

TIP8419 - Tensor Algebra

Homework 1

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

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Hadamard, Kronecker and Khatri-Rao Products

Problem 1 For randomly generated matrices \mathbf{A} and $\mathbf{B} \in \mathbb{C}^{N \times N}$, create an algorithm to compute the Hadamard Product $\mathbf{A} \odot \mathbf{B}$. Then, compare the run time of your algorithm with the operator `.*` of the *software* Octave/Matlab[®]. Plot the run time curve as a function of the number of rows/columns $N \in \{2, 4, 8, 16, 32, 64, 128\}$.

Problem 2 For randomly generated matrices \mathbf{A} and $\mathbf{B} \in \mathbb{C}^{N \times N}$, create an algorithm to compute the Kronecker Product $\mathbf{A} \otimes \mathbf{B}$. Then, compare the run time of your algorithm with the operator `kron(A,B)` of the *software* Octave/Matlab[®]. Plot the run time curve as a function of the number of rows/columns $N \in \{2, 4, 8, 16, 32, 64, 128\}$.

Problem 3 For randomly generated matrices \mathbf{A} and $\mathbf{B} \in \mathbb{C}^{N \times N}$, create an algorithm to compute the Khatri-Rao product $\mathbf{A} \diamond \mathbf{B}$ according with the following prototype function:

$$\mathbf{R} = kr(\mathbf{A}, \mathbf{B}).$$

\odot Denotes the Hadamard Product.

\otimes Denotes the Kronecker Product.

\diamond Denotes the Khatri-Rao Product.