CSE573

Homework set #4

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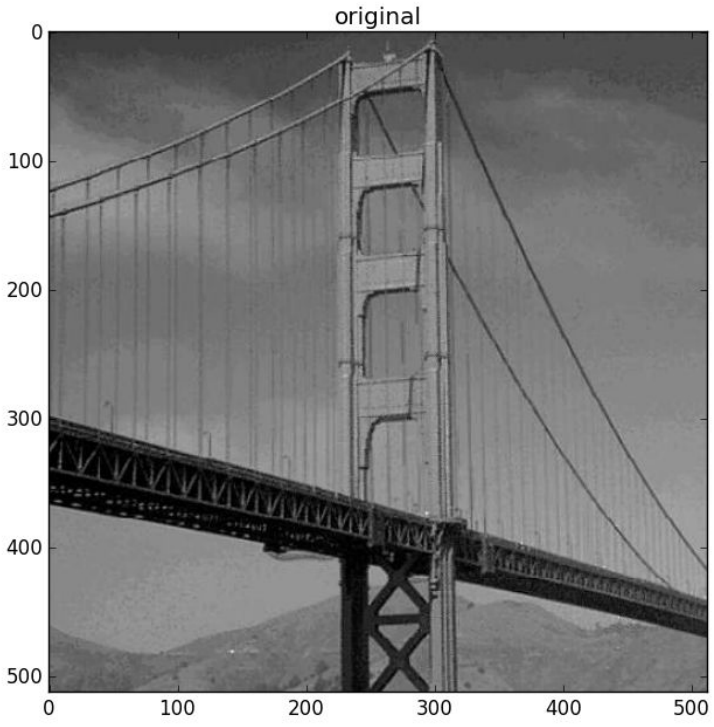
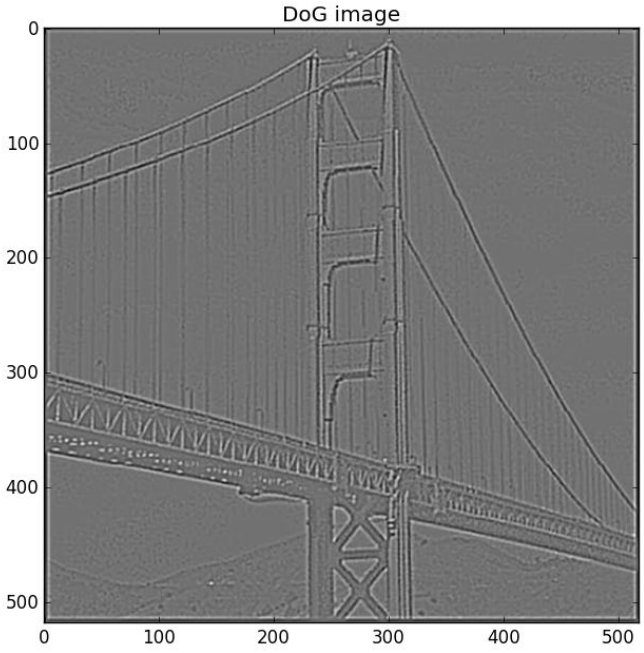
Edge Detection by Zero-crossing, DoG and LoG

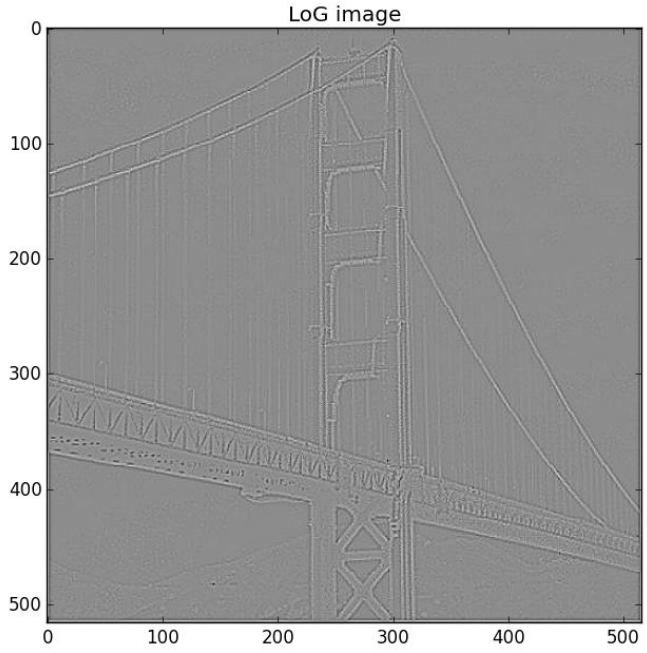
Zero-crossing of the second derivative has been considered as strong indications for edges in a given image. For practical implementations, robust computation of second derivative is usually preceded by the smoothing of an image. Two popular approaches to zero-crossing based edge detection are Difference-of-Gaussian (DoG) and Laplacian-of-Gaussian (LoG).

Original Image:

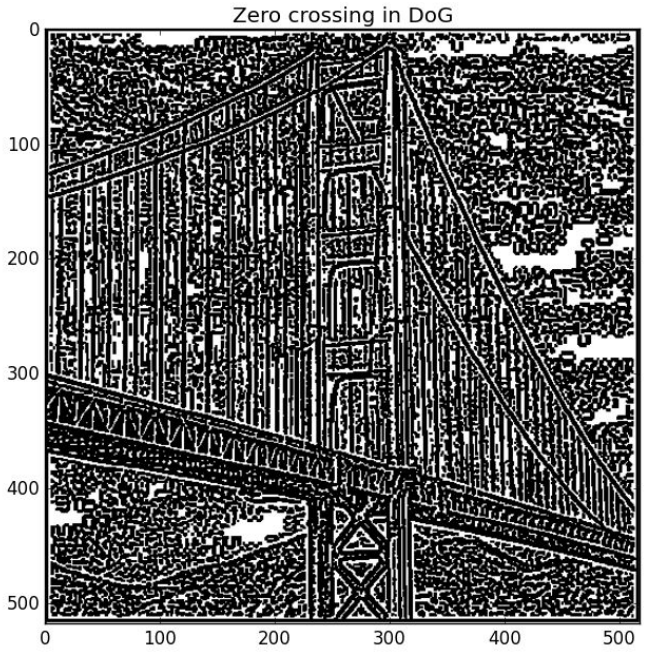


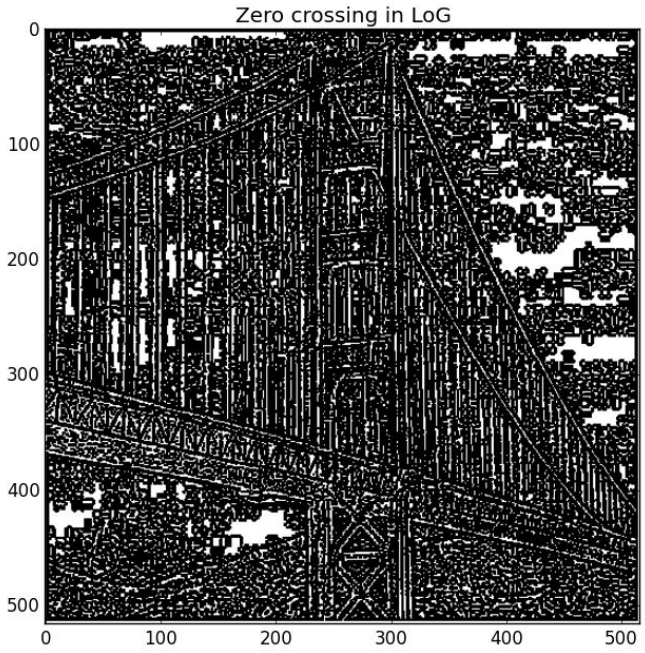
After convolving with DoG and LoG kernels:



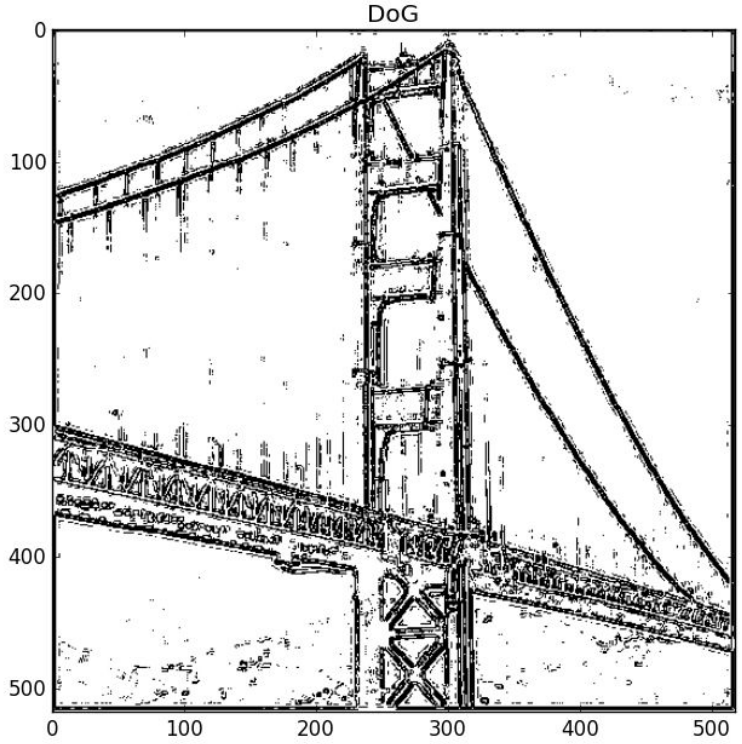


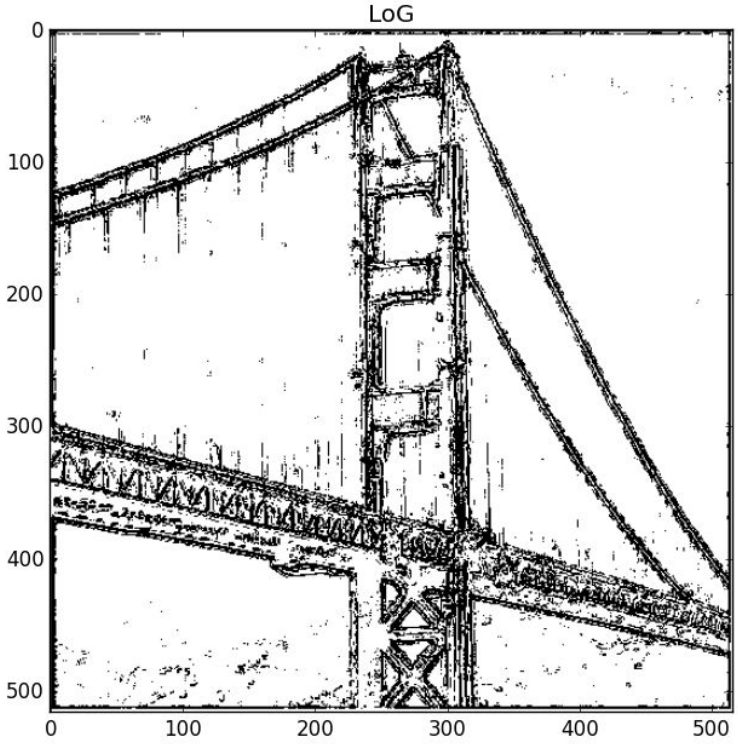
After calculating zero crossings:





After removing weak edges:





Edge detection by DoG is sharper than by LoG because in LoG the second derivative causes noise to amplify and have more effect of noise but in DoG the difference of two derivatives is taken into consideration therefore it captures more of strong edges. If we take one standard deviation in DoG to be 0, DoG may become equal to LoG. And we increase the smoothing by Gaussian in LoG, LoG may become equal to DoG.

Region Merging Segmentation

Region merging is an effective scheme for region growing based segmentation. Region growing may begin with each pixel within an image in which a pixel represents a single region initially. Regions will be merged to satisfy the region segmentation conditions as defined by Equations (6.30) and (6.31). Following algorithm is used to perform region merging segmentation:

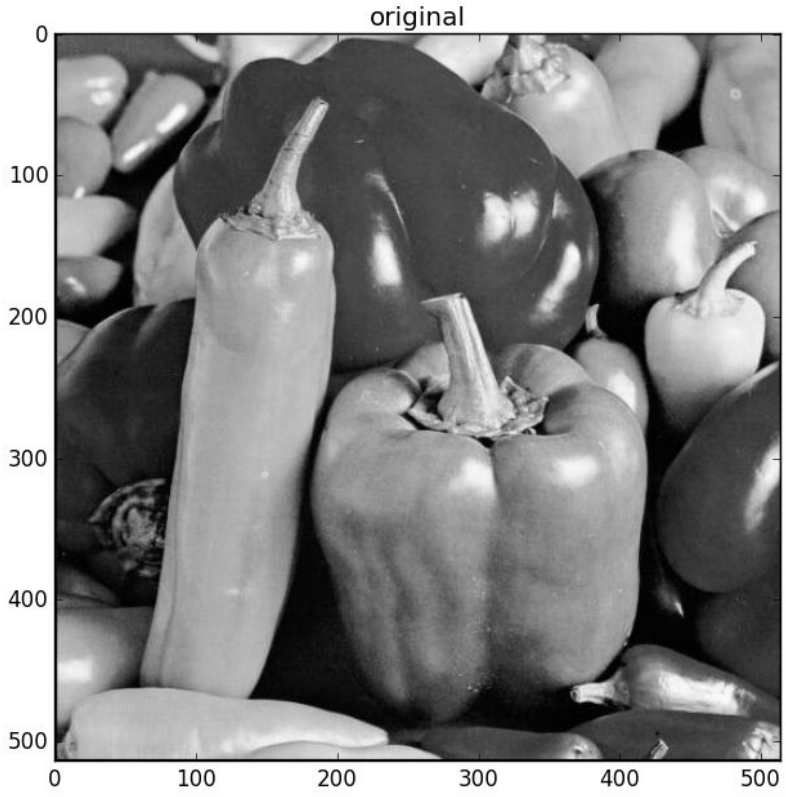
Algorithm 6.17: Region merging (outline)

1. Define some starting method to segment the image into many small regions satisfying condition (6.30).
2. Define a criterion for merging two adjacent regions.
3. Merge all adjacent regions satisfying the merging criterion. If no two regions can be merged maintaining condition (6.30), stop.

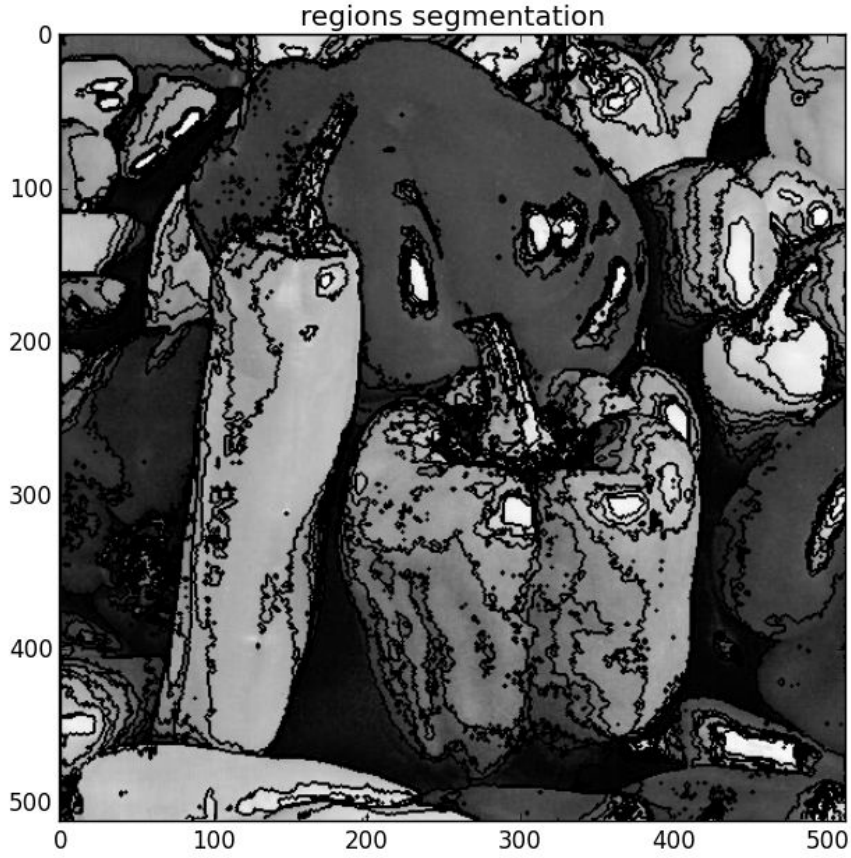
Pixel intensity is taken as homogeneity criteria as we have a gray scale image. Pixels within a threshold are considered to be forming one region.

- Labels are marked 1, 2, 3, 4,...
- Adjacency list for neighboring regions is created
- Mean for every region is calculated
- Regions with means within a threshold are merged

Original Image:



After segmentation:


regions segmentation
0
100
200
300
400
500
0
100
200
300
400
500