

Matrix Computations and Scientific Computing Seminar

Organizer: Jim Demmel and Ming Gu

Wednesday, 12:00–1:00 pm, 380 Soda Hall

Nov 25 **Jed Duersch**, UC Berkeley

True BLAS-3 QRCP with Random Sampling

By employing randomized sampling to select blocks of column pivots, we are able to achieve matrix factorizations of similar quality to standard QR with Column Pivoting (QRCP), but while retaining communication complexity of unpivoted QR. Thus we are able to obtain factorizations suitable for rank-detection and low-rank approximation at a small fraction of the time required by QRCP. We have written various approaches based on this idea in Fortran 90 with OpenMP and tested performance on 24-core shared memory systems. Our performance experiments compared these algorithms against LAPACK subroutines compiled using the Intel Math Kernel Library and verify computation time nearly as short as unpivoted QR (`dgeqrf`) and substantially shorter than QRCP (`dgeqp3`). We also compared approximation quality of low-rank Truncated QR with Column Pivoting (TQRCP) against our low-rank approximation using Truncated Randomized QR with Column Pivoting (TRQRCP). These tests consistently show approximation error similar to – and often smaller than – TQRCP.