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Computer Technology Department

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CEPARCO

Integrating Project Milestone 1
Project Proposal

GROUP 6

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Abstract

This integrating project involves altering a live video feed or image to reduce the effects of the most common types of colorblindness. The LMS Daltonization algorithm is utilized in this project for its accuracy and reliability. Using this in a real-time application allows its implementation to be widely used, especially in the health sector.

Description

a. Project inputs

- The inputs intended for the project can be an image or a live/real-time video.

b. Process

i. What processes will be parallelized using SIMT (GPU/CUDA) or SIMD-based AVX/AVX2 assembly project?

- We intend to parallelize the main algorithm process which is the LMS Daltonization algorithm.
- The LMS Daltonization algorithm consists of four main steps. Firstly, the RGB (Red, Green, and Blue) coordinates are converted into LMS (Long, Medium, and Short). Second, the image is then altered to simulate color blindness. Third, compensation is applied by shifting the wavelengths (LMS) accordingly. Lastly, the image that is in the LMS space is then converted back to RGB.

ii. What existing implementations have been done with the proposed process (i.e., related works)? How would it differ from your proposed implementation if it has been parallelized?

- There have been multiple implementations of the LMS daltonization algorithm that use MATLAB, Python, JavaScript, and more. Only a few of them apply the algorithm to a live video feed. DaltonLens is a software that allows the user to apply color filters to a selected area of their screen which uses the Python programming language. From the daltonize.org website, a JavaScript implementation of the LMS daltonization. With these other uses of the LMS daltonization algorithm, they all use a single-threaded implementation of it. Using parallelization allows for potentially faster processing and execution times, overall improving the algorithm performance.

iii. Discuss plans on how to parallelize your proposed process.

- CUDA accelerates operations like matrix transformations and the filter computations used in modifying an image. Using SIMT(CUDA) processing allows the algorithm to filter multiple pixels at the same time. Each pixel operation can be handled by a separate thread on the GPU, leading to significant reductions in processing time.
- The daltonization process, which involves applying a transformation matrix to the image, would benefit greatly from CUDA's ability to handle large matrix operations efficiently.
- Using CUDA for the real-time image output would lead to smoother performance and would maintain the real-time responsiveness of the video-feed
- CUDA's parallel nature makes it highly scalable. The higher the resolution of the input image or real-time camera becomes, the more obvious the performance difference will be between using CUDA and just using the CPU

iv. What other processes are in the project but will not be parallelized

- Since the main algorithm process will be offloaded to the GPU, the CPU is free to manage I/O operations or user interactions with the GUI. This leads to a more balanced utilization of system resources.

c. Project Output

- The output will be an altered version of the real-time video or image input displayed on a GUI for user interaction.

Target implementation platform

- The project is intended to be a computer program supported in Windows PCs

References

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