ID5130 Course Project Abstract: Image edge detection using parallel algorithms

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Edge detection algorithms have a several use-cases in industry and academia, seeing application in microscopy, biotechnology, medicine, astrophysics, materials engineering etc. This project aims to parallelise two classes of edge detection algorithms: kernel based convolutional edge detection (in particular the Sobel algorithm[1]) and fuzzy logic based edge detection (relative pixel algorithm[2]).

The above cited serial implementations of the algorithms will be referred to in developing parallel algorithms in OpenMP and possibly in OpenACC.

Multiple input dimension images will be used to evaluate the comparative performance of the serial algorithm. A successful implementation would yield identical or sufficiently similar results in a lesser amount of time for all large inputs.

Sobel algorithm: The Sobel kernels to be used in the convolution are:

$$\begin{pmatrix} -1 & 0 & 1 \\ -2 & 0 & 2 \\ -1 & 0 & 1 \end{pmatrix}, \begin{pmatrix} -1 & 2 & -1 \\ 0 & 0 & 0 \\ 1 & 2 & 1 \end{pmatrix}$$

to detect edges along vertical and horizontal direction respectively. The input image will be converted into grayscale and then convolved, normalised and visualised.

FIS algorithm: The full algorithm has been described in the cited source. Pre-defined curves are used to set pixel value as black or white. A set of black/white pixel comparison rules are established and used to detect edges in the image.

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[1] An Implementation of Sobel Edge Detection
[2] Edge Detection in Digital Images Using Fuzzy Logic Technique

Figure 1: Comparison of algorithms: Clockwise; original image, Sobel algorithm, Fuzzy relative pixel algorithm