Algorithm 1 Generalized tensor response regression with multi-sided covariates

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Input: Response tensor $\mathcal{Y} \in \mathbb{R}^{d_1 \times \cdots \times d_K}$, covariate matrices $\boldsymbol{X}_k \in \mathbb{R}^{d_k \times p_k}$ for $k = 1, \ldots, K$, target Tucker rank $(r_1, \ldots, r_K)$, link function $f$, entrywise bound $\alpha$
Output: Estimated low-rank coefficient tensor $\mathcal{B} \in \mathbb{R}^{p_1 \times \cdots \times p_K}$.
Calculate $\check{\mathcal{B}} = \mathcal{Y} \times_1 \left[(\boldsymbol{X}_1^T \boldsymbol{X}_1)^{-1} \boldsymbol{X}_1^T\right] \times_2 \cdots \times_K \left[(\boldsymbol{X}_K^T \boldsymbol{X}_K)^{-1} \boldsymbol{X}_K^T\right]$.
Initialize the iteration index $t = 0$.
Initialize the core tensor $\mathcal{C}^{(0)}$ and factor matrices $\boldsymbol{M}_k^{(0)} \in \mathbb{R}^{p_k \times r_k}$ via rank-$(r_1, \ldots, r_K)$ Tucker approximation of $\check{\mathcal{B}}$, in the least-square sense.
while the relative increase in objective function $\mathcal{L}_{\mathcal{Y}}(\mathcal{B})$ is less than the tolerance do
    Update iteration index $t \leftarrow t + 1$.
    for  $k = 1$ to $K$ do
        Obtain the factor matrix $\boldsymbol{M}_k^{(t+1)} \in \mathbb{R}^{p_k \times r_k}$ by solving $d_k$ separate GLMs with link function $f$.
        Update the columns of $\boldsymbol{M}_k^{(t+1)}$ by Gram-Schmidt orthogonalization.
    end for
    Obtain the core tensor $\mathcal{C}^{(t+1)} \in \mathbb{R}^{r_1 \times \cdots \times r_K}$ by solving a GLM with vec$(\mathcal{Y})$ as response, $\odot_{k=1}^{K}[\boldsymbol{X}_k \boldsymbol{M}_k^{(t)}]$ as covariates, and $f$ as link function.
    Rescale the core tensor subject to the entrywise bound constraint.
    Update $\mathcal{B}^{(t+1)} \leftarrow \mathcal{C}^{(t+1)} \times_1 \boldsymbol{M}_1^{(t+1)} \times_2 \cdots \times_K \boldsymbol{M}_K^{(t+1)}$.
end while
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