Comments on "Tropp_simulation.pdf"

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Below is another approach to randomized tensor SVD. Note that my notation may be slightly different from yours.

Algorithm 1 Approx tensor SVD 2

Input: Tensor $\mathcal{A} \in \mathbb{R}^{d_1 \times \cdots \times d_K}$ and Tucker rank $(r_1, \ldots, r_K)$.

Output: Core tensor $\mathcal{S} \in \mathbb{R}^{r_1 \times \cdots \times r_K}$ and Tucker factors $\boldsymbol{Q}^{(k)} \in \mathbb{R}^{d_k \times r_k}$.

1: **Initialization.** Generate Gaussian test matrices $\boldsymbol{\Omega}_k$ of size $d_k \times r_k$, for all $k = 1, \ldots, K$.

2: **for** k in $\{1, 2, \ldots, K\}$ **do**

3: Form a wide matrix $\mathcal{A}^{(k)} = \text{Unfold}_k(\mathcal{A} \times_1 \boldsymbol{\Omega}_1^T \times_2 \cdots \times_{k-1} \boldsymbol{\Omega}_{k-1}^T \times_{k+1} \boldsymbol{\Omega}_{k+1}^T \times \cdots \times_K \boldsymbol{\Omega}_k^T)$, where $\text{Unfold}_k(\cdot)$ denotes the unfolding operation along the mode k. Note that the matrix $\mathcal{A}^{(k)}$ is of dimension $d_k \times \prod_{i \neq k} r_i$.

4: Find a matrix $\boldsymbol{Q}^{(k)} \in \mathbb{R}^{d_k \times r_k}$ whose columns form an orthogonal basis for the range of $\mathcal{A}^{(k)}$.

5: **end for**

6: Return the core tensor $\mathcal{S} = \mathcal{A} \times_1 (\boldsymbol{Q}^{(1)})^T \times_2 \cdots \times_K (\boldsymbol{Q}^{(K)})^T$ and Tucker factors $\boldsymbol{Q}^{(k)}$ for all $k = 1, \ldots, K$.

Other comments: