

ALGORITHM 4.4: RANDOMIZED SUBSPACE ITERATION

Given an $m \times n$ matrix \mathbf{A} and integers ℓ and q , this algorithm computes an $m \times \ell$ orthonormal matrix \mathbf{Q} whose range approximates the range of \mathbf{A} .

- 1 Draw an $n \times \ell$ standard Gaussian matrix $\mathbf{\Omega}$.
- 2 Form $\mathbf{Y}_0 = \mathbf{A}\mathbf{\Omega}$ and compute its QR factorization $\mathbf{Y}_0 = \mathbf{Q}_0\mathbf{R}_0$.
- 3 **for** $j = 1, 2, \dots, q$
- 4 Form $\tilde{\mathbf{Y}}_j = \mathbf{A}^*\mathbf{Q}_{j-1}$ and compute its QR factorization $\tilde{\mathbf{Y}}_j = \tilde{\mathbf{Q}}_j\tilde{\mathbf{R}}_j$.
- 5 Form $\mathbf{Y}_j = \mathbf{A}\tilde{\mathbf{Q}}_j$ and compute its QR factorization $\mathbf{Y}_j = \mathbf{Q}_j\mathbf{R}_j$.
- 6 **end**
- 7 $\mathbf{Q} = \mathbf{Q}_q$.