Sparsified Randomization Algorithms for the SVD based Low Rank Approximations

K. Sabelfeld, N. Mozartova

Sparsified Randomization Monte Carlo algorithms for Singular Value Decomposition (SVD) is presented. This method is based on the Johnson-Lindenstrauss lemma which says that a large matrix can be approximated in a certain sense via random matrices of smaller size. In particular, this approach makes it possible to construct a randomized algorithm for trancated spectral decomposition for very large matrices, i.e., the top singular values and the relevant left and right singular vectors are calculated without constructing the full SVD. We extend this method for a randomized solution of integral equations of the second kind whose Neumann series converges too slow, or even diverges. Another interesting application we developed is a randomized simulation of inhomogeneous random fields, in particular, we present the results of simulations for the fractal Wiener process and 2D Lorenzian random field (for details, see [1]). In fact, this is a randomized simulation algorithm for the Karhunen-Loève expansion for inhomogeneous random fields.

1. K. Sabelfeld, N. Mozartova. Sparsified Randomization Algorithms for low rank approximations and applications to integral equations and inhomogeneous random field simulation. *Monte Carlo Methods and Applications*, 2010, vol 16, issues 3-4.