3460:677 FINAL PROJECT, FALL 2022

The purpose of the final project is to take what you have learned in this class and develop a real application to take advantage of parallel programming concepts. Write a non-trivial parallel program that uses CUDA. Project topics include, but are not limited to, the following:

- Fast Fourier transforms (FFTs)
- Data interpolation
- Image and signal processing
- Animation
- Algorithms: sorting, graphics, graph, …
- Bioinformatics
- Artificial Intelligence
- Applications from the book: N-body, tree search, …

Look in the textbook or online for ideas. You must change things up in some way from your cited sources. Note: The best topic to pick is the one you are interested in!

Requirement

For small groups of 1 – 2 people submit the following:

- Proposal description (1 or 2 pages) due Friday October 22.
  - Each group must meet with me individually to discuss their project before the due date. I must sign off on your proposal (in writing).
- Project presentation in class in November.
  - Allow 12 minutes for your talk, 2 minutes for Q&A, rigidly timed.
- Final report (about 5 pages, no longer than 7 pages) due Friday November 25.

Project Proposal (due Friday October 22)

Your project proposal will be fairly short but include the following:
- Who are the members of your team?
- What is your problem and why is it important?
- Why is the problem suitable for GPU acceleration?
  - Describe the inherent parallelism and argue that it constitutes a significant portion of the computation. Use measurements from CPU execution if possible.
  - Discuss what data structures may need to be protected by synchronization or communication through the host.
  - Discuss the data footprint and anticipated cost of copying to/from host memory.
- What makes this problem worthy of a project? Point to any difficulties you anticipate in achieving a large speedup.

Project Report (due Friday November 25)

Your project report will be limited to seven pages. The format must be readily legible. Use no less than 2.5-cm margins and a standard font with font size no smaller than 12 point and no bigger than 14 point. It should include the following sections:

- Introduction
  - Describe clearly and concisely your objectives of the project, relating them with the problem as well as the background knowledge. Also provide the overall structure of the project.
- Methodology
  - Description : In depth explanation of the problem as well as any established algorithms used in deriving a solution.
  - Complexity analysis
    - Describe your asymptotic and/or empirical analysis of any algorithms. Use tables and/or figures whenever possible.
  - Implementation : Give a high level description of your implementation, possibly including a flow chart.
- Test Case(s); may include one or more of:
  - Sample problem description
  - Data acquisition/generation
  - Data preprocessing (if needed)
  - Computational results
    - Describe the results and present the timing of your computation. Use tables or graphs wherever you can.
- Discussion
  - Possible comparison with other methods; use tables or graphs wherever you can
  - Possible numerical comparison with other algorithms
  - Comments and future work
    - You can give an indication of the scope for future work, and discuss how you might have approached the project differently were you to do it again. You might also indicate what you've learned from the project, and put in any comments on the factors which have enabled or impeded the project.
- Conclusion
  - Summarize the main objectives and results, as in the introduction, but from the perspective of the readers who have read the main part of the report and need reminding what it is all about.
- References (page limit does not apply to this section)
  - <u>Give detailed references to the sources of information</u>. References should be actually referred to in the text. For example write "see ref. 16" if you want to refer to a book/paper for an idea you present in the report. The format of the references should be consistent. See your book for the format.
- Exam Questions
  - Include three questions (with answers) appropriate for inclusion on the midterm or final exam for this class.
- Appendices (if desired)

Last Updated 1/26/2021. Based on assignments by M. Hall, Z.-H. Duan and Y. Xiao.