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Dimension reduction and low-rank approximation with randomization

Randomized techniques have recently emerged as powerful tools for designing fast and scalable algorithms for performing linear algebra computations on very large matrices. This mini-course introduces some of the fundamental ideas of the field of randomized numerical linear algebra, focusing on dimension reduction and low-rank approximation. We will discuss randomized subspace embeddings for reducing the dimensionality of data while approximately preserving its geometric structure, with applications to the fast solution of least-squares problems. We will also talk about randomized algorithms for low-rank matrix approximation, including the randomized rangefinder, the Nyström method, and ideas related to column subset selection. The course will highlight the interplay between (numerical) linear algebra and probability.

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