

LAB 1 (CS23BT013,CS23BT063)

1. IMAGE-1

```
jaswika@Sona:/mnt/c/Users/jaswi/.git/lab1/src$ make run-sharpen INPUT=1 OUTPUT=1_RES  
./a.out ../images/1.ppm ../images/1_RES.ppm  
Time (read): 41 ms  
Time (S1 smoothen): 11 ms  
Time (S2 find details): 4 ms  
Time (S3 sharpen): 4 ms  
Time (write): 29 ms  
jaswika@Sona:/mnt/c/Users/jaswi/.git/lab1/src$ make run-sharpen INPUT=1 OUTPUT=1_RES  
./a.out ../images/1.ppm ../images/1_RES.ppm  
Time (read): 34 ms  
Time (S1 smoothen): 9 ms  
Time (S2 find details): 3 ms  
Time (S3 sharpen): 4 ms  
Time (write): 31 ms  
jaswika@Sona:/mnt/c/Users/jaswi/.git/lab1/src$ make run-sharpen INPUT=1 OUTPUT=1_RES  
./a.out ../images/1.ppm ../images/1_RES.ppm  
Time (read): 48 ms  
Time (S1 smoothen): 5 ms  
Time (S2 find details): 4 ms  
Time (S3 sharpen): 9 ms  
Time (write): 28 ms  
jaswika@Sona:/mnt/c/Users/jaswi/.git/lab1/src$ make run-sharpen INPUT=1 OUTPUT=1_RES  
./a.out ../images/1.ppm ../images/1_RES.ppm  
Time (read): 41 ms  
Time (S1 smoothen): 10 ms  
Time (S2 find details): 4 ms  
Time (S3 sharpen): 4 ms  
Time (write): 33 ms  
jaswika@Sona:/mnt/c/Users/jaswi/.git/lab1/src$ make run-sharpen INPUT=1 OUTPUT=1_RES  
./a.out ../images/1.ppm ../images/1_RES.ppm  
Time (read): 35 ms  
Time (S1 smoothen): 8 ms  
Time (S2 find details): 3 ms  
Time (S3 sharpen): 3 ms  
Time (write): 32 ms
```

AVG values for:

read :- 39.8, smoothen :- 8.6, find details :- 3.6, sharpen :- 4.8, write :- 30.6

2. IMAGE-2

```
jaswika@Sona:/mnt/c/Users/jaswi/.git/lab1/src$ make run-sharpen INPUT=2 OUTPUT=2_RES  
./a.out ../images/2.ppm ../images/2_RES.ppm  
Time (read): 137 ms  
Time (S1 smoothen): 30 ms  
Time (S2 find details): 17 ms  
Time (S3 sharpen): 14 ms  
Time (write): 82 ms  
jaswika@Sona:/mnt/c/Users/jaswi/.git/lab1/src$ make run-sharpen INPUT=2 OUTPUT=2_RES  
./a.out ../images/2.ppm ../images/2_RES.ppm  
Time (read): 117 ms  
Time (S1 smoothen): 30 ms  
Time (S2 find details): 18 ms  
Time (S3 sharpen): 14 ms  
Time (write): 76 ms  
jaswika@Sona:/mnt/c/Users/jaswi/.git/lab1/src$ make run-sharpen INPUT=2 OUTPUT=2_RES  
./a.out ../images/2.ppm ../images/2_RES.ppm  
Time (read): 110 ms  
Time (S1 smoothen): 26 ms  
Time (S2 find details): 17 ms  
Time (S3 sharpen): 15 ms  
Time (write): 97 ms  
jaswika@Sona:/mnt/c/Users/jaswi/.git/lab1/src$ make run-sharpen INPUT=2 OUTPUT=2_RES  
./a.out ../images/2.ppm ../images/2_RES.ppm  
Time (read): 119 ms  
Time (S1 smoothen): 23 ms  
Time (S2 find details): 16 ms  
Time (S3 sharpen): 14 ms  
Time (write): 93 ms  
jaswika@Sona:/mnt/c/Users/jaswi/.git/lab1/src$ make run-sharpen INPUT=2 OUTPUT=2_RES  
./a.out ../images/2.ppm ../images/2_RES.ppm  
Time (read): 115 ms  
Time (S1 smoothen): 23 ms  
Time (S2 find details): 17 ms  
Time (S3 sharpen): 15 ms  
Time (write): 92 ms
```

AVG values for:

read :- 119.8, smoothen :- 26.4, find details :- 17, sharpen 14.4,

write :- 88

3. IMAGE-3

```
jaswika@Sona:/mnt/c/Users/jaswi/.git/lab1/src$ make run-sharpen INPUT=3 OUTPUT=3_RES  
./a.out ..../images/3.ppm ..../images/3.RES.ppm  
Time (read): 203 ms  
Time (S1 smoothen): 48 ms  
Time (S2 find details): 33 ms  
Time (S3 sharpen): 28 ms  
Time (write): 148 ms  
jaswika@Sona:/mnt/c/Users/jaswi/.git/lab1/src$ make run-sharpen INPUT=3 OUTPUT=3_RES  
./a.out ..../images/3.ppm ..../images/3.RES.ppm  
Time (read): 216 ms  
Time (S1 smoothen): 51 ms  
Time (S2 find details): 29 ms  
Time (S3 sharpen): 28 ms  
Time (write): 189 ms  
jaswika@Sona:/mnt/c/Users/jaswi/.git/lab1/src$ make run-sharpen INPUT=3 OUTPUT=3_RES  
./a.out ..../images/3.ppm ..../images/3.RES.ppm  
Time (read): 189 ms  
Time (S1 smoothen): 48 ms  
Time (S2 find details): 29 ms  
Time (S3 sharpen): 22 ms  
Time (write): 168 ms  
jaswika@Sona:/mnt/c/Users/jaswi/.git/lab1/src$ make run-sharpen INPUT=3 OUTPUT=3_RES  
./a.out ..../images/3.ppm ..../images/3.RES.ppm  
Time (read): 200 ms  
Time (S1 smoothen): 51 ms  
Time (S2 find details): 32 ms  
Time (S3 sharpen): 25 ms  
Time (write): 160 ms  
jaswika@Sona:/mnt/c/Users/jaswi/.git/lab1/src$ make run-sharpen INPUT=3 OUTPUT=3_RES  
./a.out ..../images/3.ppm ..../images/3.RES.ppm  
Time (read): 208 ms  
Time (S1 smoothen): 43 ms  
Time (S2 find details): 26 ms  
Time (S3 sharpen): 20 ms  
Time (write): 169 ms
```

AVG values for:

read :- 203.2, smoothen :- 48.2, find details :- 23.8, sharpen :- 24.6, write :- 166.8

4. IMAGE-4

```
jaswika@Sona:/mnt/c/Users/jaswi/.git/lab1/src$ make run-sharpen INPUT=4 OUTPUT=4_RES  
./a.out ..../images/4.ppm ..../images/4.RES.ppm  
Time (read): 438 ms  
Time (S1 smoothen): 95 ms  
Time (S2 find details): 65 ms  
Time (S3 sharpen): 76 ms  
Time (write): 331 ms  
jaswika@Sona:/mnt/c/Users/jaswi/.git/lab1/src$ make run-sharpen INPUT=4 OUTPUT=4_RES  
./a.out ..../images/4.ppm ..../images/4.RES.ppm  
Time (read): 386 ms  
Time (S1 smoothen): 100 ms  
Time (S2 find details): 68 ms  
Time (S3 sharpen): 58 ms  
Time (write): 196 ms  
jaswika@Sona:/mnt/c/Users/jaswi/.git/lab1/src$ make run-sharpen INPUT=4 OUTPUT=4_RES  
./a.out ..../images/4.ppm ..../images/4.RES.ppm  
Time (read): 444 ms  
Time (S1 smoothen): 109 ms  
Time (S2 find details): 67 ms  
Time (S3 sharpen): 63 ms  
Time (write): 344 ms  
jaswika@Sona:/mnt/c/Users/jaswi/.git/lab1/src$ make run-sharpen INPUT=4 OUTPUT=4_RES  
./a.out ..../images/4.ppm ..../images/4.RES.ppm  
Time (read): 380 ms  
Time (S1 smoothen): 99 ms  
Time (S2 find details): 71 ms  
Time (S3 sharpen): 73 ms  
Time (write): 329 ms  
jaswika@Sona:/mnt/c/Users/jaswi/.git/lab1/src$ make run-sharpen INPUT=4 OUTPUT=4_RES  
./a.out ..../images/4.ppm ..../images/4.RES.ppm  
Time (read): 385 ms  
Time (S1 smoothen): 96 ms  
Time (S2 find details): 72 ms  
Time (S3 sharpen): 65 ms  
Time (write): 346 ms
```

AVG values for: read :- 406.6, smoothen :- 99.8, find details :- 68.6, sharpen :- 70.8, write :- 309.2

5. IMAGE-5

```
jaswika@Sona:/mnt/c/Users/jaswi/.git/lab1/src$ make run-sharpen INPUT=5 OUTPUT=5_RES  
./a.out ../images/5.ppm ../images/5_RES.ppm  
Time (read): 529 ms  
Time (S1 smoothen): 112 ms  
Time (S2 find details): 84 ms  
Time (S3 sharpen): 92 ms  
Time (write): 452 ms  
jaswika@Sona:/mnt/c/Users/jaswi/.git/lab1/src$ make run-sharpen INPUT=5 OUTPUT=5_RES  
./a.out ../images/5.ppm ../images/5_RES.ppm  
Time (read): 507 ms  
Time (S1 smoothen): 169 ms  
Time (S2 find details): 120 ms  
Time (S3 sharpen): 96 ms  
Time (write): 444 ms  
jaswika@Sona:/mnt/c/Users/jaswi/.git/lab1/src$ make run-sharpen INPUT=5 OUTPUT=5_RES  
./a.out ../images/5.ppm ../images/5_RES.ppm  
Time (read): 494 ms  
Time (S1 smoothen): 116 ms  
Time (S2 find details): 87 ms  
Time (S3 sharpen): 98 ms  
Time (write): 501 ms  
jaswika@Sona:/mnt/c/Users/jaswi/.git/lab1/src$ make run-sharpen INPUT=5 OUTPUT=5_RES  
./a.out ../images/5.ppm ../images/5_RES.ppm  
Time (read): 530 ms  
Time (S1 smoothen): 121 ms  
Time (S2 find details): 92 ms  
Time (S3 sharpen): 84 ms  
Time (write): 484 ms  
jaswika@Sona:/mnt/c/Users/jaswi/.git/lab1/src$ make run-sharpen INPUT=5 OUTPUT=5_RES  
./a.out ../images/5.ppm ../images/5_RES.ppm  
Time (read): 479 ms  
Time (S1 smoothen): 102 ms  
Time (S2 find details): 77 ms  
Time (S3 sharpen): 75 ms  
Time (write): 409 ms
```

AVG values for:

read :- 507.8, smoothen :- 124, find details :- 92, sharpen :- 87.4, write :- 458

6. IMAGE-6

```
jaswika@Sona:/mnt/c/Users/jaswi/.git/lab1/src$ make run-sharpen INPUT=6 OUTPUT=6_RES  
./a.out ../images/6.ppm ../images/6_RES.ppm  
Time (read): 1166 ms  
Time (S1 smoothen): 289 ms  
Time (S2 find details): 224 ms  
Time (S3 sharpen): 192 ms  
Time (write): 1126 ms  
jaswika@Sona:/mnt/c/Users/jaswi/.git/lab1/src$ make run-sharpen INPUT=6 OUTPUT=6_RES  
./a.out ../images/6.ppm ../images/6_RES.ppm  
Time (read): 1100 ms  
Time (S1 smoothen): 339 ms  
Time (S2 find details): 223 ms  
Time (S3 sharpen): 211 ms  
Time (write): 1024 ms  
jaswika@Sona:/mnt/c/Users/jaswi/.git/lab1/src$ make run-sharpen INPUT=6 OUTPUT=6_RES  
./a.out ../images/6.ppm ../images/6_RES.ppm  
Time (read): 1077 ms  
Time (S1 smoothen): 311 ms  
Time (S2 find details): 217 ms  
Time (S3 sharpen): 196 ms  
Time (write): 1332 ms  
jaswika@Sona:/mnt/c/Users/jaswi/.git/lab1/src$ make run-sharpen INPUT=6 OUTPUT=6_RES  
./a.out ../images/6.ppm ../images/6_RES.ppm  
Time (read): 1091 ms  
Time (S1 smoothen): 318 ms  
Time (S2 find details): 233 ms  
Time (S3 sharpen): 224 ms  
Time (write): 937 ms  
jaswika@Sona:/mnt/c/Users/jaswi/.git/lab1/src$ make run-sharpen INPUT=6 OUTPUT=6_RES  
./a.out ../images/6.ppm ../images/6_RES.ppm  
Time (read): 1025 ms  
Time (S1 smoothen): 307 ms  
Time (S2 find details): 224 ms  
Time (S3 sharpen): 199 ms  
Time (write): 1263 ms
```

AVG values for:

**read :- 1091.8, smoothen :- 312.8, find details :- 224.2, sharpen :- 204.4,
write-1136.4**

7. IMAGE-7

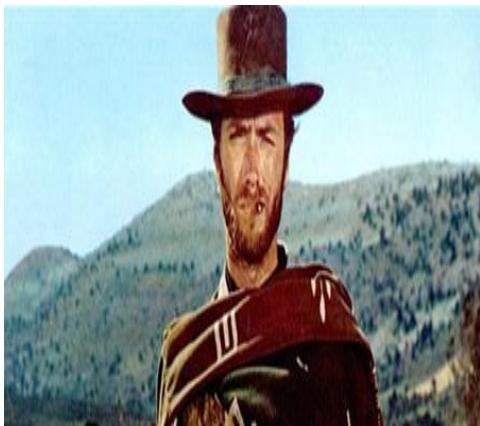
```
jaswika@Sona:/mnt/c/Users/jaswi/.git/lab1/src$ make run-sharpen INPUT=7 OUTPUT=7_RES
./a.out ../images/7.ppm ../images/7_RES.ppm
Time (read): 3950 ms
Time (S1 smoothen): 850 ms
Time (S2 find details): 675 ms
Time (S3 sharpen): 641 ms
Time (write): 2009 ms
jaswika@Sona:/mnt/c/Users/jaswi/.git/lab1/src$ make run-sharpen INPUT=7 OUTPUT=7_RES
./a.out ../images/7.ppm ../images/7_RES.ppm
Time (read): 3853 ms
Time (S1 smoothen): 683 ms
Time (S2 find details): 723 ms
Time (S3 sharpen): 559 ms
Time (write): 3060 ms
jaswika@Sona:/mnt/c/Users/jaswi/.git/lab1/src$ make run-sharpen INPUT=7 OUTPUT=7_RES
./a.out ../images/7.ppm ../images/7_RES.ppm
Time (read): 3426 ms
Time (S1 smoothen): 725 ms
Time (S2 find details): 522 ms
Time (S3 sharpen): 841 ms
Time (write): 2922 ms
jaswika@Sona:/mnt/c/Users/jaswi/.git/lab1/src$ make run-sharpen INPUT=7 OUTPUT=7_RES
./a.out ../images/7.ppm ../images/7_RES.ppm
^[[D^[[BTime (read): 2672 ms
Time (S1 smoothen): 745 ms
Time (S2 find details): 529 ms
Time (S3 sharpen): 516 ms
Time (write): 2160 ms
jaswika@Sona:/mnt/c/Users/jaswi/.git/lab1/src$ make run-sharpen INPUT=7 OUTPUT=7_RES
./a.out ../images/7.ppm ../images/7_RES.ppm
Time (read): 3128 ms
Time (S1 smoothen): 841 ms
Time (S2 find details): 801 ms
Time (S3 sharpen): 741 ms
Time (write): 2752 ms
jaswika@Sona:/mnt/c/Users/jaswi/.git/lab1/src$
```

AVG values for:

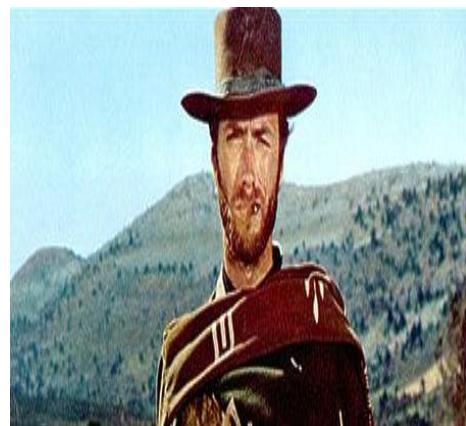
**read :- 3411.8, smoothen :- 768.8, find details :- 701.2, sharpen :- 659.6,
write :- 2580.2**

OBSERVATIONS:

ORIGINAL IMAGE:



SHARPENED IMAGE:







1. Sharpened images have stronger outlines, especially around facial features, helmets, clothing edges, and background structures.
2. The sharpened images look slightly more focused or crisp.
3. As the image size increases, the processing time also increases proportionally. That means with the increase in size of image, time is also getting increased.
4. The processing time is also affected by the number of open browser tabs or background applications, as they consume system resources and reduce the performance available for image processing.
5. Higher image resolution leads to more pixels that need to be processed, which directly increases computational load and results in longer processing time.