

Randomized Singular Value Decomposition

A review of Halko, Martinsson, Tropp. (2010, December).

Finding Structure with Randomness: Probabilistic Algorithms for Constructing Approximate Matrix Decompositions

Benjamin Keene — benkeene@knights.ucf.edu

University of Central Florida — December 8, 2022

Contents

1	Introduction and Scope	2
1.1	Low-rank matrix approximations and their applications	2
1.2	Application of the SVD	2
2	What's involved in constructing low-rank approximations?	3
2.1	Approximating a basis for the range	3
2.2	Decomposing the low-rank approximation	3
3	The Randomized Range Finder	4
3.1	Goal	4
3.2	Algorithm	4
3.3	Analysis of Scikit-Learn's implementation	4
4	Randomized SVD	5
4.1	Goal	5
4.2	Algorithm	5
4.3	Analysis of Scikit-Learn's implementation	5
5	Implementation and Error Analysis	6
5.1	Singular value decay: exponential, linear, and random	6
5.2	Subroutine for generating test matrices	6
5.3	Results	6

1 Introduction and Scope