Variational Inference for LDA

- Solve a series of constrained minimizations for each variational parameter (since they don't depend on each other)

- **Result:** a simple coordinate ascent algorithm (update each variable in turn and iterate until convergence)

$$\pi_{j,t,i} \propto \phi_{i,w_{j,t}} \exp\left(\Psi(\gamma_{j,i}) - \Psi\left(\sum_{k=1}^{K} \gamma_{j,k}\right)\right)$$

$$\gamma_{j,i} = \alpha_i + \sum_{t=1}^{N_j} \pi_{j,t,i}.$$

$$\lambda_{i,v} = \beta_v + \sum_{j=1}^{M} \sum_{t=1}^{N_j} \pi_{j,t,v} \mathbb{1}(w_{j,t} = v)$$