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Assignment 2 Report

Purpose:

To use Unsharp masking, Sobel operator, Laplacian of Gaussian operator, and Scale Space filter for edge detection and enhancement. Apply these operators to a gray scale image to generate the edge image.

Method:

Unsharp Masking:

- Initialized a 3x3 mask
- Used mask to perform convolution for every pixel of cloned image.

Sobel Operator:

- Calculated x-gradient and y-gradient.
- If the sum of the gradients is greater than 255 then corresponding pixel is 255 else 0.

Laplacian of Gaussian:

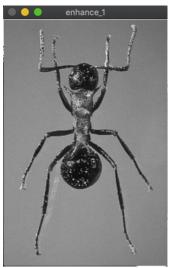
$$LoG(x,y) = -rac{1}{\pi\sigma^4} \left[1 - rac{x^2 + y^2}{2\sigma^2}
ight] e^{-rac{x^2 + y^2}{2\sigma^2}}$$

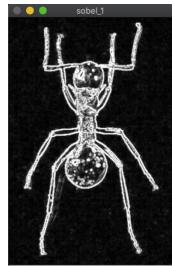
- Used above formula to calculate LoG value and generated a mask.
- Used mask on the image to get final image.

Results:

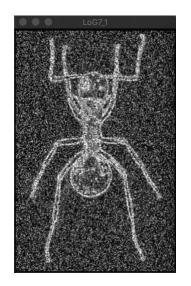
























We can see that 7x7 mask has more detailed edges. It will have lesser smoothness than 11×11 mask. Thus, the amount of noise removed is more in 11×11 leading to lesser detailed edge detection.

7 x 7										
1	3	4	5	4	3	1				
3	5	3	0	3	5	3				
4	3	-11	-23	-11	3	4				
5	0	-23	-40	-23	0	5				
4	3	-11	-23	-11	3	4				
3	5	3	0	3	5	3				
1	3	4	5	4	3	1				
_										
11 × 11										
0	-1	-3	-4	-5	-6	-5	-4	-3	-1	0
-1	-3	-6	-8	-9	-10	-9	-8	-6	-3	-1
-3	-6	-9	-11	-13	-13	-13	-11	-9	-6	-3
-4	-8	-11	-14	-16	-17	-16	-14	-11	-8	-4
- 5	-9	-13	-16	-18	-19	-18	-16	-13	-9	-5
-6	-10	-13	-17	-19	-20	-19	-17	-13	-10	-6
-5	-9	-13	-16	-18	-19	-18	-16	-13	-9	-5
-4	-8	-11	-14	-16	-17	-16	-14	-11	-8	-4
-3	-6	-9	-11	-13	-13	-13	-11	-9	-6	-3
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7 x 7										
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3	5	3	0	3	5	3				
4	3	-11	-23	-11	3	4				
5	0	-23	-23 -40	-23	9	5				
4	3	-23 -11	-23	-23 -11	3	4				
3	5	3		3	5					
1	3	4	0			3				
1					2	4				
		4	5	4	3	1				
11 ~ 11		4	5	4	3	1				
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0	-1	-3	-4	-5	-6	-5	-4 -9	-3	-1 -2	0
0 -1	-1 -3	-3 -6	-4 -8	-5 -9	-6 -10	-5 -9	-8	-6	-3	-1
0 -1 -3	-1 -3 -6	-3 -6 -9	-4 -8 -11	-5 -9 -13	-6 -10 -13	-5 -9 -13	-8 -11	-6 -9	-3 -6	-1 -3
0 -1 -3 -4	-1 -3 -6 -8	-3 -6 -9 -11	-4 -8 -11 -14	-5 -9 -13 -16	-6 -10 -13 -17	-5 -9 -13 -16	-8 -11 -14	-6 -9 -11	-3 -6 -8	-1 -3 -4
0 -1 -3 -4 -5	-1 -3 -6 -8 -9	-3 -6 -9 -11 -13	-4 -8 -11 -14 -16	-5 -9 -13 -16 -18	-6 -10 -13 -17 -19	-5 -9 -13 -16 -18	-8 -11 -14 -16	-6 -9 -11 -13	-3 -6 -8 -9	-1 -3 -4 -5
0 -1 -3 -4 -5 -6	-1 -3 -6 -8 -9 -10	-3 -6 -9 -11 -13 -13	-4 -8 -11 -14 -16 -17	-5 -9 -13 -16 -18 -19	-6 -10 -13 -17 -19 -20	-5 -9 -13 -16 -18 -19	-8 -11 -14 -16 -17	-6 -9 -11 -13 -13	-3 -6 -8 -9 -10	-1 -3 -4 -5 -6
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0 -1 -3 -4 -5 -6 -5 -4	-1 -3 -6 -8 -9 -10 -9 -8	-3 -6 -9 -11 -13 -13 -13	-4 -8 -11 -14 -16 -17 -16 -14	-5 -9 -13 -16 -18 -19 -18	-6 -10 -13 -17 -19 -20 -19 -17	-5 -9 -13 -16 -18 -19 -18	-8 -11 -14 -16 -17 -16 -14	-6 -9 -11 -13 -13 -13 -11	-3 -6 -8 -9 -10 -9 -8	-1 -3 -4 -5 -6 -5 -4

Bug Report:

No bugs. Extra parts not implemented.

Steps to run:

- 1) Open Terminal
- 2) cd to project directory
- 3) Compile using command: g++ \$(pkg-config --cflags --libs opencv4) -std=c++11 program_2.cpp
- 4) Type ./a.out

Reference:

https://stackoverflow.com/questions/2556958/laplacian-of-gaussian

https://theailearner.com/2019/05/25/laplacian-of-gaussian-log