Assignment #4 – CUDA Programming
EEL6763 Parallel Computer Architecture
Spring Semester 2019

Due: Feb 23

1. Write an original C program to perform edge detection using Sobel 3x3 filter and parallelize the code using CUDA. Input to the program would be the image size N. For simplicity, generate a 1-D input array containing N^2 elements where each element has a random values ranging from 0 to 255. For example, if the image size is 32x32, the size of the array would be 32x32 = 1024. Possible values of input size are: 16,32,64,128,256,512. Ignore edge pixels while applying the sobel filter. Include the following in the report:[50]
    a. Source code
    b. Report the speedup obtained over serial execution (plot the graph)
    c. Report communication to computation ratio (use nvprof profiler)

    In order to get extra-credit, try to optimize the code by making use of the shared memory. Compare the results with the unoptimized version[20]

2. Implement the same Sobel filter program using MPI. The program takes the same input as that of CUDA. Suppose you've lot of images of size 1024x1024 on which you want to apply sobel filter and you have budget to use either a 16-core processor or a GPU on HiPerGator. Which one would you prefer? Justify your answer.[50]

Submission Guidelines

- Submit the C Source files and a PDF containing answers through e-Learning.
- Students may work in teams of two. Only ONE team-member has to submit PDF using Canvas (NOT BOTH) - Mention your partner's name in the comments sections during your submission on canvas.
- The answers should include source codes (copy-paste each complete source code from your source file), timing information from experiments, your observations, and any other files or documentation needed to replicate your experiments.
- In the final PDF, clearly differentiate between source code for the different questions.
- Please make sure that source code is consistently indented and commented.
- All code and answers should be your own and not copied from the Internet or elsewhere!
- Results should be run using HiPerGator batch scripts