

CSE435 FALL 2024 Homework 3

This homework is assigned to each student who is registered to CSE435. Answers to the questions should be student's own work. No group work is allowed. Students may be asked to explain/present their answers if needed.

Deadline and Submission

- Submit until midnight(23:55) of December 29, 2024
- Submit in digital format. Create a zip package which includes source files, outputs of the tests and the report.
- Late Submission:
 - **Not accepted because there isn't enough time to grade the assignment.**

Questions

Show steps of derivations and state any assumptions you made.

For the following two questions, you can follow this documentation:

<https://ulhpc-tutorials.readthedocs.io/en/latest/cuda/exercises/convolution/>

In the discussion, be careful about the use of the word “kernel”. There are two types of “kernel”s. One is a CUDA kernel. The other one is the convolution kernel.

In order to test your implementation, you have to load an input image and store the resulting image. For this, you can use a library. You can use any png, bpm or ppm library.

Q1 [30 pts]

Implement a convolution operator(edge detection) for an image on Nvidia CUDA, **without** using shared memory. Try different grid sizes and shapes and try to optimize the implementation. Comment on the effect of grid shape and sizes you choose.

Q2 [30 pts]

Implement a convolution operator(edge detection) for an image on Nvidia CUDA, **with** using shared memory. Try different grid sizes and shapes and try to optimize the implementation. Comment on the effect of grid shape and sizes you choose.

Report [40 pts]

For Q1 and Q2, Try different number of repetitions, time the execution at each case, plot a graph for different runs. show input and output images of some of the tests.

Compare the performance of the implementations in Q1 and Q2