SIGEST

The SIGEST article in this issue, "Randomized Projection for Rank-Revealing Matrix Factorizations and Low-Rank Approximations," by Jed A. Duersch and Ming Gu, concerns the use of randomization to reduce the bottleneck in a central numerical linear algebra kernel. The authors consider QR factorization, which is a key component in algorithms for constructing stable bases, for solving least-squares problems, and generally for summarizing or extracting insights from data. Column pivoting is the standard technique for dealing with cases where the target matrix is not of full rank, or where the rank is in doubt. However, for large-scale problems column pivoting requires substantial communication between different levels of computer memory, which severely limits the overall efficiency. The authors therefore propose a strategy for choosing pivots based on randomization rather than exhaustive search. This approach reduces communication complexity while increasing uncertainty in the quality of the factorization in a controlled manner.

The article makes use of clear pseudocode listings in order to summarize both the original deterministic strategies and the newly developed randomized approaches; see Algorithms 1 to 6. The authors also explain how a Bayesian framework can be set up to quantify the uncertainty introduced by the use of random projections. Extensive, large-scale tests are conducted using Fortran with OpenMP, an application programming interface that supports shared-memory multiprocessing.

The original article appeared in the *SIAM Journal on Scientific Computing* in 2017, and the main idea has subsequently proved to be effective for a number of related tasks. In creating this highlighted article for the SIGEST section, the authors have

- revised the introductory material, providing additional context;
- reorganized the document structure and added new visualizations;
- updated and extended the computational experiments, while making this section more compact and easier to interpret; and
- discussed recent developments in the field and provided references to the growing literature.

The Editors