
Parallel Computing
Assignment 1 (4 Marks)
Deadline: 29th August 11:59PM

- Implement matrix multiplication in C/C++. Your program should take as input m , n and p . i.e. the result matrix $C = A \times B$ will be of dimension $m \times p$.
- Matrices A and B should be initialized by random values.
- Sparsity is also another input to your program. What is sparsity? Say $sp = 0.1$, it implies that only 10% of the entries in the matrix hold data, rest of the entries are zero.
- Both A and B will have their own sparsity input. i.e sp_A and sp_B
- When generating random input to fill the matrix, assume the sparsity is randomly distributed. For example, if $A = 4 \times 4$ matrix, and $sp_A = 0.5$, do not fill up the first two rows with values, and the last two rows with 0. The sparse entries should be randomly distributed.
- Why should you be bothered about sparsity?
<https://blogs.nvidia.com/blog/2020/05/14/sparsity-ai-inference/>
<https://developer.nvidia.com/blog/exploiting-ampere-structured-sparsity-with-cusparselt/>
- Think about how you will store these sparse matrices. Clearly, storing all the entries is not efficient. For example, if $A = 1024 \times 1024$ matrix, there is no point in taking up $1024 \times 1024 \times 4$ (4 bytes for integer) = 4MB. Maybe it can be stored efficiently. If yes, how? and once you come up with an efficient way to store these matrices, how will you multiply them? (maybe the 3 for loops might not be sufficient?)
- Time the runtime of your algorithm for various sparsity values. Compare them with the algorithm which stores matrices as dense i.e. with 0s also taking up space.
- Plot graphs. What graphs? Think about how you will convince me and yourself (!) that the storage format you have come up with is great by using those graphs.
- Use github to host your code and plots. Share the link as your submission. Any other files/zip-files attached will not be evaluated.
- Any kind of cheating will be heavily penalized. Please refer to the discussion we had in class regarding this.
- The best assignment submission will fetch you a prize.
- If you need any help or have any questions, feel free to shoot me an email. By any, I mean, any. For example: Why did Kattappa kill Baahubali? I will try to answer, some answer, though might not be the right answer!
- Clash on!