Project Proposal(ECEN 5593)

Implementation and Analysis of Adaptive Histogram Equalization in pyCUDA

AIM:

- To design a parallel implementation of Adaptive Histogram Equalization
- Compare the performance of this algorithm with and without GPU acceleration

ABSTRACT:
Histogram Equalization is generally used as a contrast enhancement method. Other applications of the algorithm include enhancing visibility of images with medical importance. We will use a modified version of histogram equalization with variable block sizes and profile the performance of these implementations with and without GPU acceleration.

IMPLEMENTATION:
For our project, we intend on implementing the algorithm in PyCUDA. Python is chosen as the language for implementation since we are keen on exposing ourselves to the APIs that are used for accessing CUDA functions. PyCUDA also enjoys other advantages over the traditional C version of CUDA such as easier memory handling and error checking.

The traditional histogram equalization uses the entire image for the histogram calculation. This algorithms produces appreciable enhancement when the image has evenly distributed intensity values. But images that have uneven distribution of intensity fail to produce good results. To overcome this drawback, adaptive histogram equalization is used. It splits the images into multiple regions and then applies histogram equalization on each individual region.

We intend to exploit the performance of the GPU for optimizing the time taken to execute the algorithm. Since the image is split into various regions, the GPU computes each of these regions simultaneously thus providing a significant boost over the traditional implementation on a CPU. The python time module can be implemented to profile execution time for our algorithms.

CONCLUSION:

This project will help evaluate and optimize the performance of the algorithm on a GPU platform. Experimenting with different regions sizes and the corresponding execution time will give us better insight into parallel algorithms. It will help gain a better understanding of GPU architecture and how GPUs can be exploited to accelerate traditional algorithms.

REFERENCES:

- J. Alex Stark, Adaptive Image Contrast Enhancement Using Generalizations of Histogram Equalization
- S Muniyappan, Dr.A.Allirani & S.Saraswathi, A Novel Approach for Image Enhancement by Using Contrast Limited Adaptive Histogram Equalization Method

FUTURE SCOPE:
We intend to implement contrast limited adaptive histogram equalization as a stretch goal.

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