

Put everything together: EM-algorithm

E-step:

$$p(t|d, w) = \frac{p(w|t)p(t|d)}{p(w|d)} = \frac{\phi_{wt}\theta_{td}}{\sum_{s \in T} \phi_{ws}\theta_{sd}}$$

M-step:

$$\phi_{wt} = \frac{n_{wt}}{\sum_w n_{wt}}$$

$$n_{wt} = \sum_d n_{dw} p(t|d, w)$$

$$\theta_{td} = \frac{n_{td}}{\sum_t n_{td}}$$

$$n_{td} = \sum_w n_{dw} p(t|d, w)$$