

Clemson University  
ECE 4310: Computer Vision  
Lab 5: Active Contours  
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Due: October 27, 2020

**Purpose:**

The purpose of this lab is to use the input image, hawk.ppm, and perform active contouring on the image. The initial contour of the image was given, and those points were roughly around the edge of the hawk. A Sobel filter is used to detect the edges of the hawk. When deciding to move the points, seral energies were calculated using a 7x7 window.

**Input:**

Figure 1: Original Image

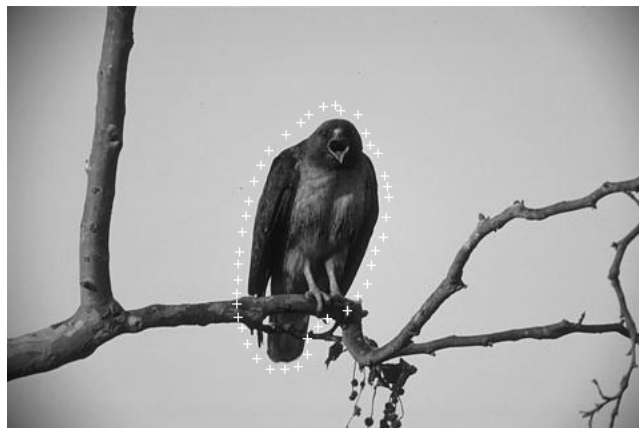


Figure 2: Initial Contour Image

**Output:**

Figure 3: Sobel Filter Implementation



Figure 4: Final Output Image

Final Contour Point Locations:

Contour Point 0: 166 275  
Contour Point 1: 169 274  
Contour Point 2: 180 270  
Contour Point 3: 191 266  
Contour Point 4: 203 261  
Contour Point 5: 218 254  
Contour Point 6: 220 257  
Contour Point 7: 232 251  
Contour Point 8: 236 239  
Contour Point 9: 242 228  
Contour Point 10: 251 223  
Contour Point 11: 264 217  
Contour Point 12: 267 208  
Contour Point 13: 263 196  
Contour Point 14: 254 195  
Contour Point 15: 245 187  
Contour Point 16: 238 177  
Contour Point 17: 237 175  
Contour Point 18: 234 174  
Contour Point 19: 222 176  
Contour Point 20: 211 180  
Contour Point 21: 199 181  
Contour Point 22: 187 183  
Contour Point 23: 175 184  
Contour Point 24: 163 185  
Contour Point 25: 151 187  
Contour Point 26: 140 191  
Contour Point 27: 129 195  
Contour Point 28: 117 199  
Contour Point 29: 106 211  
Contour Point 30: 99 224  
Contour Point 31: 87 237  
Contour Point 32: 84 248

Contour Point 33: 87 258  
Contour Point 34: 96 264  
Contour Point 35: 104 266  
Contour Point 36: 115 272  
Contour Point 37: 126 276  
Contour Point 38: 137 278  
Contour Point 39: 141 278  
Contour Point 40: 152 279  
Contour Point 41: 163 276

### **Conclusion:**

To decide where to move the contour point to, many different types of energies were calculated. Around each contour point, a 7x7 window was taken to observe. Two internal energies and an external energy were calculated using this window. The internal energies are determined based on the formation of the points and the external energy is based on the edges of the image. The first internal energy was calculated by calculating the distance to the next contour point. The second internal energy does the same thing, except it subtracts the average distance between points from the distance to the next point and squares the result. Doing these two calculations, gives us the minimum point of the 7x7 window and it represents the closest point to the next point. The external energy uses the result of the Sobel filter. To get an edge to represent a lower value, the inverse of the Sobel filter is used. The Sobel filter is a result of each point in the 7x7 window and is squared which is used for the external energy. The resulting 7x7 windows of energy values are used to calculate the total energy around that contour point. The minimum value of the total 7x7 array is used to set where the next set of contour points are supposed to move to. An array temporarily holds that minimum value until calculations have been performed on all contour points. After all contour points have been used for calculations, the contour points are set to their new positions. Then the calculations are performed again 30 times for each contour point. After this is done, plus signs are drawn around the final contour points to show where they have moved to. The results above shows the final contour points listed out, the initial image with the initial contour points, the Sobel filter output, and the final output image.