

## Exercise Sheet 5

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### 1. Edge detectors

- Implement a *Sobel* edge detector
  - i. Create the two required masks, one to estimate  $G_x$ , and another to estimate  $G_y$ .

-1	0	1
-2	0	2
-1	0	1

Sobel -  $G_x$

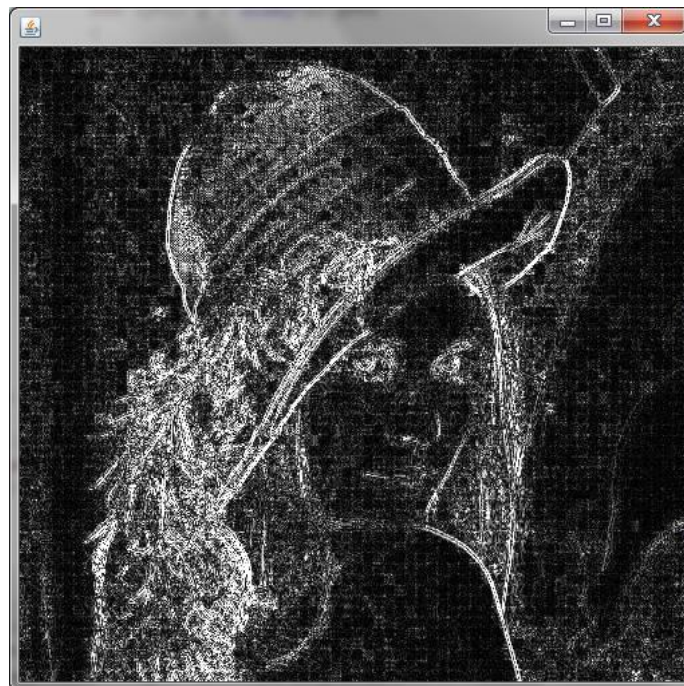
-1	-2	-1
0	0	0
1	2	1

Sobel -  $G_y$

- ii. Obtain, for each pixel, the magnitude of the gradient.  

$$|G| \approx |G_x| + |G_y|$$
- iii. Visualize the result in a spatial image format (i.e. display it as values between 0 and 255 for each pixel).

- Implement other edge detector filters.
  - i. Sobel 5x5
  - ii. Laplacian
  - iii. LoG operator
  - iv. Difference of Gaussians



**Figure 1** – Results after applying a 3x3 Laplacian filter to the *lena.jpg* image. Contrast-stretching was used for clarity. Was is the cause for the ‘little squares’ effect? (Hint: Read the slides on image compression)

## 2. Erosion and Dilation

- Create two morphological filter functions that operate on binary images: *Erosion* and *Dilation*. Use a 3x3 *kernel* as shown in Figure 2.
- Apply these function to image *Imagem\_AP5\_2*, which is the results of the segmentation of image *Imagem\_AP5\_1*, degraded by salt and pepper noise.
- [Optional] Make your functions more flexible, by allowing them to receive an additional parameter with the operating *kernel*.



a) *Imagem AP7\_2*

1	1	1
1	1	1
1	1	1

b) Kernel 3x3



c) Erosion



d) Dilation

Figure 2