Universidade Federal do Ceará
Centro de Tecnologia
Departamento de Engenharia de Teleinformática
Engenharia de Teleinformática

Multilinear Algebra
Computational Homeworks

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Course Multilinear Algebra - TIP8419

Fortaleza, 2022

Homework 0
Kronecker Product Run Time

Run Time Perfomance of Sequential Kronecker Products

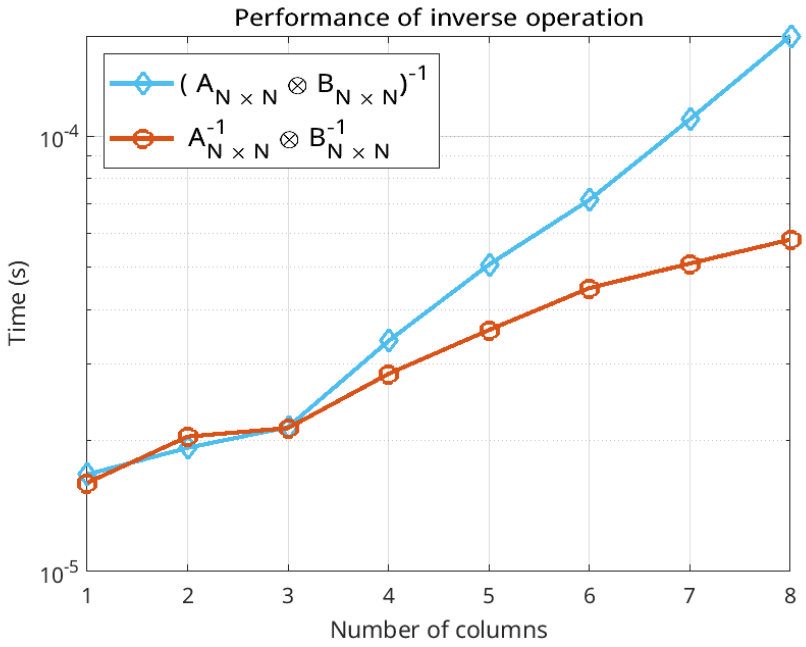

Figure 1: Monter Carlo Experiment with 5000.

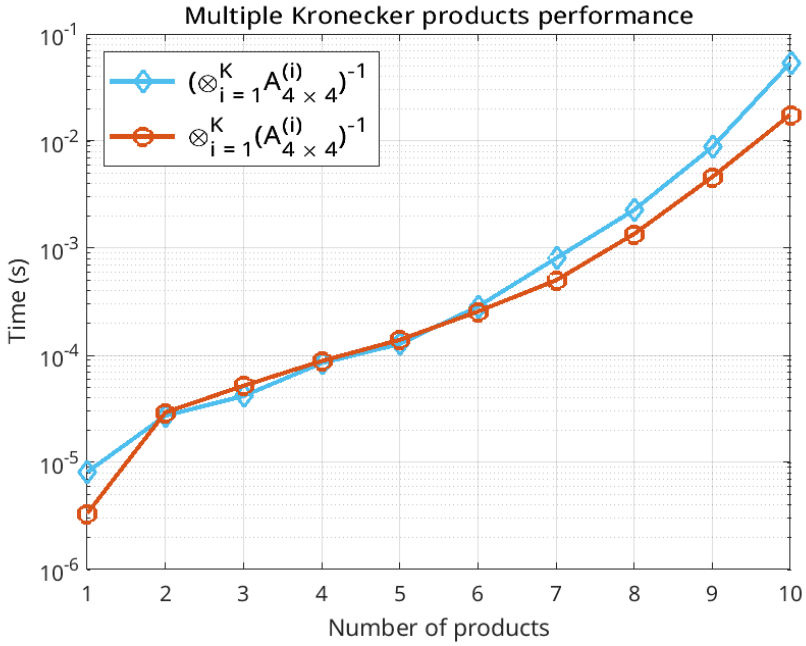

Figure 2: Monter Carlo Experiment with 10000 runs.

Show that $\mathbf{eig}(\boldsymbol{A} \otimes \boldsymbol{B}) = \mathbf{eig}(\boldsymbol{A}) \otimes \mathbf{eig}(\boldsymbol{B})$

Homework 1
Hadamard, Kronecker and Khatri-Rao Products

Run Time Perfomance of Hadamard Product

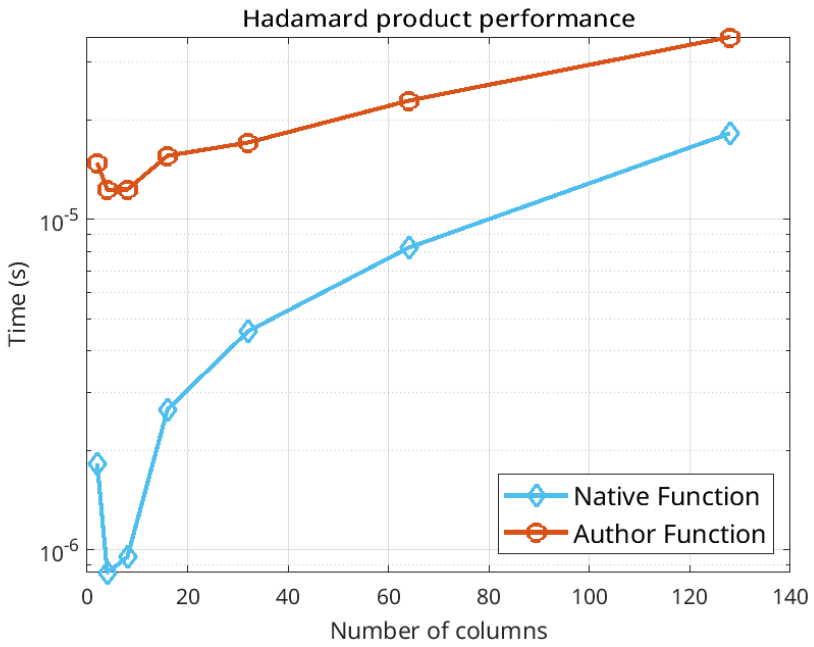

Figure 3: Monter Carlo Experiment with 1000 runs.

Run Time Perfomance of Kronecker Product

Run Time Perfomance of Khatri-Rao Product

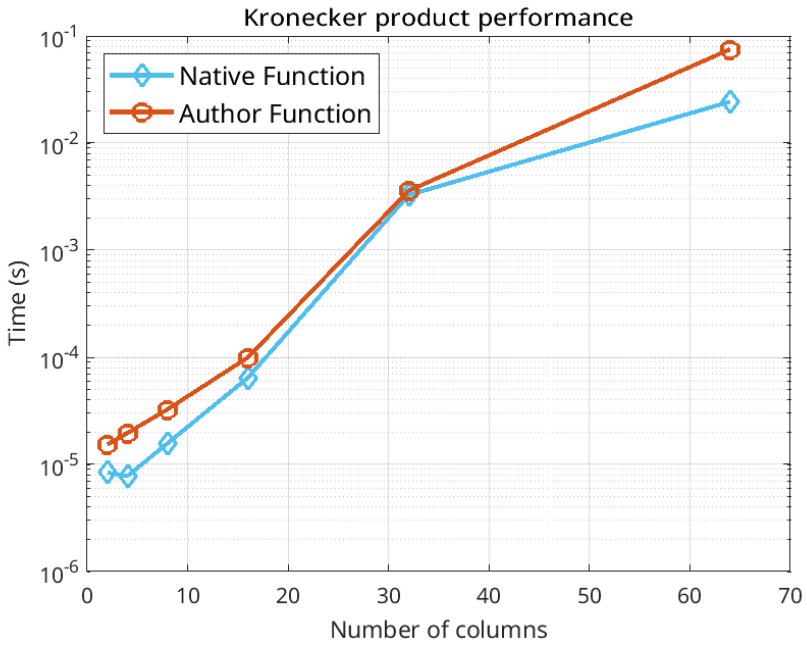

Figure 4: Monter Carlo Experiment with 1000 runs.

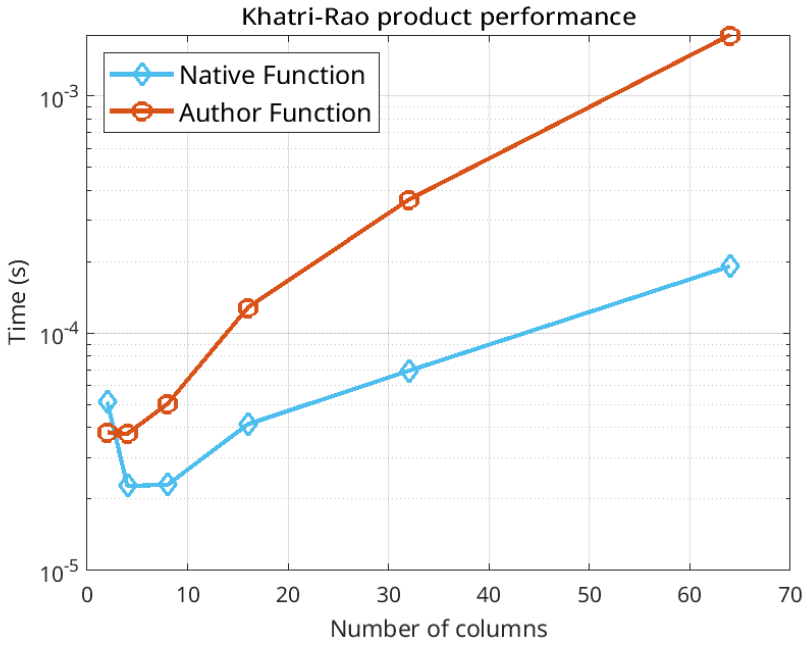

Figure 5: Monter Carlo Experiment with 1000 runs.

Homework 2
Khatri-Rao Product Run Time

Run Time Performance of Khatri-Rao Product for Different Implementations

Run Time Perfomance of Sequential Khatri-Rao Products

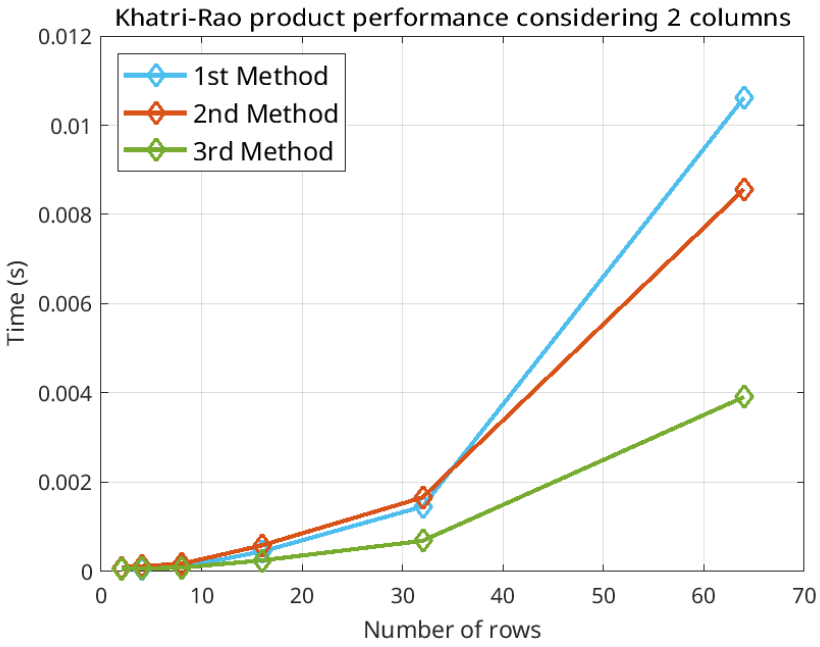

Figure 6: Monter Carlo Experiment with 250 runs and R = 2.

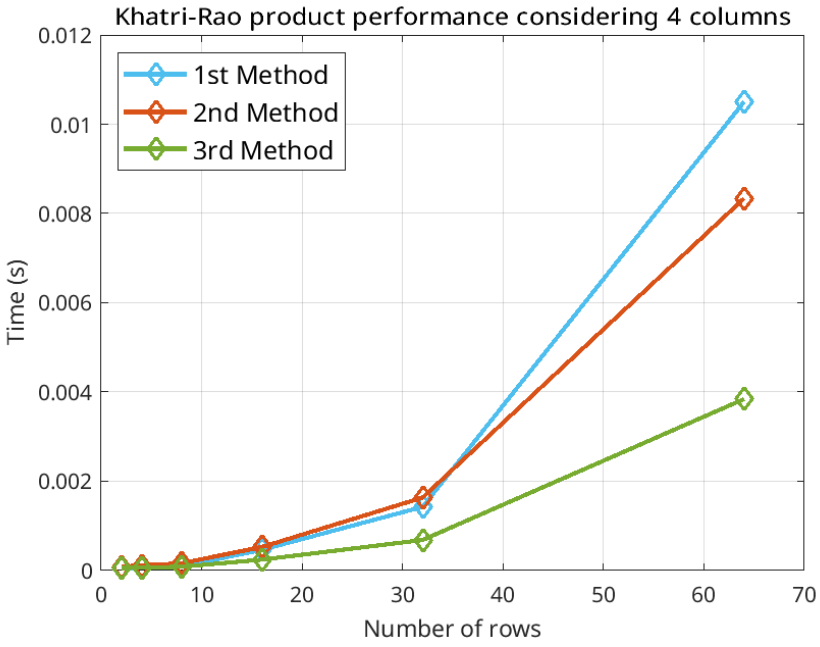

Figure 7: Monter Carlo Experiment with 250 runs and R = 4.

Homework 3
Least-Squares Khatri-Rao Factorization (LSKRF)

Implementation LSKRF

Monte Carlo Experiment

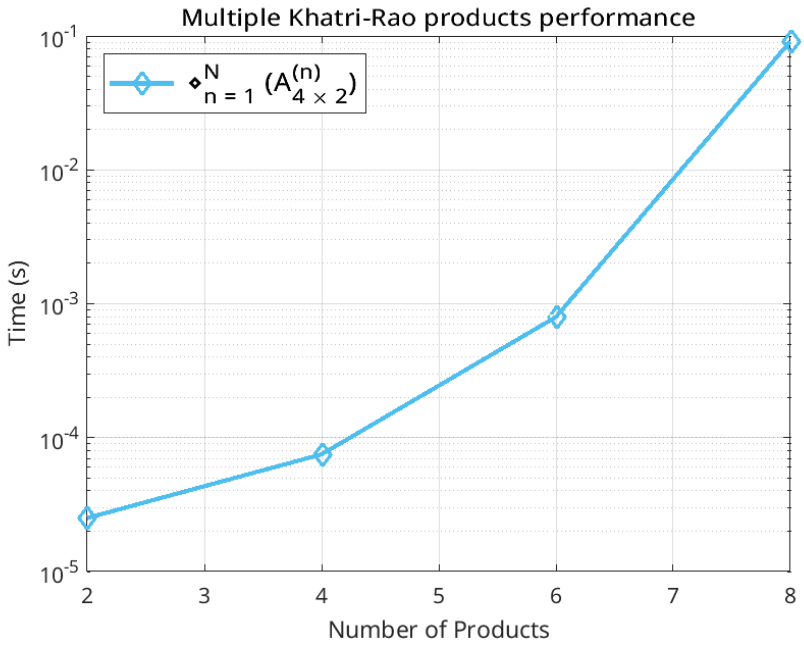

Figure 8: Monter Carlo Experiment with 250 runs.

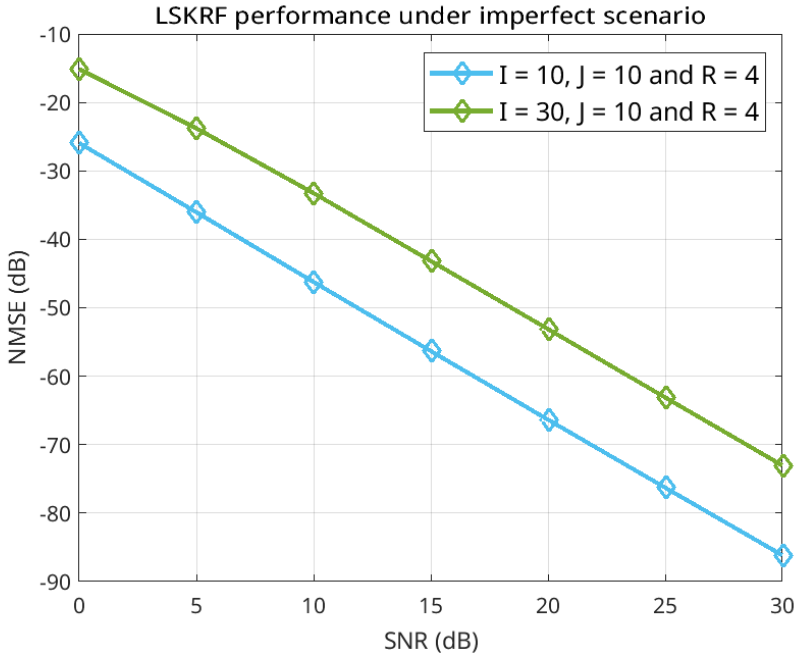

Figure 9: Monter Carlo Experiment with 1000 runs for LSKRF algorithm.

Homework 4
Least Squares Kronecker Product Factorization (LSKronF)

Implementation LSKronF

Monte Carlo Experiment

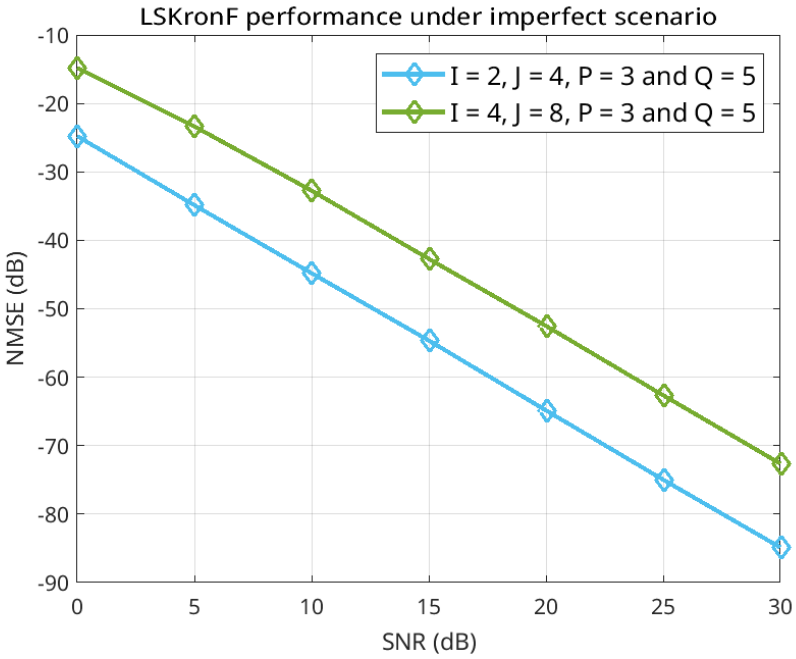

Figure 10: Monter Carlo Experiment with 1000 runs for LSKronf algorithm.

Homework 5
Kronecker Product Singular Value Decomposition (KPSVD)

Implementation KPSVD

Validation of KPSVD

Homework 6
Unfolding, folding, and n-mode product

Implementation unfolding, folding and n-mode product

Validation of unfolding, folding and n-mode product

Homework 7
High Order Singular Value Decomposition (HOSVD)

Implementation HOSVD

Validation of HOSVD

Homework 8
High Order Order Orthogonal Iteration (HOOI)

Implementation HOOI

Validation of HOOI

Homework 9
Multidimensional Least-Squares Khatri-Rao Factorization (MLS-KRF)

Implementation MLS-KRF

Monte Carlo Experiment

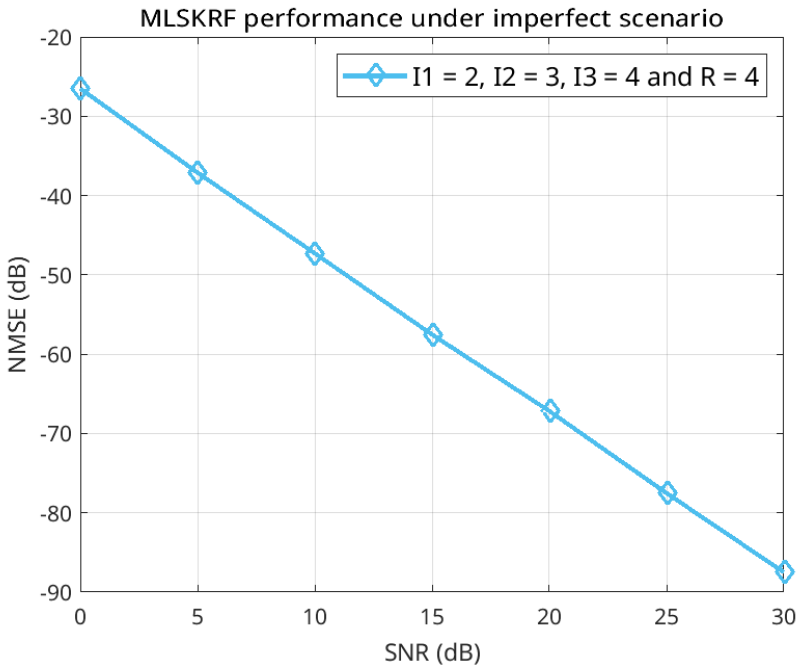

Figure 11: Monter Carlo Experiment with 1000 runs for MLS-KRF algorithm.

Homework 10
Multidimensional Least-Squares Kronecker Factorization (MLS-KronF)

Implementation MLS-KronF

Monte Carlo Experiment

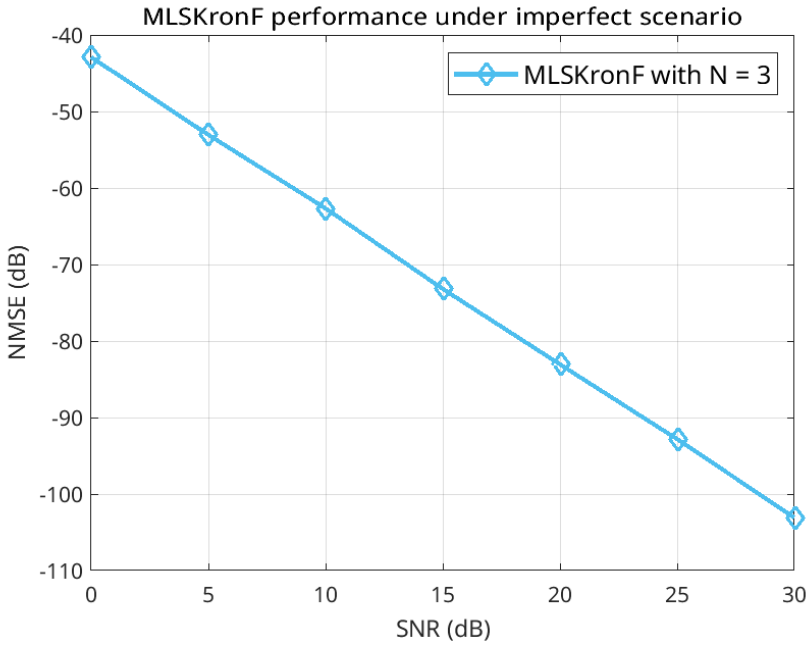

Figure 12: Monter Carlo Experiment with 1000 runs for MLS-KronF algorithm.

Homework 11
Alternating Least Squares (ALS) Algorithm

Implementation of ALS

Monte Carlo Experiment

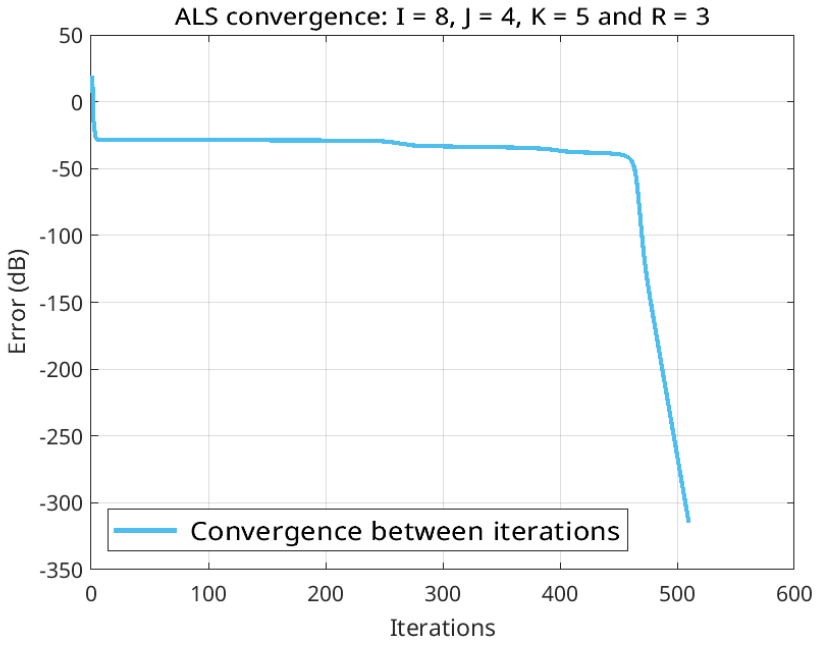

Figure 13: Convergence behavior of ALS algorithm.

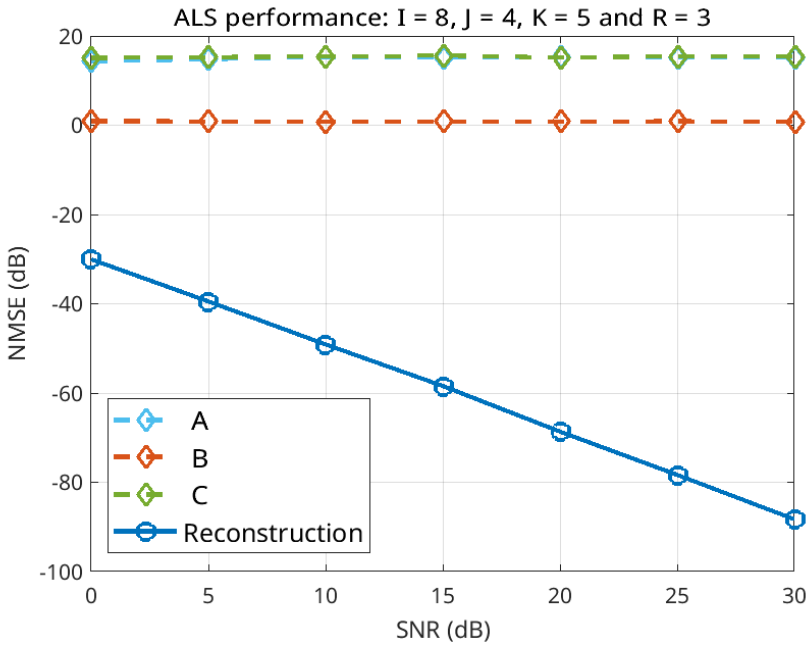

Figure 14: Monter Carlo Experimento with 1000 runs for ALS algorithm.

Homework 12

Tensor Kronecker Product Single Value Decomposition (TKPSVD)

Implementation of TKPSVD

Monte Carlo Experiment

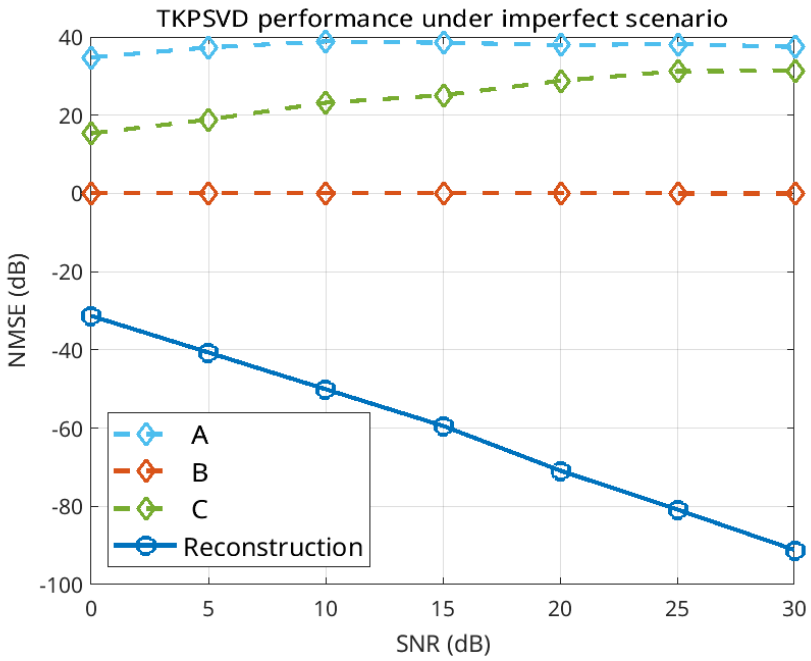

Figure 15: Monter Carlo Experiment with 1000 runs for TKPSVD algorithm.

Homework 13
Tensor Train Single Value Decomposition (TTSVD)

Implementation of TTSVD

Monte Carlo Experiment

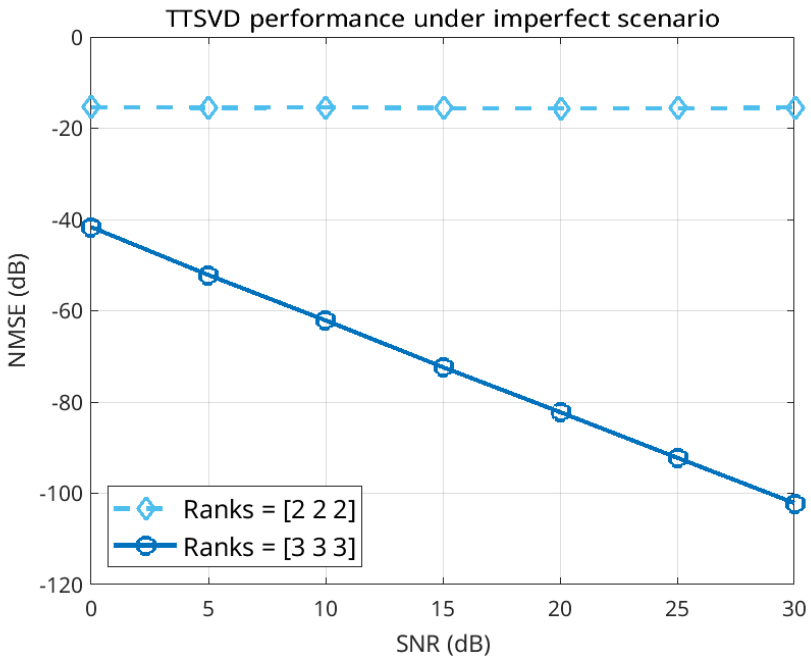

Figure 16: Monter Carlo Experiment with 1000 runs for TTSVD algorithm.