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Course: ECE 4310
Lab #5

Active Contours

In this project the student was to implement the Active Contour algorithm. The student was provided with a PPM image named “hawk.ppm” and text file containing a list of 42 initial contour points called “initial_contour.txt”. The student was to use these two files in order to complete the following requirements:

1. Read gray scale PPM “hawk.ppm” image
2. Read initial contour points from “initial_contour.txt” file.
3. Draw a “+” shape in a 7x7 window based on the initial contour points on the original PPM gray scale image.
4. Implement Active Contour Algorithm based on initial contour points.
 1. The Active contour algorithm used 2 Internal Energies and 1 External Energy.
 1. First Internal Energy
 1. The first internal energy calculation was based on calculating the square of the distances between the contour points in a 7x7 window.
 2. It should be noted that it was assumed that the contour encloses the area, therefore the last contour point was connected to the first contour point to calculate the First Internal Energy.
 2. Second Internal Energy
 1. The second internal energy calculation was based on:
 1. Calculating the average distance between all contour points.
 2. Taking the square difference between the average and the distance between the current contour point and the next contour point.
 3. It should be noted that it was assumed that the contour encloses the area, therefore the last contour point was connected to the first contour point to calculate the Second Internal Energy.
 3. External Energy
 1. The external energy was calculated by obtaining the gradient magnitude of the original image which was calculated by convolution with a Sobel template
 4. Normalization
 1. Each of the Energies calculated in a 7x7 window were normalized by finding the maximum and minimum value of that size window and then re-scaling each window to a min-max value of 0 and 1 respectively.
 5. New Contour Points
 1. After normalization of all Energy windows, the new contour points were calculated by finding the minimum value after the summation of all values in the 7x7 window of the three energies.
 6. Repeat Algorithm
 1. The Active Contour algorithm was run a total of 30 iterations with the purpose of obtaining the best contour points.

All C code can be seen at the end of the report.

RESULTS



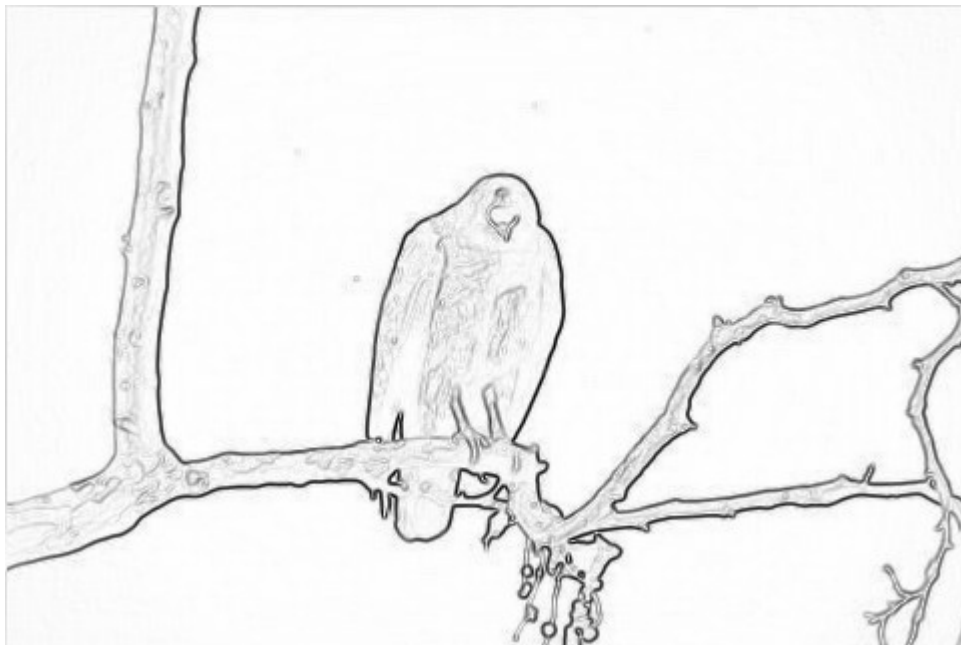
Original gray-scale PPM image



Original gray-scale PPM image with Initial Contour Points



Sobel Edge Gradient Magnitude Image



Inverted Sobel Edge Gradient Magnitude Image



Original gray-scale PPM image with Final Contour Points



Initial Contour Points PPM Image vs Final Contour Points Image

FINAL CONTOUR POINTS TABLE

COLS	ROWS
266	104
272	114
275	123
277	133
278	143
278	154
275	167
270	180
266	191
262	201
255	213
254	226
246	237
235	234
225	239
226	249
221	260
212	266
199	266
195	255
194	245
185	242
177	237
185	223
180	211
181	201
182	190
183	180
184	170
186	160
188	147
193	134
196	125
199	116
206	109
214	105
222	100
230	94
237	87
246	84
256	86
264	96