

# ECE6310,1#1

## 1.) Average Time Take by the Basic 2D convolution Version – 6119890

```
PS C:\Users\dhruv\OneDrive\Desktop\Semester 1\IntroDuction To computer Vision> .\Assignment1_Part1out.exe
1630451642 58048600
1630451642 64156600
6108000
PS C:\Users\dhruv\OneDrive\Desktop\Semester 1\IntroDuction To computer Vision> .\Assignment1_Part1out.exe
1630451642 95909100
1630451642 101880100
5971000
PS C:\Users\dhruv\OneDrive\Desktop\Semester 1\IntroDuction To computer Vision> .\Assignment1_Part1out.exe
1630451643 62955300
1630451643 68709000
5753700
PS C:\Users\dhruv\OneDrive\Desktop\Semester 1\IntroDuction To computer Vision> .\Assignment1_Part1out.exe
1630451643 912668600
1630451643 922548300
9879700
PS C:\Users\dhruv\OneDrive\Desktop\Semester 1\IntroDuction To computer Vision> .\Assignment1_Part1out.exe
1630451647 939141700
1630451647 944879600
5737900
PS C:\Users\dhruv\OneDrive\Desktop\Semester 1\IntroDuction To computer Vision> .\Assignment1_Part1out.exe
1630451649 760976200
1630451649 766873900
5897700
PS C:\Users\dhruv\OneDrive\Desktop\Semester 1\IntroDuction To computer Vision> .\Assignment1_Part1out.exe
1630451650 792749800
1630451650 798423100
5673300
PS C:\Users\dhruv\OneDrive\Desktop\Semester 1\IntroDuction To computer Vision> .\Assignment1_Part1out.exe
1630451651 678773100
1630451651 684542300
5769200
PS C:\Users\dhruv\OneDrive\Desktop\Semester 1\IntroDuction To computer Vision> .\Assignment1_Part1out.exe
1630451652 575818200
1630451652 581868200
6050000
PS C:\Users\dhruv\OneDrive\Desktop\Semester 1\IntroDuction To computer Vision> .\Assignment1_Part1out.exe
1630451661 40147600
1630451661 46610300
6462700
```

Thus, 7x7 mean filter using 2D convolution takes around 6119890 nsecs to deliver the desired output.

## 2.) Average Time Take by the Separable filter (1X7 and 7X1) – 3322610

```
PS C:\Users\dhruv\OneDrive\Desktop\Semester 1\IntroDuction To computer Vision> .\Assignment1_Part2out.exe
1630449540 100179200
1630449540 103423500
3244300
PS C:\Users\dhruv\OneDrive\Desktop\Semester 1\IntroDuction To computer Vision> .\Assignment1_Part2out.exe
1630449541 89917400
1630449541 93107800
3190400
PS C:\Users\dhruv\OneDrive\Desktop\Semester 1\IntroDuction To computer Vision> .\Assignment1_Part2out.exe
1630449542 134647300
1630449542 138027000
3379700
PS C:\Users\dhruv\OneDrive\Desktop\Semester 1\IntroDuction To computer Vision> .\Assignment1_Part2out.exe
1630449542 939162000
1630449542 942251300
3089300
PS C:\Users\dhruv\OneDrive\Desktop\Semester 1\IntroDuction To computer Vision> .\Assignment1_Part2out.exe
1630449543 712656200
1630449543 715815800
3159600
PS C:\Users\dhruv\OneDrive\Desktop\Semester 1\IntroDuction To computer Vision> .\Assignment1_Part2out.exe
1630449544 409589900
1630449544 412711700
3121800
PS C:\Users\dhruv\OneDrive\Desktop\Semester 1\IntroDuction To computer Vision> .\Assignment1_Part2out.exe
1630449545 125061400
1630449545 128151700
3090300
PS C:\Users\dhruv\OneDrive\Desktop\Semester 1\IntroDuction To computer Vision> .\Assignment1_Part2out.exe
1630449545 790226300
1630449545 793450900
3224600
PS C:\Users\dhruv\OneDrive\Desktop\Semester 1\IntroDuction To computer Vision> .\Assignment1_Part2out.exe
1630449546 502800200
1630449546 506210700
3410500
PS C:\Users\dhruv\OneDrive\Desktop\Semester 1\IntroDuction To computer Vision> .\Assignment1_Part2out.exe
1630449547 185693200
1630449547 190008800
4315600
```

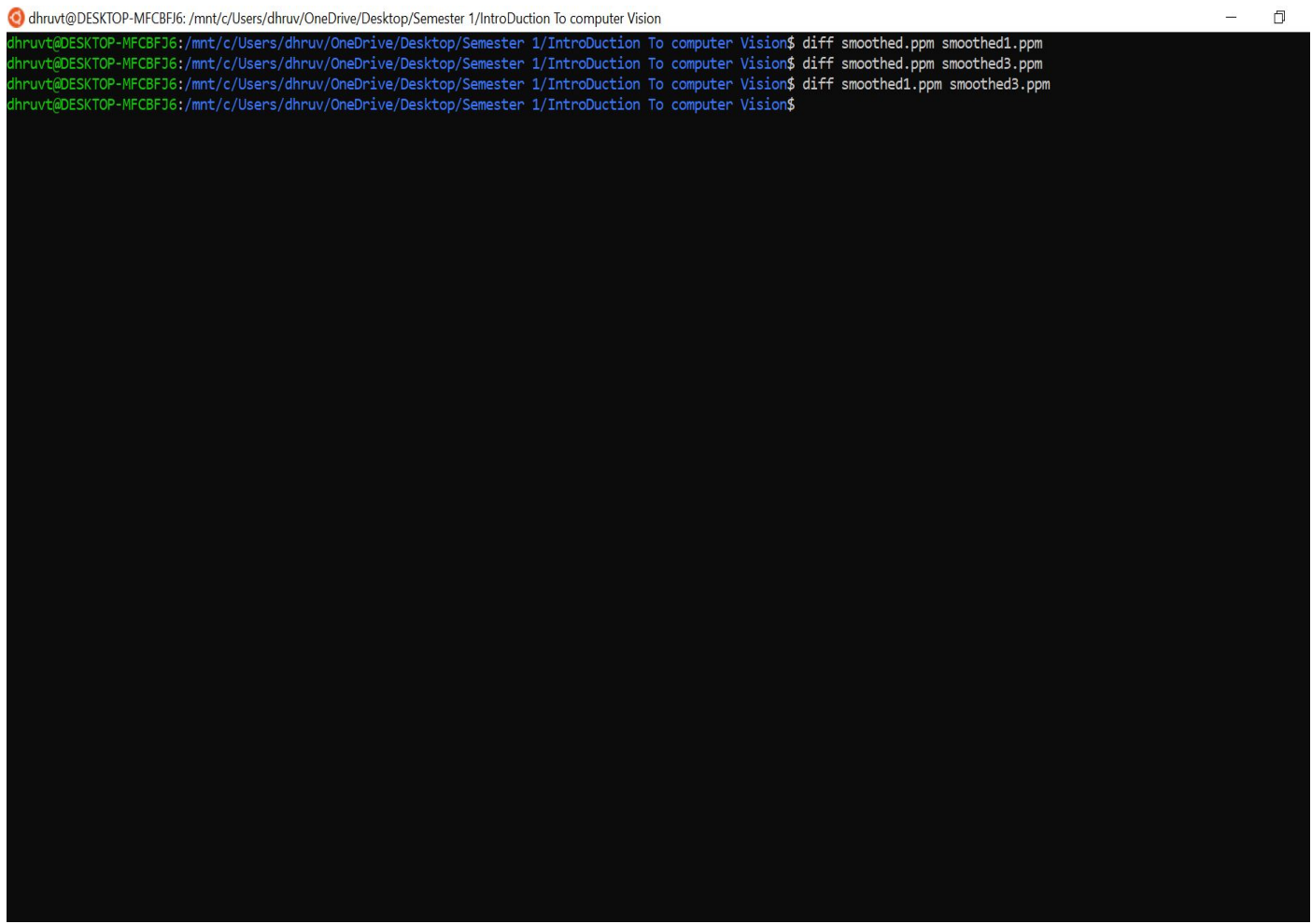
Thus, (1X7 7X1) Separable filter takes around 3322610 nsecs to deliver the desired output. It is fast as compared to the mean filter using 2D convolution.

### 3.) Average Time Take by the Separable filter and sliding window technique – 2510570 nsecs

```
PS C:\Users\dhruv\OneDrive\Desktop\Semester 1\IntroDuction To computer Vision> .\Assignment1_Part3out.exe
1630449648 347789900
1630449648 349850000
2060100
PS C:\Users\dhruv\OneDrive\Desktop\Semester 1\IntroDuction To computer Vision> .\Assignment1_Part3out.exe
1630449650 429251900
1630449650 434732800
5480900
PS C:\Users\dhruv\OneDrive\Desktop\Semester 1\IntroDuction To computer Vision> .\Assignment1_Part3out.exe
1630449651 525356900
1630449651 527511800
2154900
PS C:\Users\dhruv\OneDrive\Desktop\Semester 1\IntroDuction To computer Vision> .\Assignment1_Part3out.exe
1630449652 286717800
1630449652 288891900
2174100
PS C:\Users\dhruv\OneDrive\Desktop\Semester 1\IntroDuction To computer Vision> .\Assignment1_Part3out.exe
1630449652 998765200
1630449653 856100
-997909100
PS C:\Users\dhruv\OneDrive\Desktop\Semester 1\IntroDuction To computer Vision> .\Assignment1_Part3out.exe
1630449653 647455900
1630449653 649605000
2149100
PS C:\Users\dhruv\OneDrive\Desktop\Semester 1\IntroDuction To computer Vision> .\Assignment1_Part3out.exe
1630449654 287785700
1630449654 290298700
2513000
PS C:\Users\dhruv\OneDrive\Desktop\Semester 1\IntroDuction To computer Vision> .\Assignment1_Part3out.exe
1630449654 911293400
1630449654 913300500
2007100
PS C:\Users\dhruv\OneDrive\Desktop\Semester 1\IntroDuction To computer Vision> .\Assignment1_Part3out.exe
1630449655 497601000
1630449655 499898200
2297200
PS C:\Users\dhruv\OneDrive\Desktop\Semester 1\IntroDuction To computer Vision> .\Assignment1_Part3out.exe
1630449662 852949100
1630449662 855232100
2283000
PS C:\Users\dhruv\OneDrive\Desktop\Semester 1\IntroDuction To computer Vision> .\Assignment1_Part3out.exe
1630449727 620709300
1630449727 622695600
1986300
```

Thus, This Separable filter along with sliding window takes around 251070 nsecs to deliver the desired output, Hence, this is the fastest technique as compared to other two techniques, if the solution holds.

#### 4.) Comparing Smoothed Images using “diff” program-

A terminal window with a black background and green text. The title bar shows the path /mnt/c/Users/dhruv/OneDrive/Desktop/Semester 1/IntroDuction To computer Vision. The terminal contains three lines of commands and their outputs. Each line shows the 'diff' command being used to compare 'smoothed.ppm' with 'smoothed1.ppm', 'smoothed3.ppm', and 'smoothed3.ppm' respectively. The output for each command is empty, indicating no differences were found.

```
dhruvt@DESKTOP-MFCBFJ6: /mnt/c/Users/dhruv/OneDrive/Desktop/Semester 1/IntroDuction To computer Vision
dhruvt@DESKTOP-MFCBFJ6:/mnt/c/Users/dhruv/OneDrive/Desktop/Semester 1/IntroDuction To computer Vision$ diff smoothed.ppm smoothed1.ppm
dhruvt@DESKTOP-MFCBFJ6:/mnt/c/Users/dhruv/OneDrive/Desktop/Semester 1/IntroDuction To computer Vision$ diff smoothed.ppm smoothed3.ppm
dhruvt@DESKTOP-MFCBFJ6:/mnt/c/Users/dhruv/OneDrive/Desktop/Semester 1/IntroDuction To computer Vision$ diff smoothed1.ppm smoothed3.ppm
dhruvt@DESKTOP-MFCBFJ6:/mnt/c/Users/dhruv/OneDrive/Desktop/Semester 1/IntroDuction To computer Vision$
```

The “diff” program gives the following output. Hence, we can say that whenever we apply 3 different filters to remove the noise from the image, we get the same output. However, time taken by each filter to execute is different as seen above but the expected output is always similar. In the end we can conclude that Separable filter using the window sliding technique is the fastest filtering technique as compared to other two.