These modified modules enable us to also estimate μ_p in the algorithm.

Notation:
$\boldsymbol{\theta}_p = \{\mu_p, \boldsymbol{\beta}_p, \sigma_p^2\}$,
$\boldsymbol{\theta} = \{\boldsymbol{\theta}_1, \ldots, \boldsymbol{\theta}_P\}$,
$\boldsymbol{\mu} = [\mu_1, \ldots, \mu_P]^T$,
$\boldsymbol{\Lambda}_i = [\lambda_{1,i}, \ldots, \lambda_{P,i}]^T$,
$\boldsymbol{\Sigma}_\epsilon = \mathrm{diag}(\sigma_1^2, \ldots, \sigma_P^2)$,
$\boldsymbol{\Sigma}_{y,i} = \boldsymbol{\Lambda}_i \boldsymbol{\Lambda}_i^T + \boldsymbol{\Sigma}_\epsilon$,
$\mathbf{y}_{\cdot,i} = [y_{1,i}, \ldots, y_{P,i}]^T$,
$\mathbf{y}_{p,\cdot} = [y_{p,1}, \ldots, y_{p,n}]^T$,
$\eta_i^{(r)} = \mathrm{E}_{\boldsymbol{\theta}^{(r-1)}}(\eta_i | \mathbf{y}_{\cdot,i})$,
$(\check{\eta}_i^2)^{(r)} = \mathrm{Var}_{\boldsymbol{\theta}^{(r-1)}}(\eta_i | \mathbf{y}_{\cdot,i})$,
$\boldsymbol{\omega}_p = [\omega_{p,u|v}, \omega_{p,v|u}, \omega_{p,t}]^T$,
$\tilde{\mathbf{X}}^{(r)} = \boldsymbol{\eta}^{(r)} \circ \mathbf{X}$, where $\boldsymbol{\eta}^{(r)} = [\eta_1^{(r)}, \ldots, \eta_n^{(r)}]^T$,
$\check{\mathbf{X}}^{(r)} = \check{\boldsymbol{\eta}}^{(r)} \circ \mathbf{X}$, where $\check{\boldsymbol{\eta}}^{(r)} = [(\check{\eta}_1^2)^{(r)}, \ldots, (\check{\eta}_n^2)^{(r)}]^T$,
$\underline{\tilde{\mathbf{X}}}^{(r)} = [\mathbf{J}_n, \tilde{\mathbf{X}}^{(r)}]$,
$\underline{\check{\mathbf{X}}}^{(r)} = [\mathbf{0}_n, \check{\mathbf{X}}^{(r)}]$,
$\mathbf{B}_{\boldsymbol{\omega}_p}^{(r)} = \begin{bmatrix} \mathbf{0} & \mathbf{0} & \mathbf{B}_{\boldsymbol{\omega}_{p,uv}}^{(r)} & \mathbf{0} \\ \mathbf{0} & \mathbf{0} & \mathbf{0} & \mathbf{B}_{\boldsymbol{\omega}_{p,t}}^{(r)} \end{bmatrix}$, where $(\mathbf{B}_{\boldsymbol{\omega}_{p,uv}}^{(r)})^T \mathbf{B}_{\boldsymbol{\omega}_{p,uv}}^{(r)} = \omega_{p,u|v}^{(r)} \mathbf{S}_{u|v} + \omega_{p,v|u}^{(r)} \mathbf{S}_{v|u}$,
$(\mathbf{B}_{\boldsymbol{\omega}_{p,t}}^{(r)})^T \mathbf{B}_{\boldsymbol{\omega}_{p,t}}^{(r)} = \omega_{p,t}^{(r)} \mathbf{S}_t$, and the first two columns are all zero.

E2():
Changed Formulas:

$$\eta_i^{(r)} = (\boldsymbol{\Lambda}_i^T)^{(r-1)} \left(\boldsymbol{\Sigma}_{y,i}^{(r-1)} \right)^{-1} (\mathbf{y}_{\cdot,i} - \boldsymbol{\mu}^{(r-1)})$$

$$\log \mathcal{L} \left(\boldsymbol{\theta}^{(r-1)} \middle| \mathbf{y} \right) \propto -\frac{1}{2} \sum_{i=1}^{n} \left[\log \left| \boldsymbol{\Sigma}_{y,i}^{(r-1)} \right| + (\mathbf{y}_{\cdot,i} - \boldsymbol{\mu}^{(r-1)})^T \left(\boldsymbol{\Sigma}_{y,i}^{(r-1)} \right)^{-1} (\mathbf{y}_{\cdot,i} - \boldsymbol{\mu}^{(r-1)}) \right]$$

Added Arguments:
(1) **mu**: the $P \times 1$ vector, $\boldsymbol{\mu}^{(r-1)}$.

M_SVD2():
Changed Formulas:

$$\begin{bmatrix} \mu_p^{(r)} \\ \boldsymbol{\beta}_p^{(r)} \end{bmatrix} = \left[\left(\underline{\tilde{\mathbf{X}}}^T \right)^{(r)} \underline{\tilde{\mathbf{X}}}^{(r)} + \left(\underline{\check{\mathbf{X}}}^T \right)^{(r)} \underline{\check{\mathbf{X}}}^{(r)} + (\mathbf{B}_{\boldsymbol{\omega}_p}^T)^{(r)} \mathbf{B}_{\boldsymbol{\omega}_p}^{(r)} \right]^{-1} \left(\underline{\tilde{\mathbf{X}}}^T \right)^{(r)} \mathbf{y}_{p,\cdot}$$

$$\underline{\tilde{\mathbf{X}}}^{(r)} = \tilde{\mathbf{Q}} \underline{\tilde{\mathbf{R}}}^{(r)}, \quad \check{\mathbf{X}}^{(r)} = \check{\mathbf{Q}} \check{\mathbf{R}}^{(r)}, \quad \underline{\check{\mathbf{R}}}^{(r)} = [\mathbf{0}_K, \check{\mathbf{R}}^{(r)}]$$

$$\begin{bmatrix} \underline{\tilde{\mathbf{R}}}^{(r)} \\ \underline{\check{\mathbf{R}}}^{(r)} \\ \mathbf{B}_{\boldsymbol{\omega}_p}^{(r)} \end{bmatrix} = \begin{bmatrix} \mathbf{U}_1 \\ \mathbf{U}_2 \\ \mathbf{U}_3 \end{bmatrix} \mathbf{D}\mathbf{V}^T$$

Added Arguments:
(1) **mp**: is $\mu_p^{(r)}$.
Details:
K is the dimension of $\boldsymbol{\beta}_p^{(r)}$, and also the number of columns in $\mathbf{X}$. $\mathbf{U}_1$ is a $(K+1)\times(K+1)$ matrix, and $\mathbf{U}_2$ is a $K\times(K+1)$ matrix. So, compared with 'M_SVD()', we change the indices for extracting $\mathbf{U}_1$ and $\mathbf{U}_2$ from 'Um'.