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The implicit trace estimation problem asks for an approximation of the trace of a square matrix, accessed via matrix–vector products (matvecs). This talk introduces new randomized algorithms, XTRACE and XNYSTRACE, for the trace estimation problem by exploiting both variance reduction and the exchangeability principle. For a fixed budget of matvecs, numerical experiments show that the new methods can achieve errors that are orders of magnitude smaller than existing algorithms. A theoretical analysis confirms the benefits by offering a precise description of the performance of these algorithms as a function of the spectrum of the input matrix.

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