DATA-PARALLEL adaptive TENSOR-TRAIN CROSS approximation

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Abstract

The tensor-train (TT) format is a low rank tensor representation frequently used for high order tensors. Traditionally, the TT format is computed directly with all the elements in the tensor. In this talk, we propose a TT decomposition algorithm that partitions the tensor into subtensors and performs decomposition individually before merging back together. This factorization routine is ideal for distributed memory parallelism. In addition, instead of computing the TT format with singular value decomposition based techniques, our proposed method, parallel adaptive TT cross, is a data-centric iterative method based on data skeletonization and has a low computational cost. In particular, our method is based on two innovative iterative formulations for data extraction and TT format construction, and we provide theoretical guarantees, communication analysis, and scaling results. For example, strong scaling results on synthetic datasets and discretized solutions of 2D and 3D Maxwellian equations suggest that this algorithm scales well with the number of computing cores, with respect to both storage and timing. This talk is based on the preprint `https://arxiv.org/abs/2407.11290`

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