

# High-Resolution Image Contrast Enhancement using CUDA and Performance Comparison with Serial code

**Operating System:** Ubuntu 20.04 LTS

## 1. Implementation:

### a . Dependency Required:

```
sudo apt-get install graphicsmagick-imagemagick-compat
```

## 2. Environment & Programming Language: CUDA in C Language

## 3. Software tools: Sublime Text, Make, MS Word (for report)

**Serial Code:**

**Compile:** make

**Execute:** make run

**Results:**

```
(base) zaibi@zbook:~/Desktop/Task/code_seq$ make
gcc -o contrast contrast-enhancement.cpp histogram-equalization.cpp contrast.c
pp -lm
convert highres.jpg in.pgm
convert highres.jpg in.ppm
(base) zaibi@zbook:~/Desktop/Task/code_seq$
(base) zaibi@zbook:~/Desktop/Task/code_seq$ make run
./contrast
Running contrast enhancement for gray-scale images.
Image size: 23240 x 19973
Starting CPU processing...
Processing time: 2.148618 (ms)
Running contrast enhancement for color images.
Image size: 23240 x 19973
Starting CPU processing...
HSL processing time: 27.037824 (s)
YUV processing time: 15.937875 (s)
Total Processing Time = 54.542858 (s)
convert out.pgm out_blankwhite.jpg
convert out_hsl.ppm out_high_contrast1.jpg
convert out_yuv.ppm out_high_contrast2.jpg
```

## CUDA Code:

**Compile:** make

**Execute:** make run

## Results:

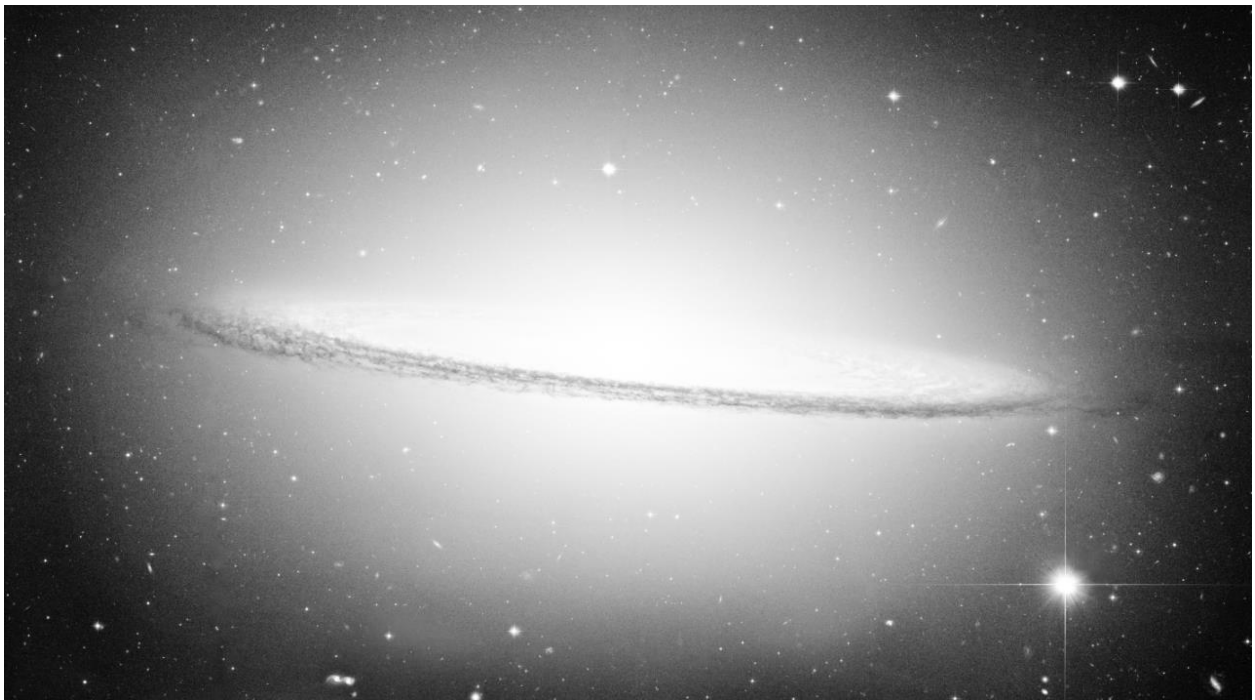
```
(base) zaibi@zbook:~/Desktop/Task/cuda$ make
nvcc -o contrast contrast-enhancement.cu histogram-equalization.cu contrast.cu
-lm
convert highres.jpg in.pgm
convert highres.jpg in.ppm
(base) zaibi@zbook:~/Desktop/Task/cuda$
(base) zaibi@zbook:~/Desktop/Task/cuda$
(base) zaibi@zbook:~/Desktop/Task/cuda$ make run
./contrast
Running contrast enhancement for gray-scale images.
Image size: 23240 x 19973
Starting GPU CUDA processing...
Processing time: 2.196331 (ms)
Running contrast enhancement for color images.
Image size: 23240 x 19973
Starting GPU CUDA processing...
HSL processing time: 2.428214 (s)
YUV processing time: 2.478848 (s)
Total Processing Time (Including CPU) = 17.007873 (s)
convert out.pgm out_blankwhite.jpg
convert out_hsl.ppm out_high_contrast1.jpg
convert out_yuv.ppm out_high_contrast2.jpg
```

**Image Results:**

**Before**



**After**



# Benchmarking Serial vs Parallel

## Comparison of Timings (Serial vs Parallel):

**Image Resolution: 23240 x 19973**

	Sequential	CUDA
HSL Time	27.0378	2.4282
YUV Time	15.9378	2.4788
Total Run Time	54.5428	17.0078

**Image Resolution: 11472 x 6429**

	Sequential	CUDA
HSL Time	5.3786	0.4090
YUV Time	2.4999	0.3835
Total Run Time	9.6946	2.7034