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Effective Implementation of Matrix-Vector Multiplication on Intel's AVX Multicore Processor

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Highlights

- Implementing dense matrix-vector multiplication kernels in parallel using Intel's advanced vector extension (AVX) instruction sets.
- The obtained results are compared using inline assembly versus intrinsic functions for programming.
- A comparative study to indicate the effects of two widely used C++ compilers: Intel C++ compiler (ICC) in Intel Parallel Studio XE 2017 against Microsoft Visual Studio C++ compiler 2015 (MSVC++) has been investigated.
- The performance of using intrinsic functions compared to the inline assembly demonstrates that the intrinsic functions has better performance than inline assembly by 1.15 and 1.23 using Intel compiler and by 1.29 and 1.29 using MSVC++ compiler for $y = A \cdot x$ and $A^T \cdot x$ respectively.
- Implementing single-precision matrix-vector multiplications algorithm in parallel using Intel's AVX instruction sets, memory access optimization, and OpenMP parallelization.
- The obtained results are compared against the latest version of Intel MKL 2017 SGEMV subroutines.
- The obtained results are compared using single-thread against multithreads.
- The obtained results of the proposed optimized algorithms were achieved a performance improvement of 18.2% and 14.1% on multi-core platform for ($y = A \cdot x$ and $y = A^T \cdot x$) respectively compared to the results are achieved using the last version of Intel Math Kernel Library 2017 (SGEMV) subroutines.

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