CS432 GPU Accelerated Computing
Assignment 2

CS Program
Habib University

Spring 2023
Due Date: 24 February 2022 @ 11:59PM

1 Question 1

Phillipe Thevanes wrote a seminal paper on B-spline interpolation [1]. A sample CPU implementation is given here [2]. You are required to provide the following:

1. Implement the code on the CPU in Google colab environment showing results of the circular pattern image (Fig 8(c) in [1]) . Give comparison of your code output against fig 9(a) and fig 11(c). The figures are copied in figure 1 and 2 respectively. Use any timing function like clock() or hiresolution counters to note the amount of time it takes to process image data on the CPU. (+30)

2. Implement the code on the GPU in Google colab environment showing results of the circular pattern image (Fig 8(c) in [1]). Give comparison of your code output against fig 9(a) and fig 11(c). The figures are given below for your reference again. Note the time it takes to run the kernel using the CUDA event API to calculate the amount of time needed by the GPU. (+30)

3. Optimize the CUDA code by using shared memory or any other means such that you get significant speedup compared to the previous GPU implementation. Output the speedup you obtained on the GPU. (+30)

4. Add comments in the code and do error handling. (+10)

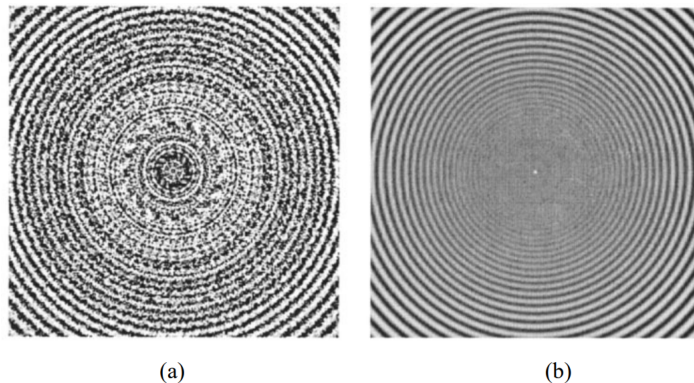(a)   (b)

Fig. 9. Rotation of a circular pattern. (a) Nearest-neighbor. (b) Linear interpolation.

Figure 1: Figure 9 in original paper [1].
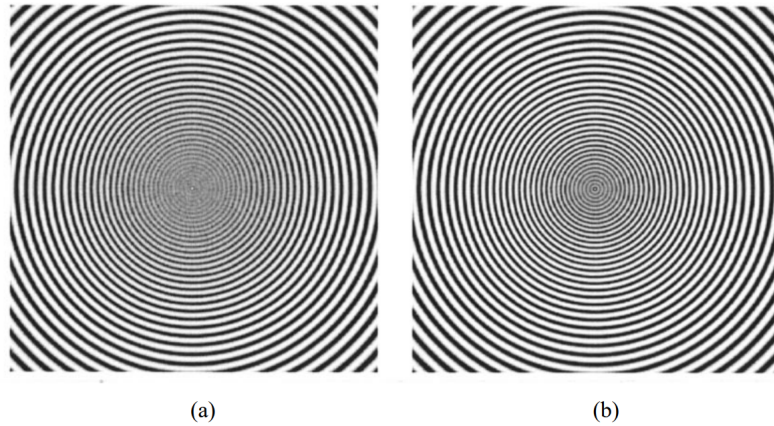
Fig. 11.   Rotation of a circular pattern. (a) Keys. (b) Cubic spline. (c) Cubic o-Moms.

Figure 2: Figure 11 in original paper [1].

2   Deliverables

Submit a colab notebook (.ipynb) file with your regn. no. as the filename i.e. $[ABxxxx\_Assgn1]$.ipynb. It should contain your solutions for Questions 1. Use the jupyter notebook text and code cells and write a consolidated report detailing your CPU, unoptimized and optimize GPU implementation. **No other file name or file type will be accepted.**

3   Deductions Note

Failing to comply to the instructions will result in a deduction of 20 percent score.

4   Plagiarism Policy

We have zero tolerance for plagiarism. The assignment submission should be your own genuine work without copying content from anyone else in the class or from the internet. If there is any evidence of plagiarsim, the case will be reported.

References

[1] P. Thévenaz, T. Blu, M. Unser, "Interpolation Revisited," IEEE Transactions on Medical Imaging, vol. 19, no. 7, pp. 739-758, July 2000.

[2] https://github.com/sobotka/interpolation_revisited