

High-Performance Matrix Computations Homework #1

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Due: Friday, May 15th, 1pm



Matrix-matrix product (GEMM)

Operation: $C := C + A * B$

where $A \in \mathcal{R}^{m \times k}$, $B \in \mathcal{R}^{k \times n}$, and $C \in \mathcal{R}^{m \times n}$

Implementations

- “**BLAS-0**”: Explicit triple loop; 6 variants.
- **BLAS-1**: Inner products; 2 variants.
- **BLAS-2**: Matrix vector products; 2 variants. Outer product; 1 variant.
- **BLAS-3**: Direct call.

Goal: Study the performance of different implementations of GEMM

- 1) **Implement** at least 4 variants, covering all four BLAS levels.
- 2) **Validate** your routines. Make sure you are computing the right quantity. Explain how you assessed the correctness of your code.
- 3) **Time** your routines.
 - a. *Repetitions*. Repeat your timings; include statistics (min, max, med, ...).
 - b. *Caching*. Repeat each experiment with and without cache thrashing.
 - c. *Efficiency*. In addition to timings, report efficiency (perf/TPP).
- 4) **Present** your results (visually). Explain the experiments. Provide your data. Comment.

Rules and Submission

- Format: Anything works. Email, pdf, webpage, ...
- Turn in your code
- Use an optimized BLAS: MKL, OpenBLAS, BLIS, (ATLAS).
No reference BLAS!
- No need to (attempt to) optimize your code manually!
- Include a description of the architecture used
- Sequential execution! No multi-threading
- Submission by email to `pauldj@aices.rwth-aachen.de`
- Email's subject: "HPMC-15 HW1 your_last_name"
- **Deadline: Friday, May 15th, 1pm**