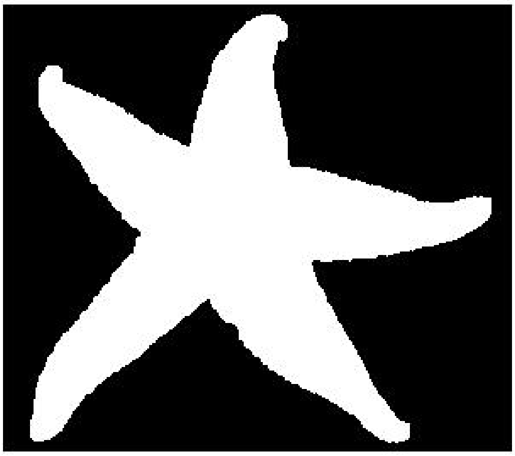
CS767 Assignment 1

I use all 4 late days. new deadline is Oct. 7 Friday 11:59 p.m.

Problem 1

1.1 mySegmenter(imIn)

- Segmentate the image into foreground and background.
- Inputs : A 2-D logical or integer array, the image.
- Outputs :
  - imOut : The Segmentated image.
  - bdd_points : A polygon boundary of the image.
  - bdd_length: The length of the polygon boundary.
  - Area: Area inside the polygon boundary.
  - diameter: the largest distance between two points in the ROI.
- Implementation:
  - Segmentation: Ostu's Method on the histogram.
  - boundary points: The (max_x,y) and (min_x,y) for every y, and fill up the gaps between boundary points. Given there is only one blob, this gives a polygon that surrounds the blob.
  - bdd_length: The number of boundary points, sinces all boundary points are neighbors.
  - Area: The integral of (max_x - min_x + 1) over y
  - diameter: Runs a n^2 pairwise distances to find the diameter. Necessary because boundary is not convex.
- Results:
  - Foregound pixels:



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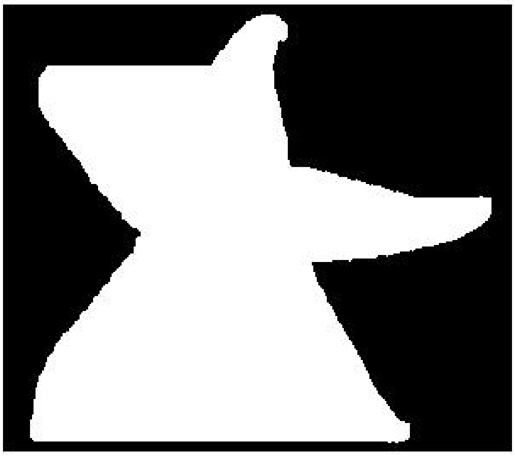
  - Pixels inside boundary:



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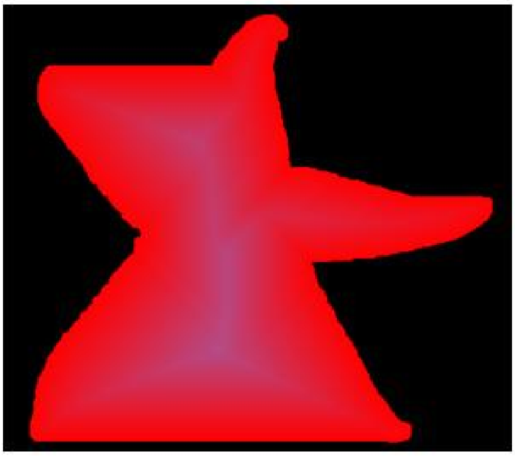
1.1 other (maybe unused) implementations

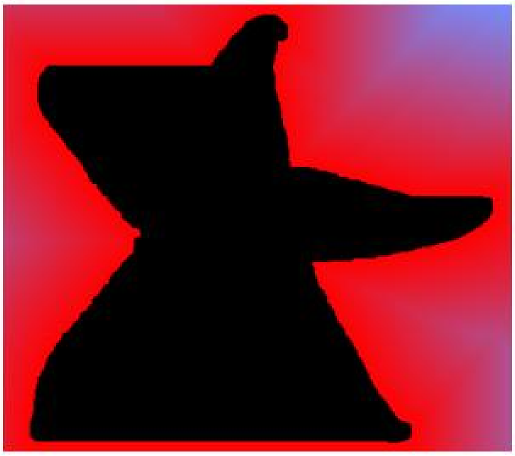
- myPerimeter: Handles bdd_points, bdd_length, Area, diameter for mySegmenter.
- myDiameter: Handles diameter for myPerimeter.

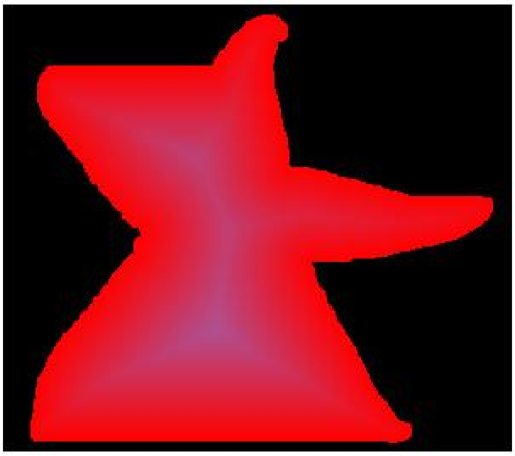
- myFill: Fills the blob so that it contains no holes.
- myArea(unused): Takes the set of boundary points, and calulates the area by dividing it into triangles.
- myPerimeterLength(unused):the sum of Euclidian distances between boundary points.

1.2 myDT(imIn,method)

- Creates the distance transfrom
- Inputs : A 2-D logical or integer array, the image.
- Outputs: [A,B]
    - A: the distance map outside the boundary
    - B: the distance map inside the boundary
- implementation: By default, uses BFS to calculate the mannhattan distance to the closest boundary point. If specified (method = '2-norm'), calculates distance from all pixels to each boundary point, then take min, vector programming, super fast.
- Results
- BFS



- 
- 2-norm



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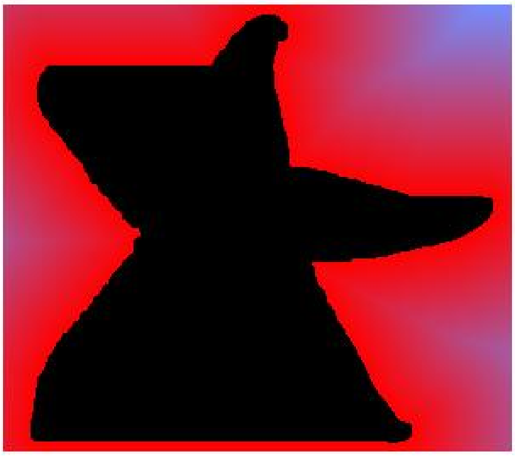
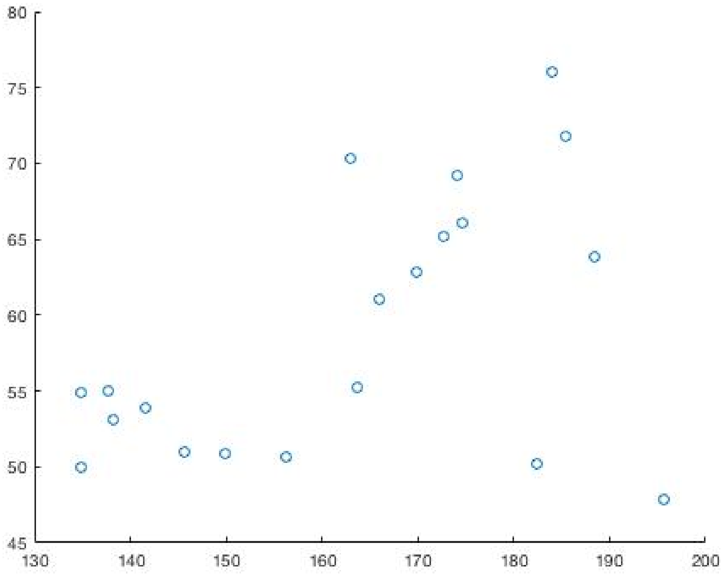


1.3 Experiments

- The predictor seems to grow with area/boundary length/diameter. Since the blobs are mostly circles, boundary length and diameter grow together, area is their square. So the predictor has the same behavior to the three measures.
- Scatter plots:
- x = Diameter, y = prepictor, correlation = 0.4818



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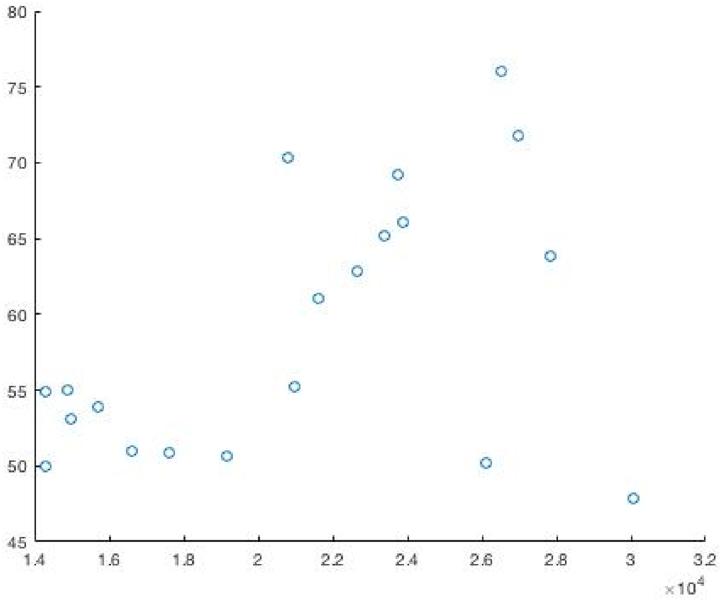
- x = Area, y = prepictor, correlation = 0.4646



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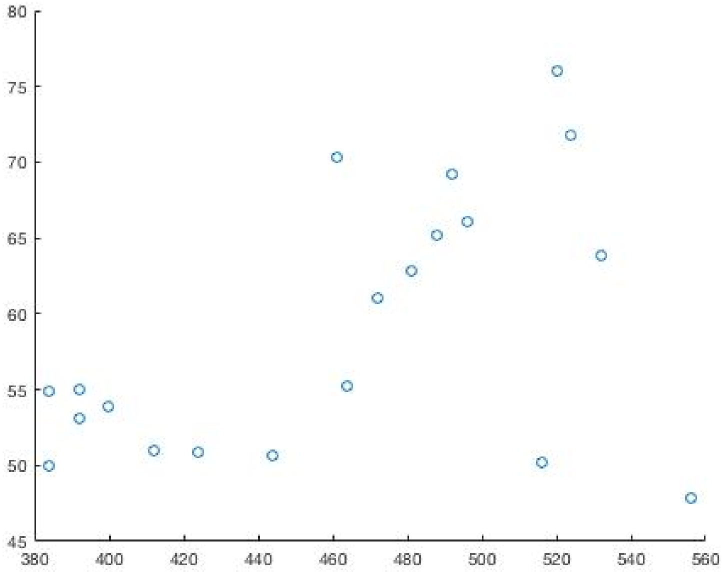
- x = Boundary length, y = prepictor, correlation = 0.4753



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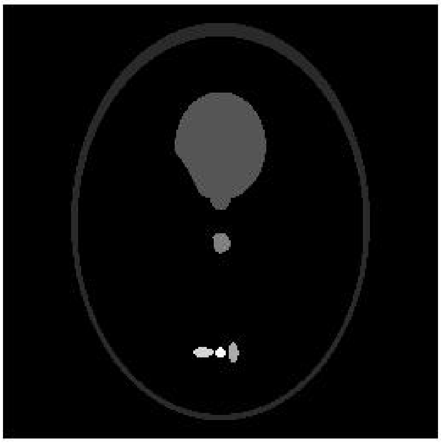
Problem 2

2.1 myRegionFinder(imIn)

- Assign different values to different blobs.
- Inputs : A 2-D logical or integer array, the image.
- Outputs: A 2-D uint8 array
- implementation: DFS to find connected components.
- Results: imshow(imOut/double(imOut)/max(max(imOut))



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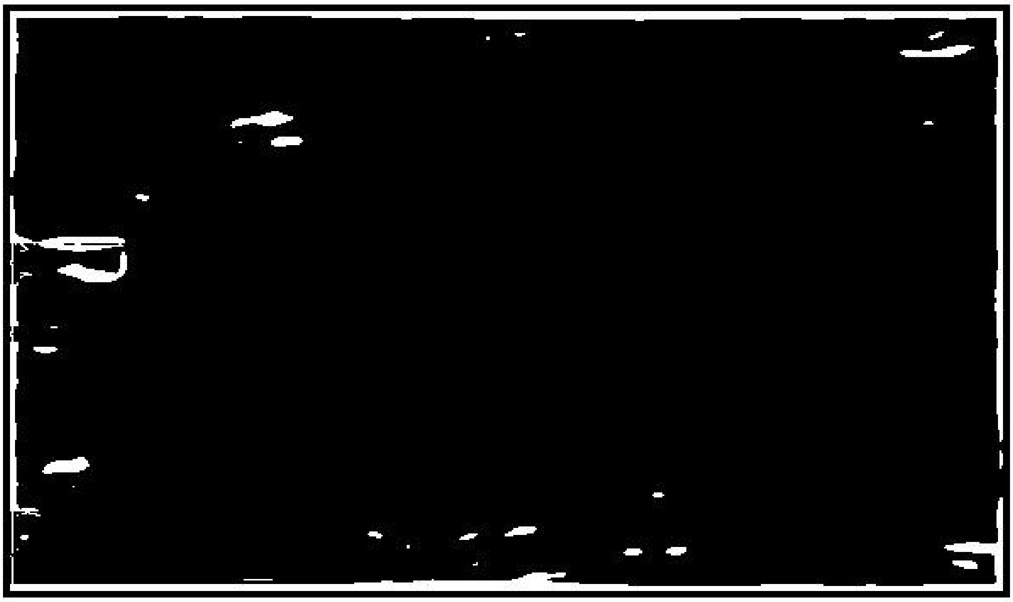
Problem 3.1

- myEdge(imIn,sigma): Based on Canny.
    1. Apply Gaussian filter
    2. Calculate gradient
    3. Filter out small gradients
    4. Non-maxium surpression
- myEdge2(imIn,n):
    1. Quantize intensitys into n values.
    2. Calculate gradient
    3. Filter out small gradients
    4. Non-maxium surpression
- Removing culttered edges:
    1. Erosion
    2. edge(x,y) = 0, if edge(x,y) has less than 2 pixels in the 8-neighborhood are edge pixels.
- Results
- myEdge:



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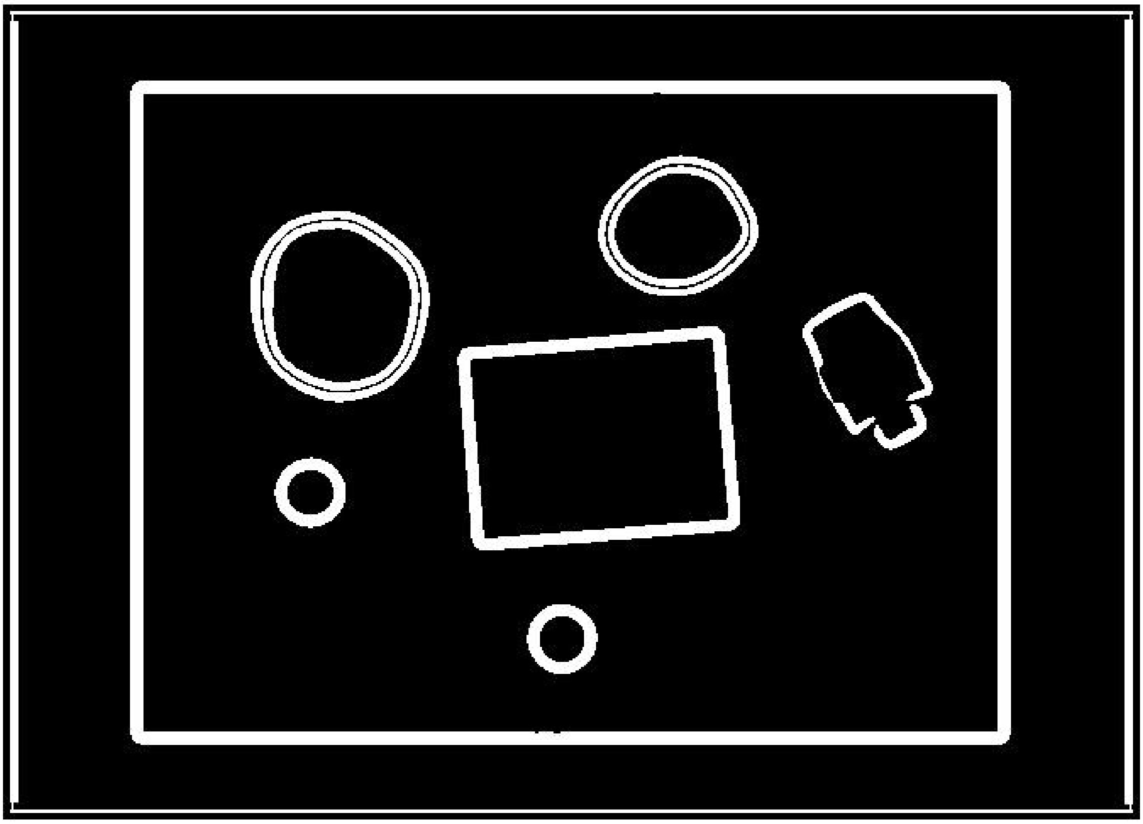
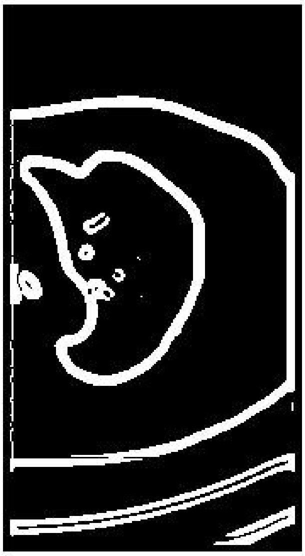
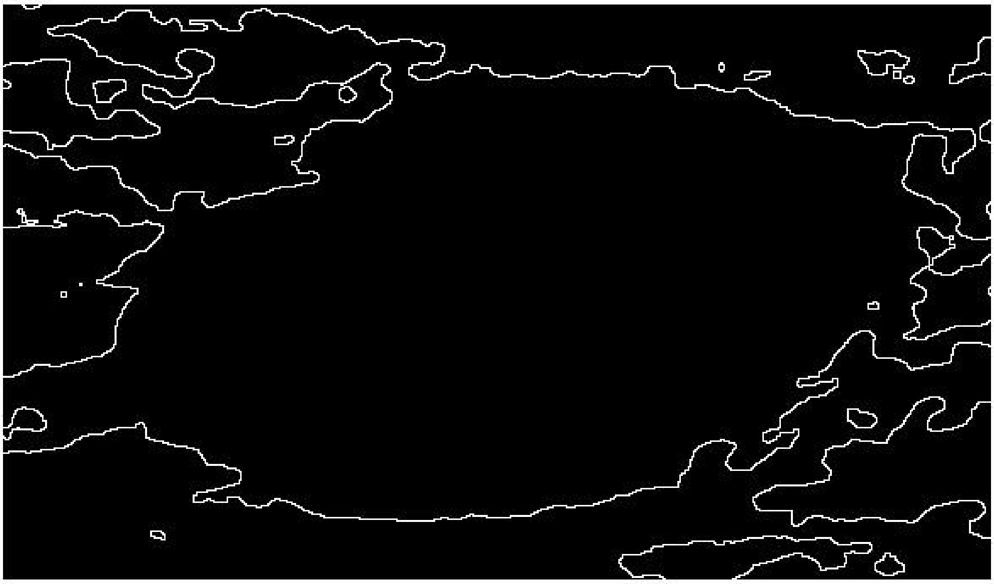
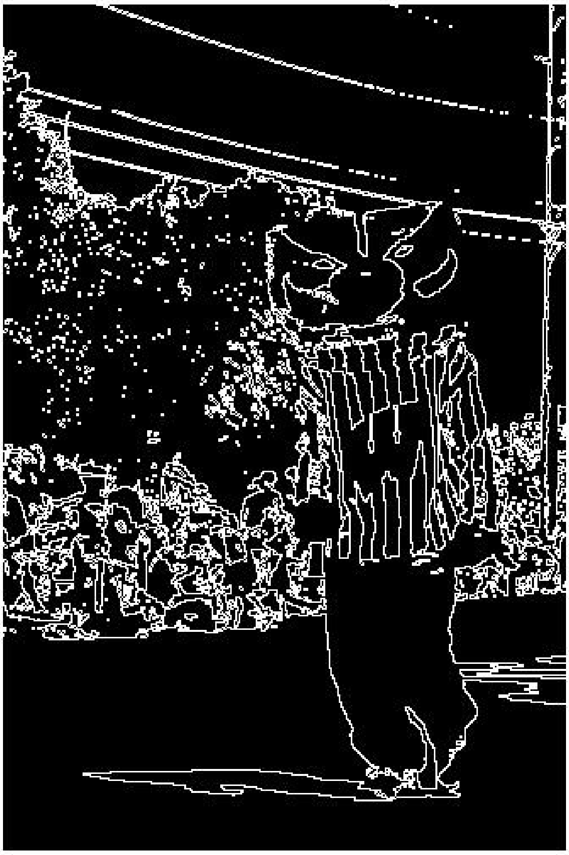
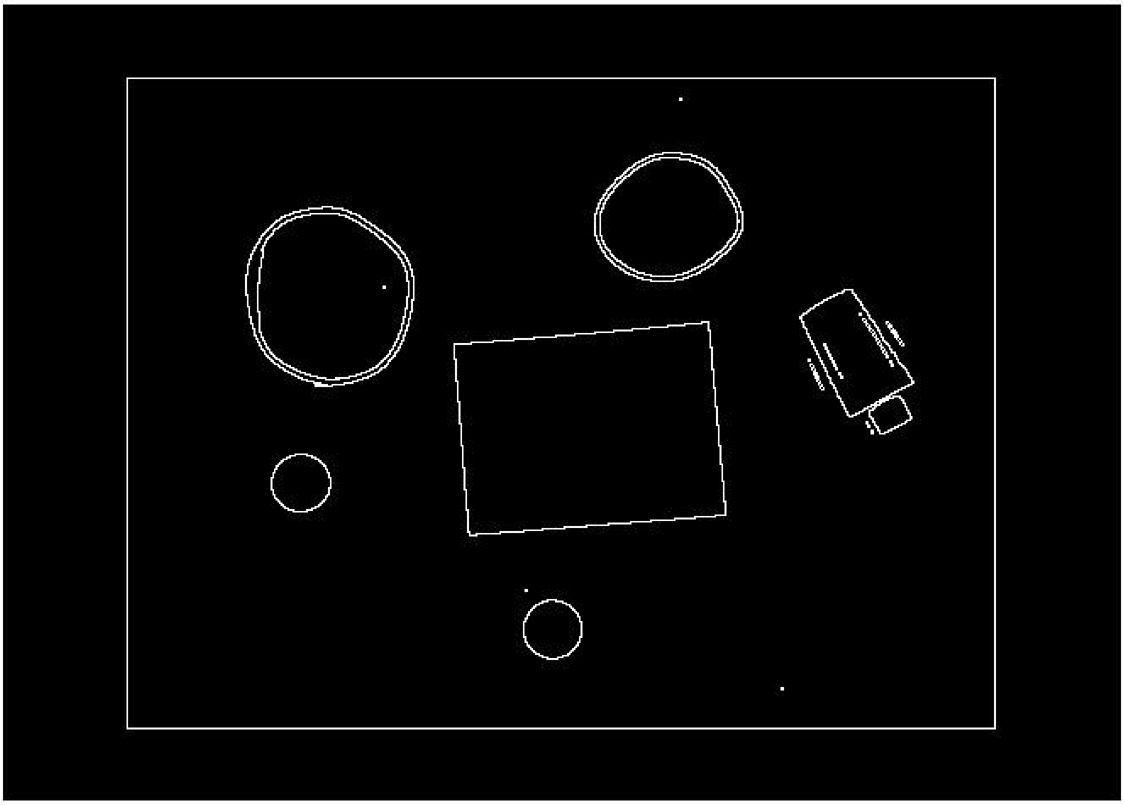


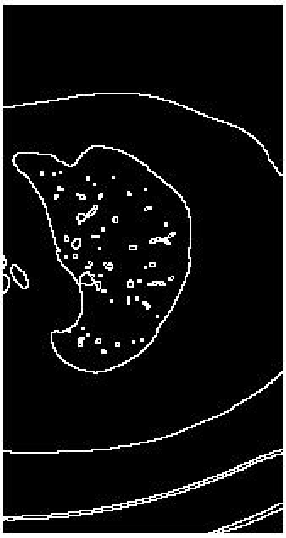


- myEdge2:



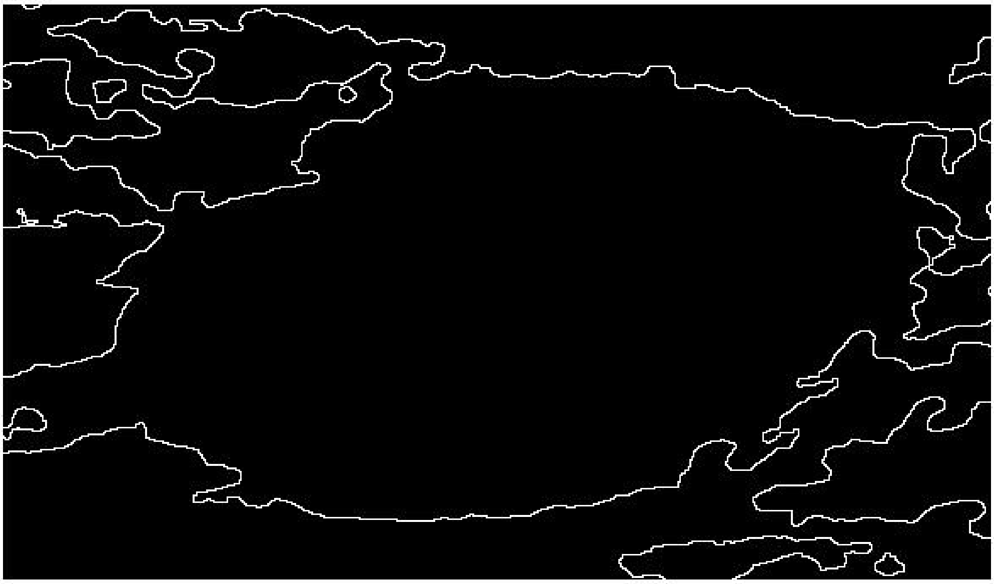
- 





Problem 3.2

- groupEdge(imIn,x,y) Uses connected components method the group the edges. But allows a gap if 2 pixels between edges.
- Cloud.png, (150,76)



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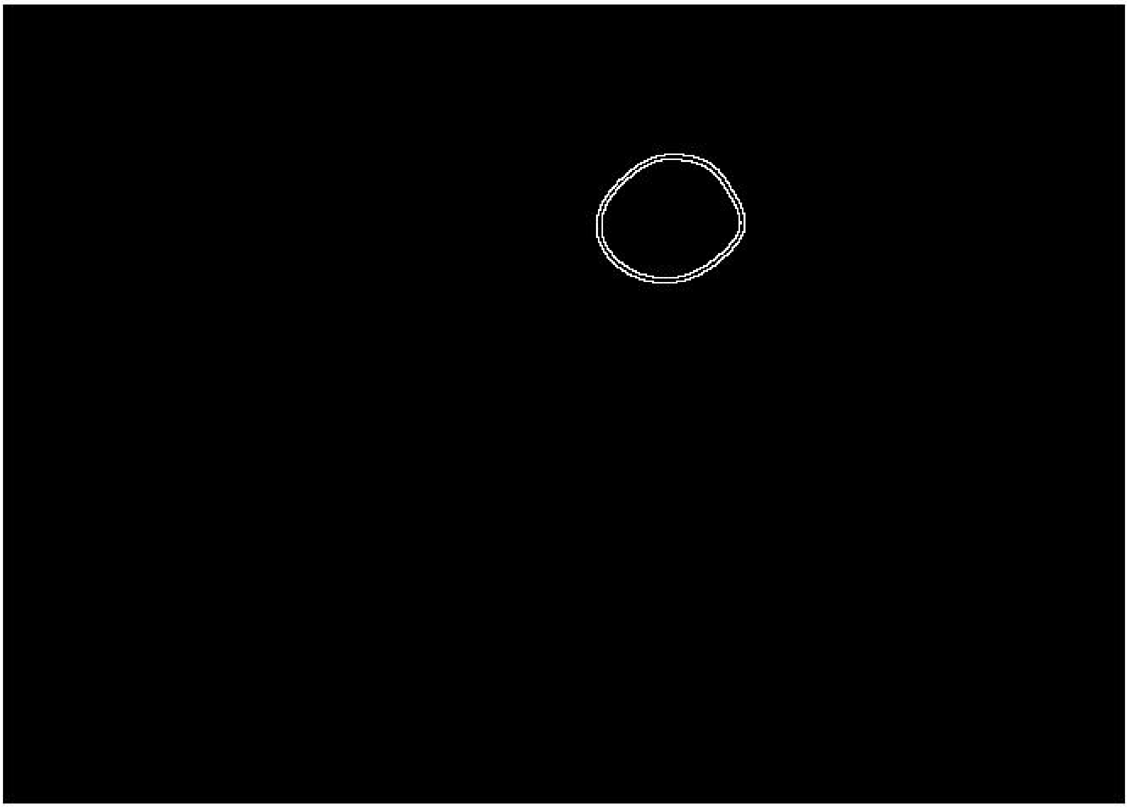
- edge_link.png, (150,76)



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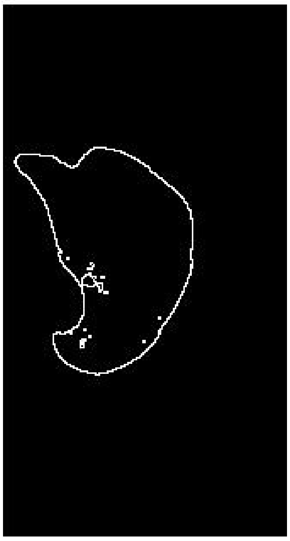
- img_ct_lung, (100,88)



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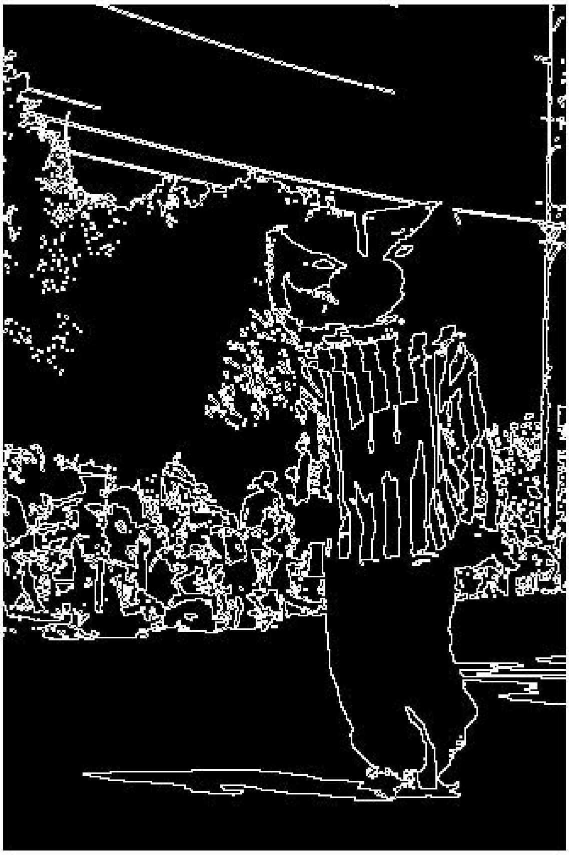
- edge_detecter, (400,197)



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Problem 4

- IJCV 2001 Real-Time Face Detection
    - For getFeature, I didn't implement any concepts from the paper. Since directly summing all the pixels would be the fastest.
    - For getFeatureHist, I calculated the integral image first, then all the queries for getFeature(m,n,i,j) would be O(1) time.
- getFeature
    - Regions that give no response are aproximately homogenious on the left and right.
    - Regions that have positive response have decresing intensity from left to right.
    - Regions that have negitive response have incresing intensity from left to right
- getFeatureHist