Data-Based Performance Analysis of Algorithmic Variants

Variants Analysis of Scientific Algorithms in the Presence of Performance Variations

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1. Background

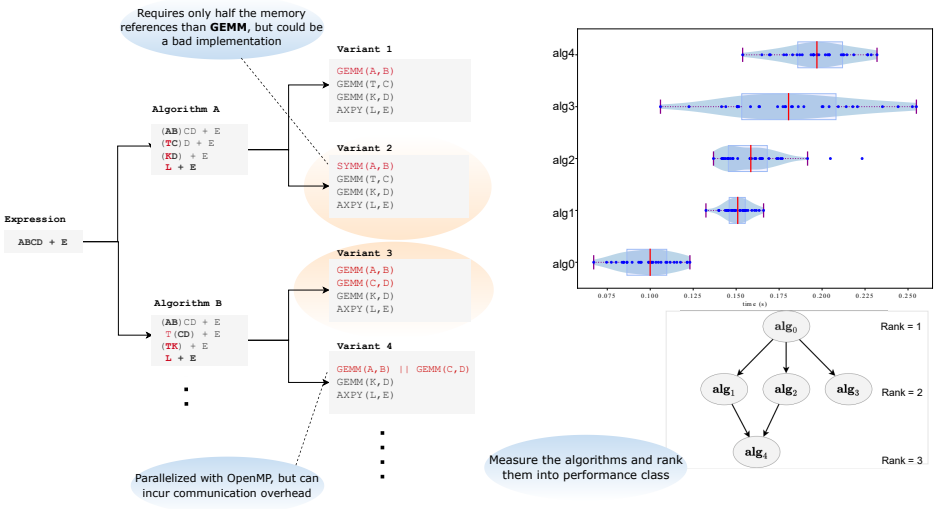
Motivation

- An algorithmic problem can have many possible algorithmic solutions (variants); although those variants are equivalent from a mathematical perspective, they can differ in terms of performance.
- Popular computing systems such as Matlab, TensorFlow, PyTorch, etc. often choose the sub-optimal variant [1].

Objective

- Perform data-driven performance analysis of variant implementations and aid in selecting a fast variant.

2. Same expression, but many variants with different performance



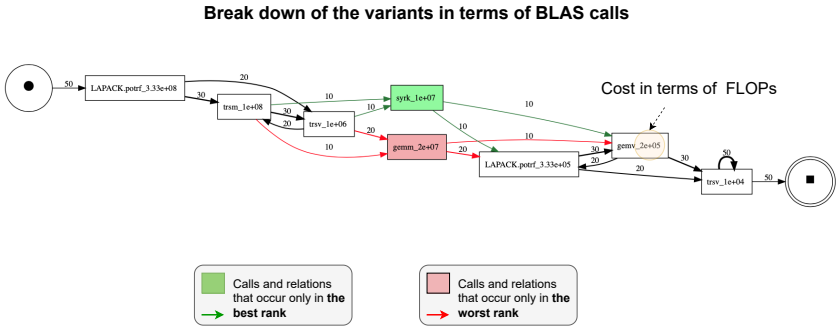
Parenthesization and Kernel choices results in different implementations of a Matrix chain.

3. Deliverables

The increasing complexity of computing systems induces variations in performance measurements. In this work, we develop methods to analyze the variants in the presence of performance variations.

- Methodologies to rank the variants while allowing for ties based on noisy performance measurements.
- A ranking with ties effectively clusters the variants into performance classes, which highlights the similarities and differences between the variants in terms of performance.
- The ranks are used in the identification of the root causes of performance variations and to aid in selecting a fast variant.

4. Performance Analysis



Process model of the variants in the best and the worst ranks.

[1] **A. Sankaran**, NA. Alashti, C.Psarras and P. Bientinesi, *"Benchmarking the Linear Algebra Awareness of TensorFlow and PyTorch."*, IPDPS: iWAPT 2022.
[2] **A. Sankaran** and P. Bientinesi, *A Test for FLOPs as a Discriminant for Linear Algebra Algorithms*, IEEE SBAC-PAD 2022