Estimating $\hat{\boldsymbol{\pi}}$ using expectation maximization

We don't know $\mathbf{z}$, so we replace $\mathbf{z}$ with the expected value of $\mathbf{z}$, conditioned on the data and the last known $\hat{\boldsymbol{\pi}}$:

$$\hat{\boldsymbol{\pi}}^{(t)} = \underset{\boldsymbol{\pi}}{\operatorname{argmax}}\, \mathbb{E}\left[\ell(\boldsymbol{\pi}) \middle| \mathbf{x}, \mathbf{y}, \hat{\boldsymbol{\pi}}^{(t-1)}\right]$$

Starting with some random initial value for $\hat{\boldsymbol{\pi}}^{(0)}$, we iteratively

- Find the expected value of $\ell(\boldsymbol{\pi})$ using the current expected values of the latent variable $\mathbf{z}$
- Set $\hat{\boldsymbol{\pi}}^{(t)}$ to the $\underset{\boldsymbol{\pi}}{\operatorname{argmax}}$ of this expectation, which is simple to compute

And repeat until $\ell(\boldsymbol{\pi})$ stabilizes to a range $< 10^{-4}$