Truncated QR factorization with pivoting in mixed precision

Alfredo BUTTARI, Université de Toulouse, IRIT, CNRS - Toulouse
Theo MARY, Sorbonne Université, LIP6, CNRS - Paris
André PACTEAU, Université de Toulouse, IRIT, CNRS - Toulouse

Low-rank approximations are widely used to reduce the memory footprint and operational complexity of numerous linear algebra algorithms in scientific computing and data analysis. In some of our recent work we have demonstrated that low-rank approximations can be stored using multiple arithmetic precisions to further reduce the storage and execution time. In this work we present a method that can produce this mixed-precision representation directly ; this relies on a mixed-precision truncated rank-revealing QR (RRQR) factorization with pivoting. We present a floating-point error analysis and provide bounds on the error of the approximation demonstrating that the use of multiple precisions does not alter the overall accuracy. Finally, we present experimental results showing the execution time reduction for the cases where either classical or randomized pivoting are used.

Contact : alfredo.buttari@irit.fr