**Jessie George**

HW3

Part I

Question 1.1 (DIP 5.1)

The custom filter in Adobe Photoshop is not strictly a linear filter because you can specify a constant Offset value to shift negative results caused by negative coefficients into the visible range of values. This means it is not strictly a weighted sum because some values may be offset.

Question 1.2 (DIP 5.2)

Because there is no clamping, the pixel values can go out of the range [0, 255].

Maximum possible pixel value = 1275 Assuming it is applied to the pixel matrix:

|  |  |  |
| --- | --- | --- |
| 0 | 0 | 0 |
| 0 | 0 | 255 |
| 0 | 255 | 255 |

Minimum possible pixel value = -1275 Assuming it is applied to the pixel matrix:

|  |  |  |
| --- | --- | --- |
| 255 | 255 | 0 |
| 255 | 0 | 0 |
| 0 | 0 | 0 |

Question 1.3 (DIP 5.9)

Speed gained from separability = ((Number of steps for non-separable filter - Number of steps for x/y separable filter) / (Number of steps for non-separable filter)) \* 100

|  |  |  |  |
| --- | --- | --- | --- |
| Filter Size | Number of steps for non-separable filter | Number of steps for x/y separable filter | Speed Gained from separability |
| 5x5 | 25 | 10 | 60% |
| 11x11 | 121 | 22 | 82% |
| 25x25 | 625 | 50 | 92% |
| 51x51 | 2601 | 102 | 96% |

Question 1.4 (DIP 6.1)

Gradient using equation 6.2 df/dx (u) = (f(u+1)-f(u-1) )/ 2 for horizontal component of gradient.  
Set Hx = 0.5 [-1 0 1]

Handle Image borders by setting to black.

Ix =

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | -4 | 2 | -1 | 4 | 0 |
| 0 | 3 | 6 | -1 | -10 | 0 |
| 0 | -2 | -5 | 1 | -1 | 0 |
| 0 | 4 | 1 | -1 | -3 | 0 |
| 0 | 0 | 0 | 0 | 0 | 0 |

Similarly, for vertical component of gradient,

set Hy = 0.5 \* -1

0

1

Handle image borders by setting to black. See next page for Iy.

Iy =

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 2 | -2 | 5 | -1 | 0 |
| 0 | 9 | 3 | 3 | 5 | 0 |
| 0 | 2 | 2 | -4 | 2 | 0 |
| 0 | -9 | -2 | -5 | 2 | 0 |
| 0 | 0 | 0 | 0 | 0 | 0 |

Laplacian filter using equation 6.32

H^L =

|  |  |  |
| --- | --- | --- |
| 0 | 1 | 0 |
| 1 | -4 | 1 |
| 0 | 1 | 0 |

I^L =

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 17 | 11 | 15 | 18 | 0 |
| 0 | 4 | 8 | -47 | 9 | 0 |
| 0 | -38 | 9 | 13 | -14 | 0 |
| 0 | -6 | -5 | -18 | 10 | 0 |
| 0 | 0 | 0 | 0 | 0 | 0 |

Question 1.5

|  |  |  |
| --- | --- | --- |
| 0 | 0 | 0 |
| 0 | 0 | 1 |
| 0 | 0 | 0 |

The above kernel shifts image 1 pixel to the right.

|  |  |  |
| --- | --- | --- |
| 0 | 0 | 0 |
| 0 | 2 | 0 |
| 0 | 0 | 0 |

The above kernel makes the image brighter (i.e. makes pixels more towards the white side).

|  |  |  |
| --- | --- | --- |
| 0 | 0 | 1/3 |
| 0 | 1/3 | 0 |
| 1/3 | 0 | 0 |

The above kernel darkens the right slanting diagonals.

Part II

Question 1

Plugin: Edge Highlights (one version for all three parts).

Images below.

C:\Users\Jessie\Desktop\Multimedia\HW3\Output\edge highlight.tif

C:\Users\Jessie\Desktop\Multimedia\HW3\Output\bright highlight.tif

C:\Users\Jessie\Desktop\Multimedia\HW3\Output\dark highlight.tif