

Homework 4 - BLAS practice

In this homework, we will be comparing the performances of different BLAS implementations. You are required to implement a simple algorithm in C language and perform the comparison on the program. Please consider **at least four** of the following BLAS libraries in your report:

- The Netlib BLAS/CBLAS
- Intel MKL
- AMD BLIS
- GotoBLAS

See the NY Times article.

This GotoBlas is not actively maintained now, so it's unclear if the code can be easily used or not.

- ATLAS (Its GEMM is used from Kazushige Goto's)
- OpenBLAS (An optimized BLAS library based on GotoBLAS2 1.13 BSD version.)
- Any other implementation listed on the wiki page:

The power iteration method

The **power method** is an algorithm for finding the largest eigenvalue of a given matrix. In your code, you should

- (1) Generate or read a diagonalizable matrix
- (2) Apply Algorithm 1.
- (3) Print the eigenvalue found.

Algorithm 1 Power method

Require: The input matrix $A \in \mathbb{R}^{d \times d}$ and the error tolerance $\epsilon_{\text{tol}} \in \mathbb{R}$

$b \leftarrow [1 \dots 1] \in \mathbb{R}^d$

$\epsilon \leftarrow \infty$

while $\epsilon > \epsilon_{\text{tol}}$ **do**

$b' \leftarrow b$

$b \leftarrow Ab$

$b \leftarrow \frac{b}{\|b\|_2}$

$\epsilon = \|b - b'\|_1$

end while

return $\|Ab\|_2$

▷ the largest eigenvalue

Requirement

1. Implement the power method in C and link it with different BLAS implementations that you choosed. You should properly utilize the functionalities provided by BLAS in implementing the algorithm. Also, you are required to **include your code in the report pdf file**.
2. Time the algorithm with sufficiently large matrix so that the difference is significant enough.
3. Compare and discuss the performance of different implementation. Are some of the implementations faster? Why? You should specify whether your implementation has multi-thread enabled.