Randomized matrix-free quadrature

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We discuss randomized matrix-free quadrature algorithms for spectrum and spectral sum approximation. The algorithms studied are characterized by the use of a Krylov subspace method to approximate independent and identically distributed samples of $\mathbf{v}^* f(\mathbf{A})\mathbf{v}$, where $\mathbf{v}$ is an isotropic random vector, $\mathbf{A}$ is a Hermitian matrix, and $f(\mathbf{A})$ is a matrix function. This class of algorithms includes the kernel polynomial method and stochastic Lanczos quadrature, two widely used methods for approximating spectra and spectral sums. We will provide a unified framework for understanding these algorithms, and provide examples which shed light on the commonalities and tradeoffs between them.

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