# Report- Assignment 3

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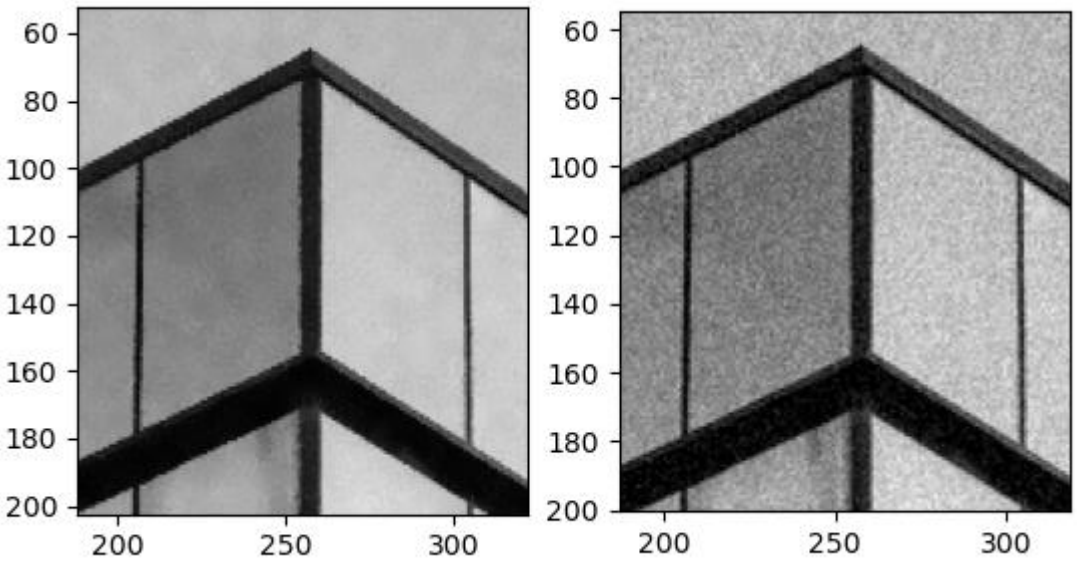
1. **Image Denoising:**
   (a) **Use the bilateral filter to denoise the image building noisy.png corrupted by the Gaussian noise and compare the results with the Gaussian smoothing. Use a window size of 7 × 7 and tune the other parameters to get a good result.**
   (b) **Apply Laplace filter on the input image, bilateral filtered image and the Gaussian smoothed image. What do you observe from the results?**

**Results:**

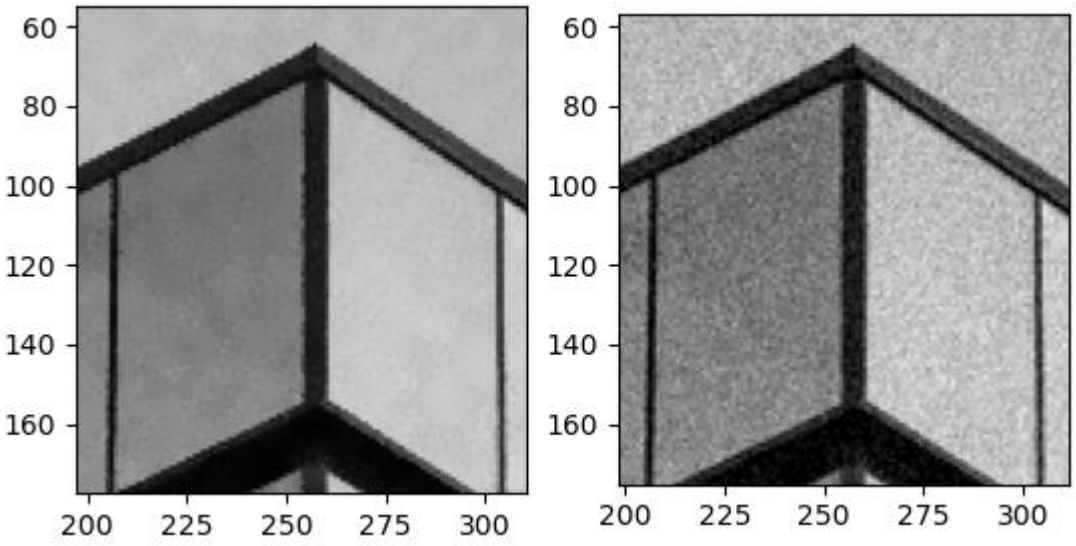
Sigma_g =100, sigma_h=50

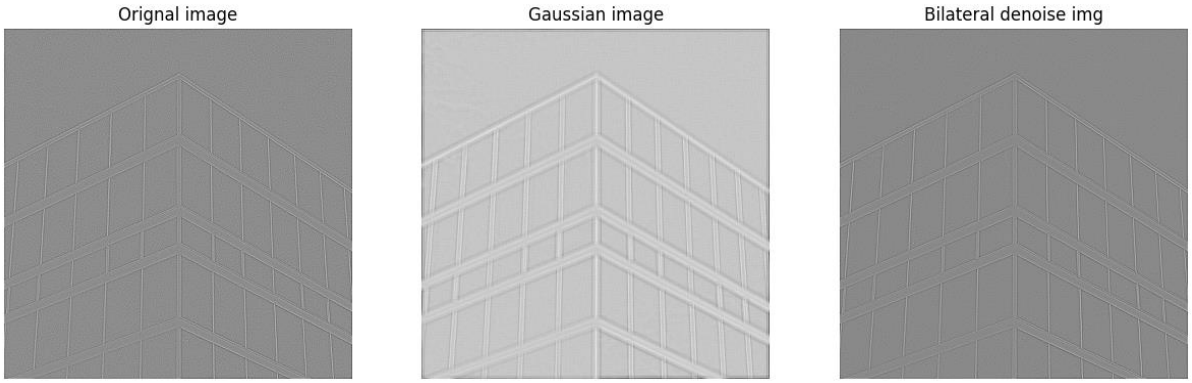
Right-Orignal Image, left-denoised image



Sigma_g =100, sigma_h=100

Right-Orignal Image, left-denoised image




**Inferences:**

- In laplacian edge is detected by the zero-crossing.
- It can be observed that the laplacian of the gaissian filtered image gives thicker edges detection. This image seem to have a more gradual decrease to the zero crossing.
- In the Bilaterally filtered image, the laplacian of the image has prominent and noticeable edges, if we compare it with the laplacian of the original image than we can see, the abrupt changes in the smooth areas have reduced.

**Q2. Edge Detection: Perform edge detection on book noisy1.png, book noisy2.png, architecture noisy1.png and architecture noisy2.png based on the following instructions:**

**a) First smooth the images using a spatial domain Gaussian filter.**

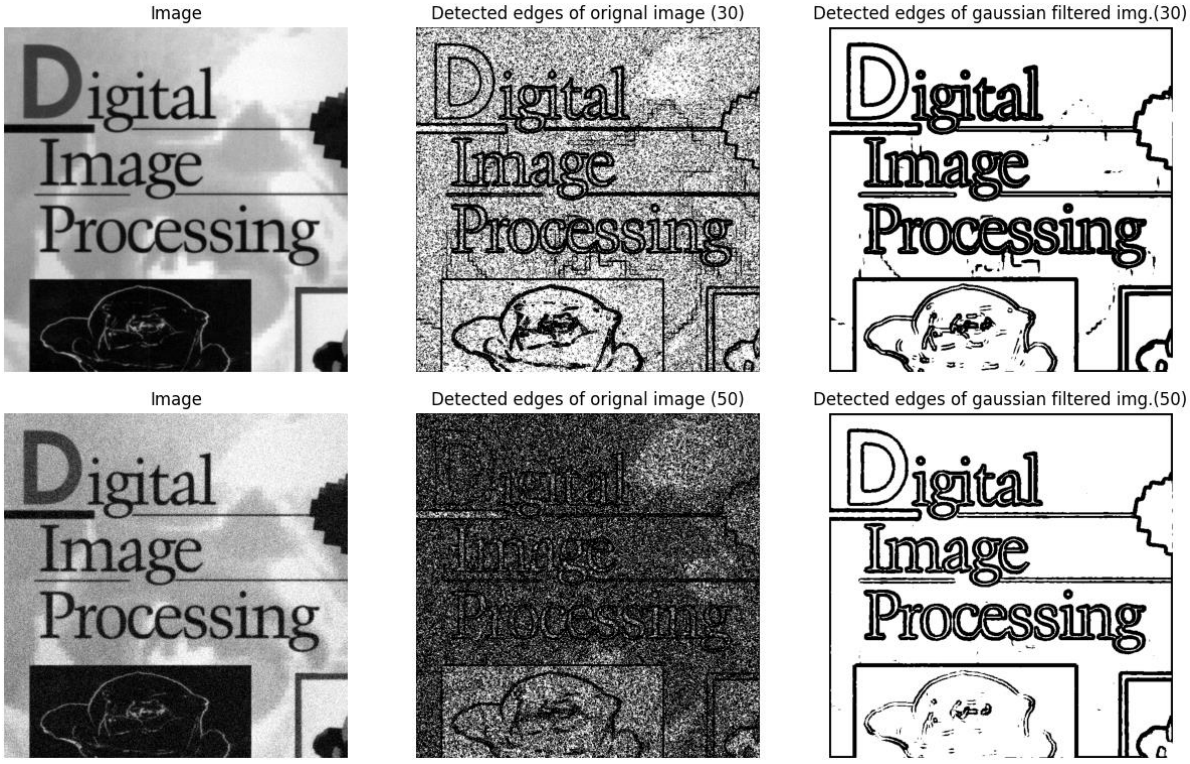
**b) Use one of the gradient based edge detectors to calculate gradients and compute the edges using thresholding.**

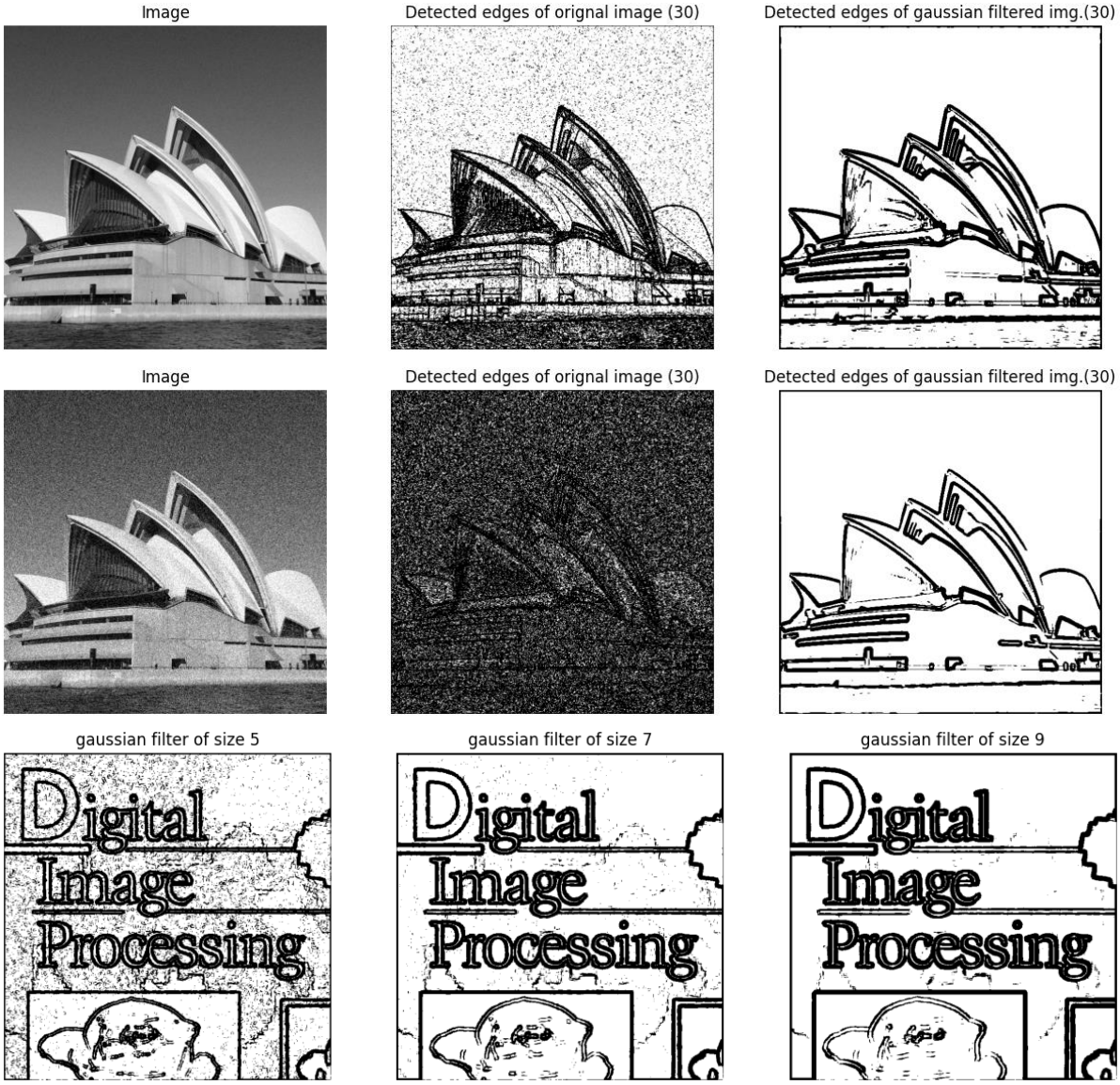
**c) Analyse:**

- **What is the effect of the amount of Gaussian smoothing on the detected edges.**
- **What is the effect of the gradient threshold on the detected edges?**

**Results:**

The thresholds of the edges are mentioned in brackets for all images






**Inferences:**

- It can be observed from by changing the filter size of the Gaussian filter the amount of noise leaking in the edge detection increases. But it also dilates the edges which is bad for the edge detection purpose.
- By changing the threshold values of the edge filter, the amount of information can be controlled, but also decreasing it too much will result in detection of false edges and in this case even the noise seeps in.

## Q3. Hough Transform:

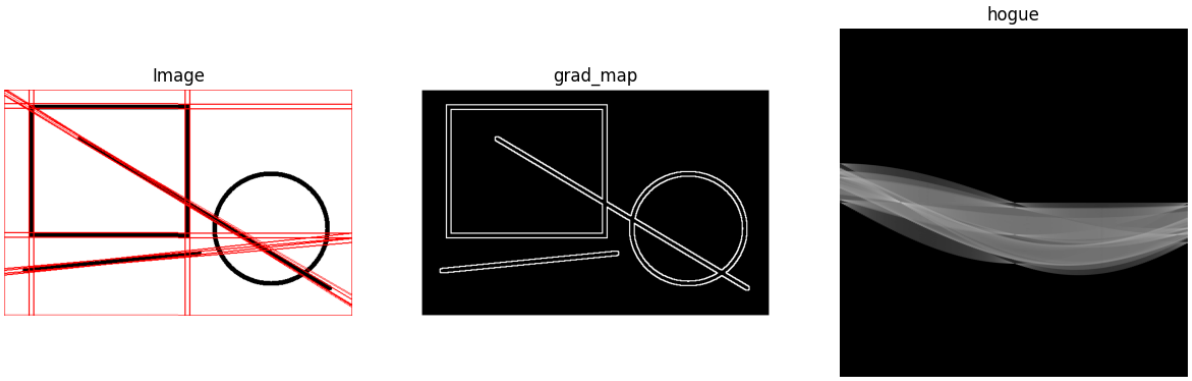
**Create a synthetic image with few lines and other shapes. Implement Hough transform to detect lines. Try different number of bins and thresholds and observe whether the lines are detected.**

**Analyze how the results are affected by:**

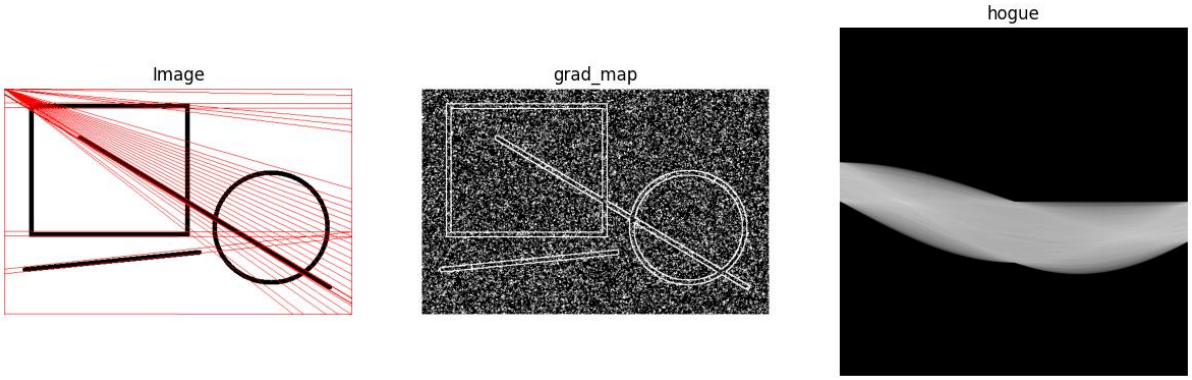
**(i) Noise**
**(ii) Occlusions**
**(iii) Real images.**

## Results:

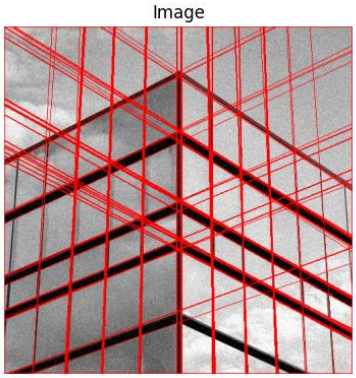
Detecting lines using Orignal Image

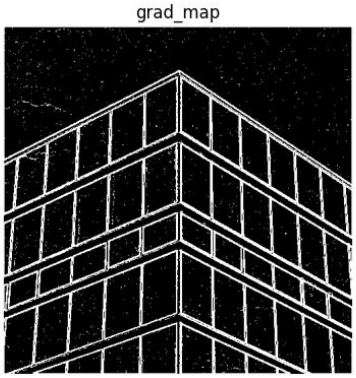


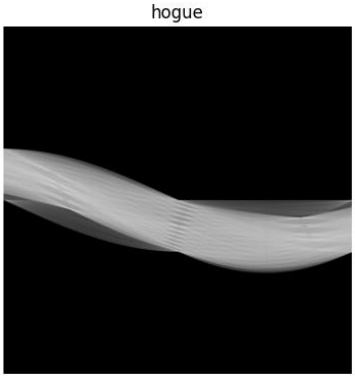

Detecting lines using noisy version of the same Image



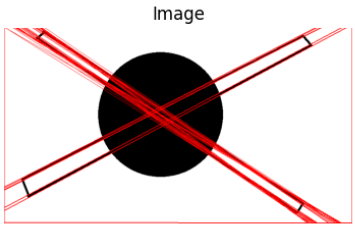
## Results on a real Image

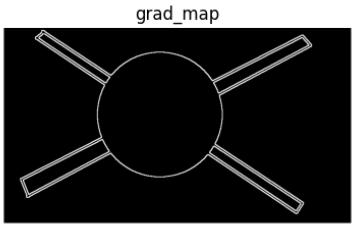


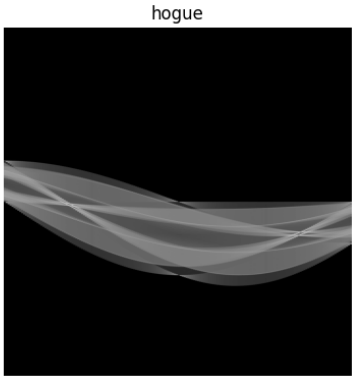



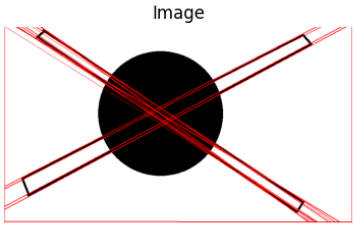

Threshold=200

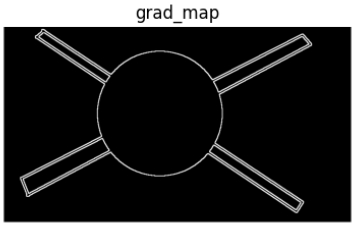


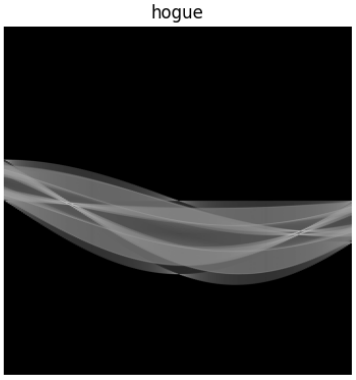



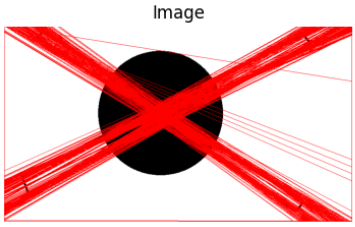

Threshold=250

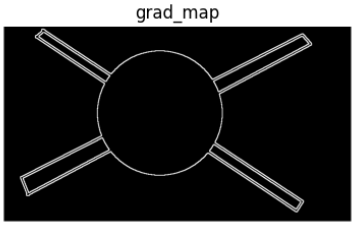


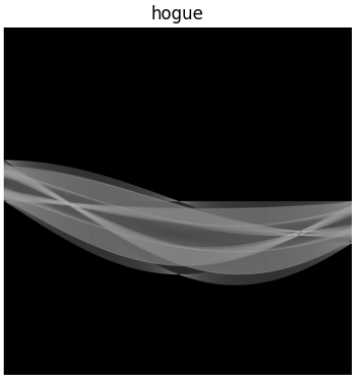




Threshold=150




**Inferences:**

- By changing the Threshold it can be seen that the no. of lines detected changes, increasing the threshold decreases the no. of lines being detected decreases
- Clearly there are false detections due to the noise in the image. It is due to accumulation of false lines corresponding to the noisy points