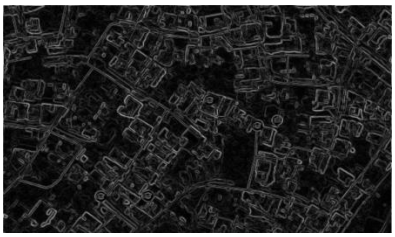
Image and Video Processing Lab (CSC18205) **Session: Winter 2020-21**
VIII Dual Degree (CSE) **Date: 11.03.2021**

Assignment-7 (Edge Detection based Image segmentation)

1. You are developing a mobile application for the processing of satellite images. The task is to find the regions which contain some buildings. Your application requires some low-level features to locate buildings. For extracting these features, you are required to detect the edges in the given image. Suppose you have the satellite image of Dhanbad. Convert the given image into a gray scale image and apply *sobel* and *prewitt* edge detection methods. Use **20**% of maximum intensity value from the gradient magnitude image to threshold edge pixels. Do not use *built-in* functions.

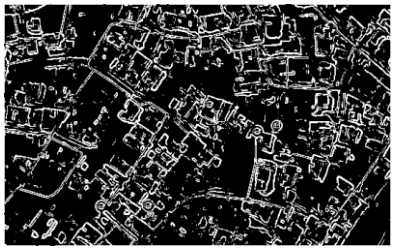
Input image



Gradient image using sobel operator

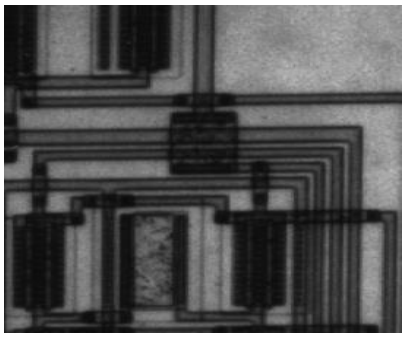
Detected edges using sobel operator

Gradient image using prewitt operator

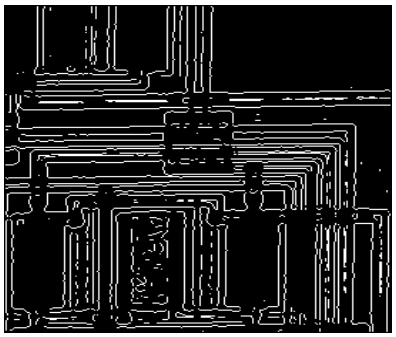


Detected edges using prewitt operator

2. The second order derivative operator is usually sensitive to noise. It creates different false positives in the output image. Therefore, you need to implement an edge detection operator that applies *Gaussian filtering* followed by *Laplacian filtering*. *Gaussian filtering* helps to remove noise whereas *Laplacian filtering* performs edge detection. Use the kernel of size $\mathbf{5} \times \mathbf{5}$. Do not use *built-in* functions.



Sample input



Sample output

3. In this problem, you need to implement *Canny edge detection* method step by step. The steps used in this method are given below.

   a) *Reduction of noise:* it uses Gaussian kernel for reducing noisy effect from the input images. Take 5 × 5 spatial Gaussian filter for performing this step.
   b) Find edges intensity and direction by calculating gradient. To calculate the intensity magnitude and direction use *Sobel* kernel.
   c) *Non-maximum suppression:* To remove any unwanted pixels those are not constitute edges. In this step, local maxima replace the processed pixel value if the maximum value found in the direction of gradient. The input of this step is edges directions (taken as radian) and pixel intensities.
   d) *Hysteresis Thresholding:* Use two thresholds $\boldsymbol{T_{Low}}$ and $\boldsymbol{T_{High}}$. If an edge response is above $\boldsymbol{T_{High}}$, those pixels constitute a definite edge. Individual weak responses usually correspond to noise. If weak responses are connected to the pixels with strong responses and they are above $\boldsymbol{T_{Low}}$, they are edge pixels. Use $\boldsymbol{T_{Low} = 0.3}$ and $\boldsymbol{T_{High} = 0.7}$.

Sample input

Sample output