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Row-aware Randomized SVD with applications

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The randomized singular value decomposition proposed in [1] has certainly become one of the most well-established randomization-based algorithms in numerical linear algebra. The key ingredient of the entire procedure is the computation of a subspace which is close to the column space of the target matrix $\mathbf{A}$ up to a certain probabilistic confidence. In our work [2] we propose a modification to the standard randomized SVD procedure which leads, in general, to better approximations to $\mathrm{Range}(\mathbf{A})$ at the same computational cost. To this end, we explicitly construct information from the row space of $\mathbf{A}$ enhancing the quality of our approximation. We also observe that very few pieces of information from $\mathrm{Range}(\mathbf{A}^T)$ are indeed necessary. We thus design a variant of our algorithm equipped with a subsampling step which largely increases the efficiency of our procedure while attaining competitive accuracy records.
Our findings are supported by both theoretical analysis and numerical results.

1. N. Halko, P. G. Martinsson, and J. A. Tropp. Finding Structure with Randomness: Probabilistic Algorithms for Constructing Approximate Matrix Decompositions. SIAM Review \textbf{53.2}, 217–288 (2011). DOI: 10.1137/090771806
2. Davide Palitta and Sascha Portaro. Row-aware Randomized SVD with applications. arXiv: 2408.04503 [math.NA] (2024). URL: https://arxiv.org/abs/2408.04503.

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