

Computer Vision: Representation and Recognition

Assignment 2

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1 Edge Detection

1.1 design choices and parameters

- (i) Gaussian std=sigma=1
- (ii) The non-maxima suppression algorithm is based on my own estimates of the magnitude and orientation. The boundary scores can be rescaled to an exponent of 0.7, as the manual suggests for better visualization.

1.2 bank of filters

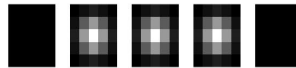


Figure 1: bank of filters(different orientations of Gaussian kernels).

1.3 Qualitative results

see figure 2 and figure 3.



Figure 2: result of gradient-based edge detector



Figure 3: result of oriented filters

1.4 Quantitative results

Method gradient: overall F-score = 0.565 average F-score = 0.589

Method oriented: overall F-score = 0.564 average F-score = 0.589

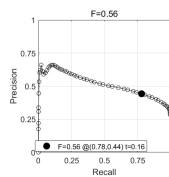


Figure 4: pr of gradient-based edge detector

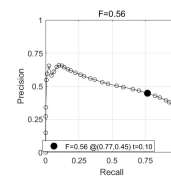


Figure 5: pr of oriented filters

1.5 Ideas for improvement

The noise and the edge signal are both high frequency signals. Therefore, a simple Gaussian operation may erase edges while smoothing the whole image. As a result, we can use selective smoothing methods, which can preserve edges.

Furthermore, we can choose different kernels for gradient calculation, which may improve the accuracy of finding true edges.

2 Image segmentation with k-means

2.1 parameter values

winSize, numColorRegions, numTextureRegions=3, 10, 10

2.2 segmentation results

Results are as follows (figure 6-17). The upper one is the segmentation result of texture, while the other is the segmentation result of color.



Figure 6: coins

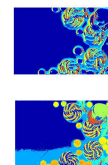


Figure 7: segmentation results

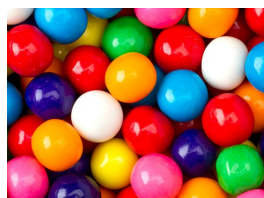


Figure 8: gumballs

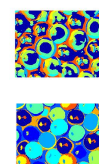


Figure 9: segmentation results



Figure 10: planets

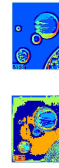


Figure 11: segmentation results



Figure 12: snake

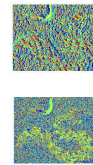


Figure 13: segmentation results

2.3 window sizes

As we can see in figure 18 and figure 19, a smaller window size will have a more precise segmentation result, while a larger window size will have less noise.

2.4 run script

run `segmentMain.m` to get the result of a certain image and you may change target image and parameters in function `compareSegmentations`(line 17).



Figure 14: twins

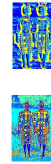


Figure 15: segmentation results



Figure 16: my image



Figure 17: segmentation results

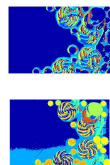


Figure 18: winSize=3

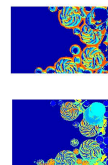


Figure 19: winSize=11