

Evaluation of Parallelization Approaches for Efficient Multiplication of Sparse Matrices

Ing. Matěj Javorka

Supervisor: doc. Ing. Ivan Šimeček, Ph.D.



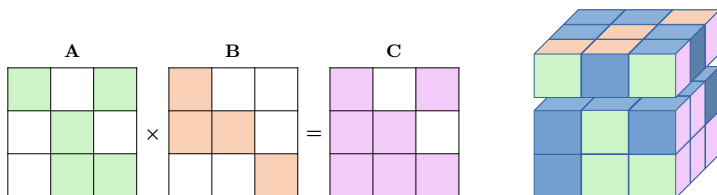
**FACULTY
OF INFORMATION
TECHNOLOGY
CTU IN PRAGUE**

Thesis goals

- Research of methods used for representation of sparse matrices
- Analysis of algorithms for parallel multiplication of sparse matrices
- Design and implementation of an algorithm in C++ for multiplication of sparse matrices in the following variants:
 - sequential variant
 - parallel variant using OpenMP
 - parallel variant using only the C++ standard library
- Measurement of computation time and parallel metrics
- Evaluation of measured data and parallelization approaches

Methodology

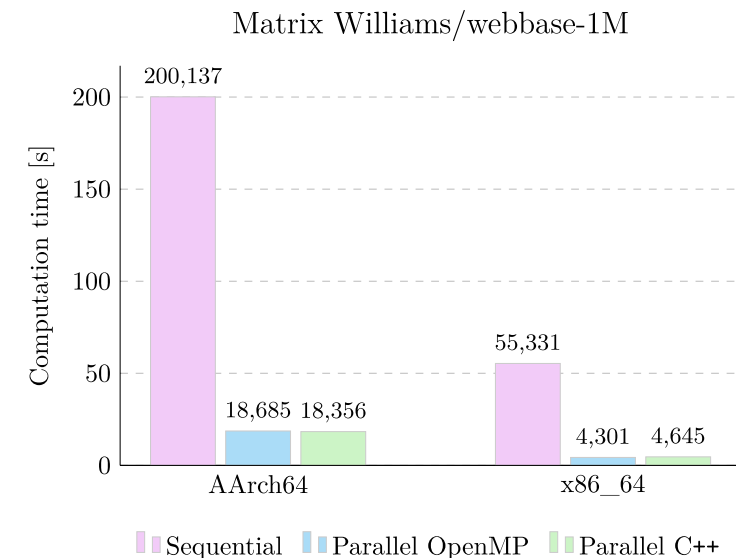
- Precise prediction used to determine the size of the output matrix
- 1D T -partitioning used for work distribution and load balancing
- Hash-based accumulator used for result accumulation



1D T -partitioning. Illustration inspired by [1].

Results

- Measurements performed on two types of CPU architectures
- Matrices from SuiteSparse Matrix Collection used for measurements
- In most cases, the parallel OpenMP variant achieved the best results



References

1. GAO, Jianhua; JI, Weixing; CHANG, Fangli; SHI-YU, Han; WEI, Bingxin; LIU, Zeming; WANG, Yizhuo. A Systematic Survey of General Sparse Matrix-Matrix Multiplication. ACM Computing Surveys. 2023, 55(12), 1–36. ISSN 0360-0300. Available from DOI: 10.1145/3571157.