

Jacobi Iteration

Introduction:

The Jacobi Iteration problem solves a linear system of equations like the Gaussian elimination except that it is an iterative approximation method. This problem lends itself to the mass parallelization on GPUs very well. The only true performance differences on GPU implementations is the handling of data management. Optimally using bus transactions called data coalescence, is the main mechanism of data management improvement. In this problem the data coalescence can be achieved by switching the matrix from a row major form to a column major form.

Results

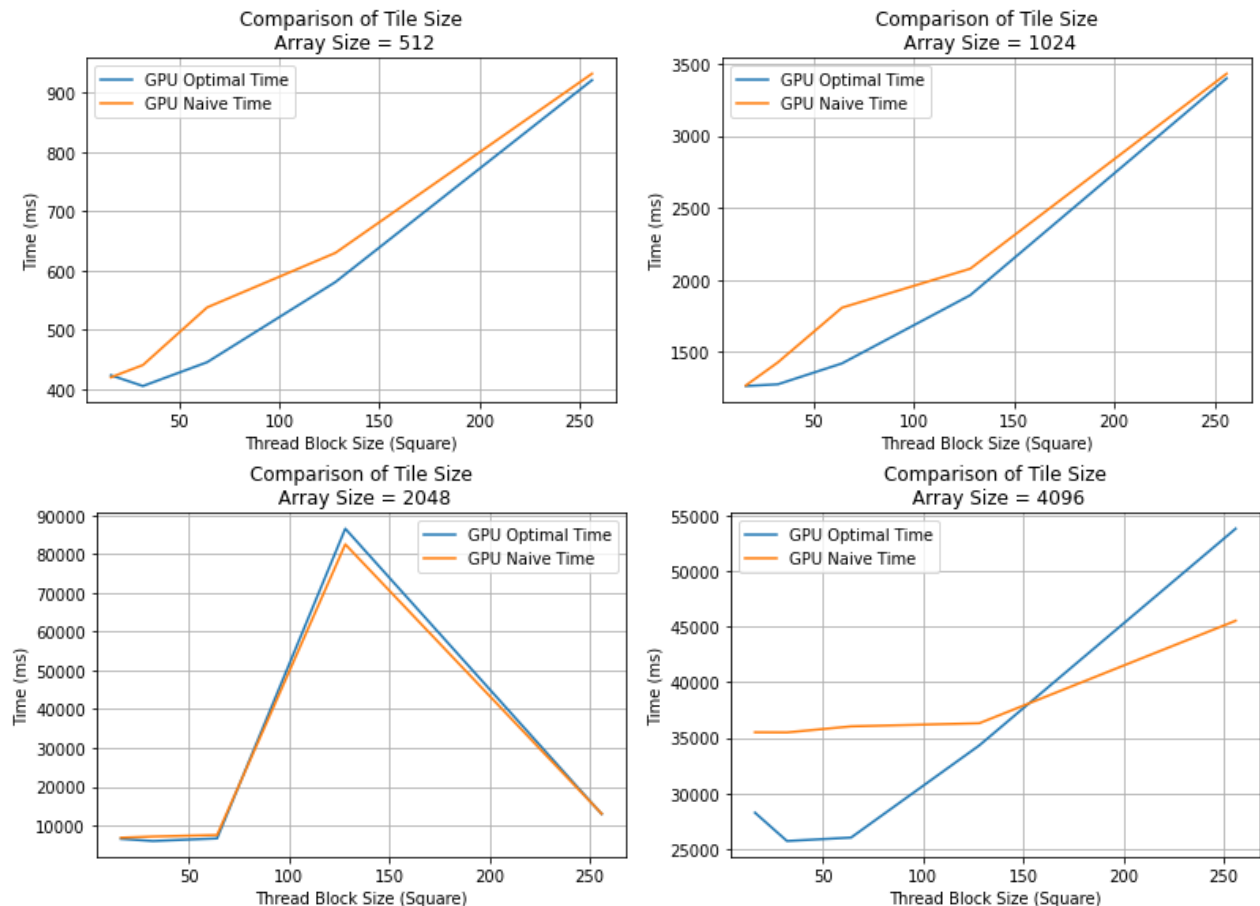


Figure 1: Runtime differences between GPU methods differing in data coalescence.

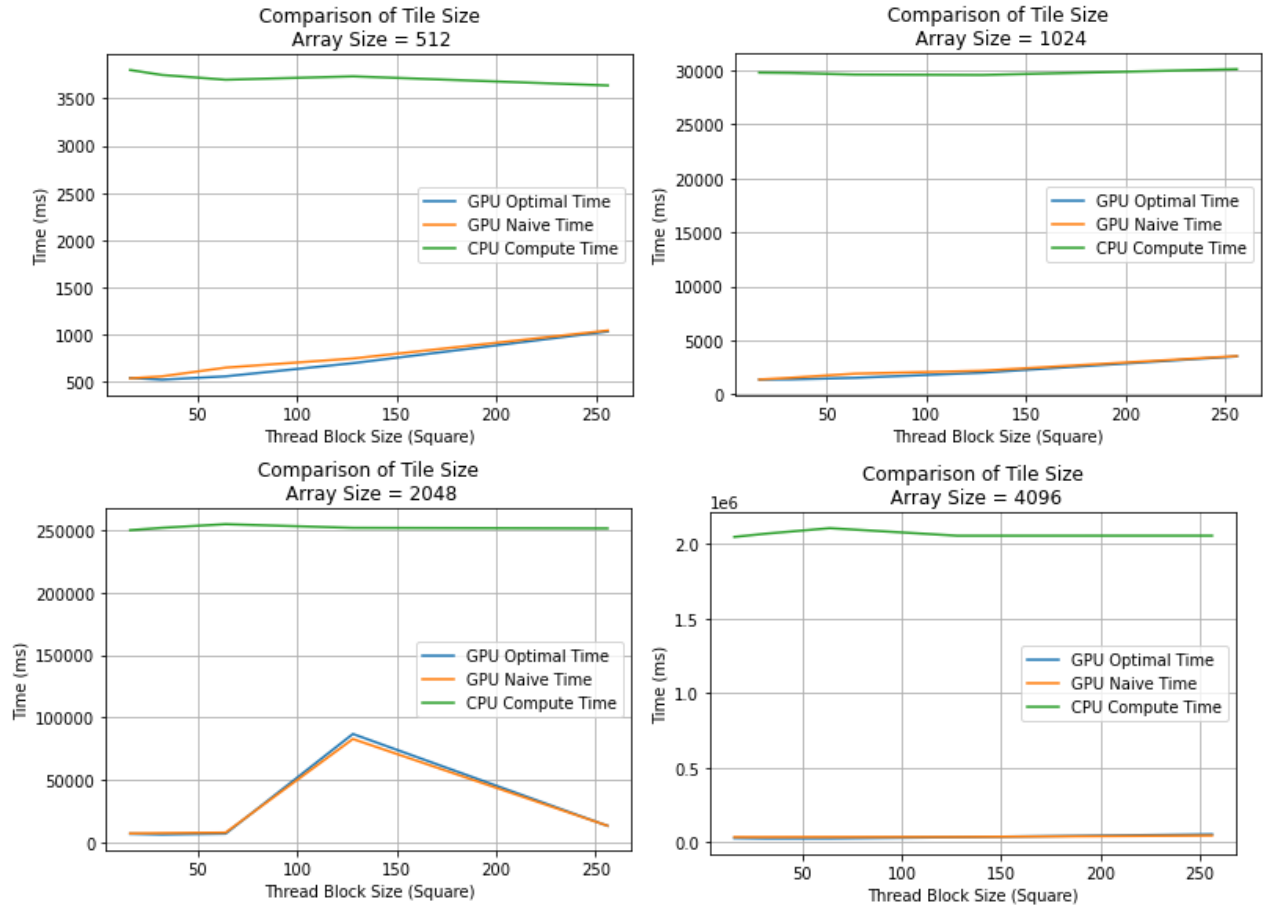


Figure 2: GPU implementation time vs CPU time by varying of thread block size.

Conclusion

From these specific implementation results, it appears that a smaller thread block size leads to slightly faster performance. This phenomenon is most likely due to a smaller thread block size using more available cores and SMs than a larger thread block size. The GPU implementation was significantly faster than the CPU implementation and converged with the same Mean Squared Error in the same number of iterations.