Spring 2021: ME759 Final Project Proposal

Project Title: Straight Line Boundary Detection for Large Images
Link to git repo for project: https://euler.wacc.wisc.edu/jliu798/me759-jliu798.git
Problem statement: The boundary of an object is a vital characteristic in image processing. Canny Edge Detector is a common tool to identify pixels that belong to an edge. Howeverpart of an object could be blocked by other objects in an image. Therefore, the edges found might not be consistent. There exist some algorithms to detect boundaries regardless of blocking, such as Hough Transformation. However, many of them have a high order of complexity and will use many resources especially when dealing with large images. An efficient way of finding boundaries of objects in a large image need to be developed with parallel programming on GPU.

Motivation/Rationale: The motivation of this project comes when I implemented a boundary detection algorithm with Hough transformation in Matlab. The process was slow even for a small image. After I took ME 759, I feel like parallel computing is useful in improving the runtime of this algorithm. In canny edge detection and Hough transformation, each pixel of an image can be processed independently, so parallel computing is possible here.

Explain how you contemplate going about it: OpenMP will be used for parallel computing. Opencv library will be used to process images. Canny edge detector will be used to generate edge matrix. Hough Transformation will be implemented to find line boundaries of objects with the edge matrix.

ME759 aspects the proposed work draws on:

- Process of each pixel to determine if it is an edge pixel.
- Process of each edge pixel to determine the parameters of a line in this image.

Team member[s]:

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- Home department: Mechanical Engineering
- Advisor: Dr. Peter Adamczyk
- Student's role in project: Owner

Deliverables:
code for detecting edge and calculate linear boundaries.
Input files: High-resolution images from https://www.pexels.com/
Output files: Images with boundaries of object annotated.
Tech report: include the accuracy of boundary detection and the improvement of runtime compared with CPU implementation.

How you will demonstrate what you accomplished: I will demonstrate by listing the output images, input images and the time it took to find these boundaries.