

ASSIGNMENT 2 REPORT

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1. Implemented Solutions

- The program uses two methods to extract boundaries of objects : 3x3 Sobel gradient operator and binary morphology.
- LPF pre-processing is applied before the gradient-based method to improve overall accuracy of edge detection.
- The original is binarized before applying the morphological boundary detection method.
- From the generated black/white images gradient.bmp and morphology.bmp, Hough transform is applied to detect the presence of straight lines and measure their orientations.

2. Analysis

- Sobel operator has low computational complexity and good performance in finding boundaries of objects. However this method is sensitive to noise. The increase in noise will decrease the magnitude of the edges.
- With LPF pre-processing of images (blur, threshold) before giving it to a gradient operator, LPF has reduced noise in the image (but not efficient with asm2.bmp which has high amount of noise). Therefore, the efficiency of edge detection can increase significantly.
- Binary morphology works on binary image. Therefore, it is not sensitive to noise, thresholding has removed noise. To binarize the input image selection of threshold can be difficult if an image has not a very high contrast. For the image asm2.bmp, it has very high contrast and selection of a threshold is not very difficult (100 is selected).

3. Observations and Findings

- Binary morphology method by applying thresholding can remove all of the noise in the image (both asm2n.bmp and asm2.bmp) and produce an image with thinner but not smooth boundaries of objects. Whilst, for the Sobel gradient method, although the image is pre-processed with LPF to reduce noise, there is still some noise in the generated image (even worse with asm2n.bmp), the image then need to be applied erosion and thresholding to remove noise so that Hough Transform can detect the presence of lines. The boundaries produced by Sobel gradient method are thicker and smoother. Also, in the resulting image produced by Sobel gradient operator (before thresholding and erosion), there is a small circle inside a bigger circle. That circle is lost in the image produced by Binary morphology.
- For image "asm2.bmp", both methods can detect boundary almost accurately, but Sobel operator detects more accurately (it can detect boundary of a small circle inside a bigger circle).
- Hough transform can detect presences of 2 diagonal and parallel lines in generated images gradient.bmp and morphology.bmp.

4. Conclusions

Sobel gradient operator and binary morphology has been applied in the program to extract boundaries of objects in an image and Hough transformation is for detecting presence of lines. Gradient operator has more accuracy in edge detection than binary morphology and gradient operator

is more sensitive to noise. Hough transform efficiently detects lines but can only detect lines accurately when noise in an image is low or free. Applying LPF pre-processing can reduce noise and increase accuracy of boundaries extraction methods.