

Mathematical Multilinear Manifold Detection for Compression

SAND2017-3290PE

Scientific Achievement

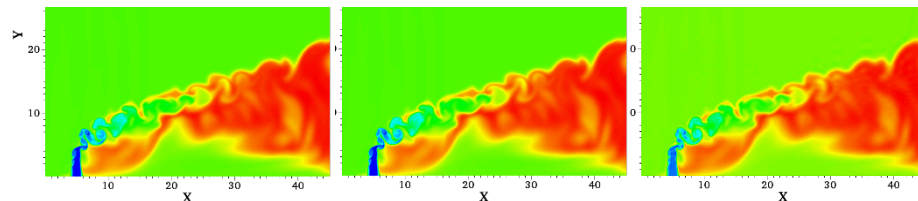
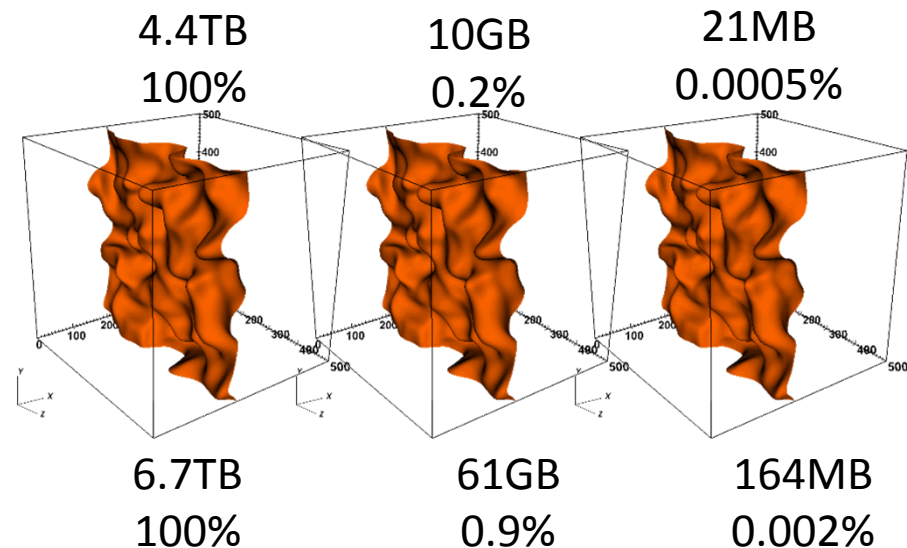
Reducing terabyte-sized scientific data sets by up to five orders of magnitude using mathematical techniques to uncover inherent low-rank multilinear structure

Significance and Impact

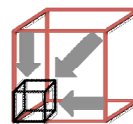
Reduces storage and communication costs, facilitates faster and more complex scientific analysis and visualization

Research Details

- Large-scale simulations produce vast quantities of output data which is unwieldy to analyze or visualize
- Mathematical compression based on the Tucker tensor decomposition detects inherent redundancies in the data, uncovering multilinear structure
- Sandia developed a massively parallel MPI implementation to compress massive datasets
- Ongoing work is extending and integrating these methods into NW program workflows



Reconstruction of Compressed Data: Time to compress 4.4TB or 6.6TB data sets is less than a few minutes on 1000 processors (less time than to simply read the data from storage) and image reconstruction takes only seconds on a single workstation. Reconstructed images have virtually no degradation. (Image Credit: Hemant Kolla)



TUCKERMPI

Austin, Ballard, Kolda, IPDPS, 2016

<https://gitlab.com/tensors/TuckerMPI>

work was performed at Sandia National Laboratories



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