

# M-step details

$$\begin{aligned}\mathcal{L}(\theta, q) &= \sum_i \sum_c q(t_i = c) \log \frac{p(x_i, t_i = c \mid \theta)}{q(t_i = c)} \\&= \sum_i \sum_c q(t_i = c) \log p(x_i, t_i = c \mid \theta) \\&\quad - \sum_i \sum_c q(t_i = c) \log q(t_i = c) \\&= \mathbb{E}_q \log p(X, T \mid \theta) + \text{const}\end{aligned}$$