

CUDA Advanced Libraries Assignment

Module 9

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Goals

For this assignment, I wanted to work towards the direction of my final project while practicing utilizing the CUDA advanced libraries. Since my final project involves image processing (eventually on video), I implement a skeletonization algorithm hoping to gain experience so that I'm not overwhelmed later. I use NPP for image pre-processing and Thrust for counting ZhangSuen-marked pixels to find whether to continue the algorithm.

Challenges

I wanted to use NPP for thresholding as well, but I had issues on my Windows system where it would not recognize the Ctx version or the non-ctx version. I couldn't resolve it, so I have a regular kernel for thresholding instead of using another great application of NPP.

Triumphs

I learned about skeletonization and was able to pre-process the data, apply the algorithm and see good results. It felt good to gain familiarity with how to use these libraries, though I still had (and will have) more struggle.

Additional Information

Since I know almost nothing about skeletonization, I needed to build context on it. Skeletonization is a form of thinning of shapes in an image that preserves the structure [1]. The core steps of the skeletonization algorithm are: initialization, iterative removal of border pixels, and iterative convergence [1]. It was interesting to see the shapes of various objects in [2]. The algorithm I've chosen to implement is the Zhang-Suen algorithm that produces a 1-pixel-wide skeleton of an image. The Zhang-Suen algorithm consists of two passes that repeat until no more skeletonization can be done [3]. Pass 1 removes the bottom right corner, and Pass two removes the top left corner [3].

Resources

- [1] <https://www.educative.io/answers/what-is-skeletonization-in-image-processing>
- [2] <https://homepages.inf.ed.ac.uk/rbf/HIPR2/skeleton.htm>
- [3] https://rstudio-pubs-static.s3.amazonaws.com/302782_e337cfbc5ad24922bae96ca5977f4da8.html