TIP8419 - Tensor Algebra
Homework 5

Prof. André de Almeida
andre@gtel.ufc.br

2019.1

Kronecker Product Singular Value Decomposition (KPSVD)

Problem 1 On practice 04 we implement the LS-KF(Least Square Kronecker Factorization) algorithm, now we will go to implement a generalization of that. Let

$$\mathbf{X} = \begin{pmatrix} \mathbf{X}_{1,1} & \cdots & \mathbf{X}_{1,c_2} \\ \vdots & \ddots & \vdots \\ \mathbf{X}_{r_2,1} & \cdots & \mathbf{X}_{r_2,c_2} \end{pmatrix}, \quad \mathbf{X}_{i_2,j_2} \in \mathbb{R}^{r_1 \times c_1}.$$

Implement the KPSVD for the matrix $\mathbf{X}$ by computing σ_k, $\mathbf{U}_k$ and $\mathbf{V}_k$ such that

$$\mathbf{X} = \sum_{k=1}^{r_{KP}} \sigma_k \mathbf{U}_k \otimes \mathbf{V}_k.$$

Problem 2 At the above problem, set $r_1 = r_2 = c_1 = c_2 = 3$ and chose $\mathbf{A}_{i,j}$ =rand(r_1, c_1), $1 \leq i \leq r_2$, $1 \leq j \leq c_2$. Then compute the KPSVD and r_{KP} of $\mathbf{A}$ by using your KPSVD prototype function. Consider $r \leq r_{KP}$. Compute the nearest rank-r for the matrix $\mathbf{A}$.