



Multidimensional seismic data reconstruction based on Parallel Square Matrix Factorization

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Summary

Multidimensional seismic data reconstruction can be viewed as a low-rank matrix or tensor completion problem. We present a new fast and efficient low-rank tensor type completion algorithm named Parallel Square Matrix Factorization (PSMF) and apply it to reconstruct 5D undersampled seismic data in the frequency-midpoint-offset domain. For each frequency slice, we establish a tensor minimization model composed by a low-rank constrained term and a data-misfit term, and then we adopt the PSMF algorithm to reduce the rank of the unfolding matrices of the data tensor and to recover the missing samples. The PSMF method could rearrange an unbalanced "long strip" matrix into a more balanced square matrix while preserving the low-rank property. We also compare the proposed PSMF method to other state-of-the-art matrix type and tensor type completion methods. Experiments of synthetic data and field data set validate the efficiency and effectiveness of the proposed algorithm.