

## Randomized Householder-Cholesky QR Factorization with Multisketching

*Monday, September 1, 2025 9:00 AM (30 minutes)*

We present and analyze a new randomized algorithm called rand-cholQR for computing tall-and-skinny QR factorizations. Using one or two random sketch matrices, it is proved that with high probability, its orthogonality error is bounded by a constant of the order of unit roundoff for any numerically full-rank matrix. An evaluation of the performance of rand-cholQR on a NVIDIA A100 GPU demonstrates that for tall-and-skinny matrices, rand-cholQR with multiple sketch matrices is nearly as fast as, or in some cases faster than, the state-of-the-art CholeskyQR2. Hence, compared to CholeskyQR2, rand-cholQR is more stable with almost no extra computational or memory cost, and therefore a superior algorithm both in theory and practice. Joint work with Andrew J. Higgins, Erik Boman, and Yichitaro Yamazaki

**Primary author:** SZYLD, Daniel (Temple University)

**Presenter:** SZYLD, Daniel (Temple University)

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