d) = \mathrm{Dir}(\beta) \qquad p(\phi_t) = \mathrm{Dir}(\alpha)$$

$$p(z_{dn}|\theta_d) = \Theta_{dz_{dn}} \qquad p(w_{dn}|z_{dn}, \Phi) = \Phi_{z_{dn}w_{dn}}$$

Can compute analytically

$$p(\Theta \mid Z)$$

$$p(Z) = \int p(Z \mid \Theta)p(\Theta)d\Theta$$

$$= \frac{p(Z \mid \Theta)p(\Theta)}{p(\Theta \mid Z)}$$