The original MLE problem for multivariate Student's t distributed data is

$$\underset{\boldsymbol{\mu},\boldsymbol{\Sigma},\nu}{\mathsf{minimize}} \quad \sum_{t=1}^{T} f_t\left(\boldsymbol{\mu},\boldsymbol{\Sigma},\nu\right), \tag{1}$$

where $f_t\left(\boldsymbol{\mu},\boldsymbol{\Sigma},\nu\right) = \frac{1}{2}\log\det(\boldsymbol{\Sigma}) + \frac{N+\nu}{2}\log\left(1+\frac{1}{\nu}(\mathbf{x}_t-\boldsymbol{\mu})^T\boldsymbol{\Sigma}^{-1}(\mathbf{x}_t-\boldsymbol{\mu})\right) - \log\Gamma\left(\frac{N+\nu}{2}\right) + \log\Gamma\left(\frac{\nu}{2}\right) + \frac{N}{2}\log\nu$. Since its direct minimization is complicated, the EM algorithm instead iteratively optimizes the Q function at iteration k:

$$\underset{\boldsymbol{\mu},\boldsymbol{\Sigma},\nu}{\mathsf{minimize}} \quad \sum_{t=1}^{T} Q_t\left(\boldsymbol{\mu},\boldsymbol{\Sigma},\nu\right), \tag{2}$$

where $Q_t\left(\boldsymbol{\mu},\boldsymbol{\Sigma},\nu\right) = \frac{1}{2}\log\det(\boldsymbol{\Sigma}) + \frac{\mathsf{E}_k[\tau_t]}{2}(\mathbf{x}_t-\boldsymbol{\mu})^T\boldsymbol{\Sigma}^{-1}(\mathbf{x}_t-\boldsymbol{\mu}) + \frac{\nu}{2}\mathsf{E}_k[\tau_t] - \frac{\nu}{2}\mathsf{E}_k[\log\tau_t] - \frac{\nu}{2}\log\frac{\nu}{2} + \log\Gamma\left(\frac{\nu}{2}\right)$.

Now, if we want to put more weights on the recent observations related items, we may be interested in solving the following problems:

$$\underset{\boldsymbol{\mu},\boldsymbol{\Sigma},\nu}{\mathsf{minimize}} \quad \sum_{t=1}^{T} w_t f_t\left(\boldsymbol{\mu},\boldsymbol{\Sigma},\nu\right), \tag{3}$$

where $\sum_{t=1}^{T} w_t = T$. Then the corresponding surrogate problem becomes

$$\underset{\boldsymbol{\mu},\boldsymbol{\Sigma},\nu}{\mathsf{minimize}} \quad \sum_{t=1}^{T} w_t Q_t\left(\boldsymbol{\mu},\boldsymbol{\Sigma},\nu\right), \tag{4}$$

which is

$$\begin{aligned}\underset{\boldsymbol{\mu},\boldsymbol{\Sigma},\nu}{\mathsf{minimize}} \quad & \frac{T}{2}\log\det(\boldsymbol{\Sigma}) + \sum_{t=1}^{T} w_t\left\{\frac{\mathsf{E}_k[\tau_t]}{2}(\mathbf{x}_t-\boldsymbol{\mu})^T\boldsymbol{\Sigma}^{-1}(\mathbf{x}_t-\boldsymbol{\mu}) + \frac{\nu}{2}\mathsf{E}_k[\tau_t] - \frac{\nu}{2}\mathsf{E}_k[\log\tau_t]\right\} \\ & - \frac{T\nu}{2}\log\frac{\nu}{2} + T\log\Gamma\left(\frac{\nu}{2}\right)\end{aligned} \tag{5}$$