

# Introduction to Computer Vision

## Active Contours - Project

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### **ECE 631**

### **Project Report**

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# 1 Introduction

The project deals with implementing Active Contours to segment food objects in Images. This implementation internal energy terms and a sobel based gradient term for external energy.

## 2 Design

The implementation produces best results when 3 internal Energy terms are used, and one External Energy.

The External Energy term is directly obtained from the Sobel Gradients.

The Internal Energy terms for a collapsing contour are:

- Internal Energy 1: Tries to collapse each point towards the centroid
- Internal Energy 2: Tries to maintain distance between the current point and the next point equal to the average distance between all points
- Internal Energy 3: Tries to maintain an equal distance between its next point and previous point.

The Internal Energy terms for a expanding contour are:

- Internal Energy 1: Tries to explode each point away the centroid
- Internal Energy 2: Tries to maintain distance between the current point and the next point equal to the average distance between all points
- Internal Energy 3: Tries to maintain an equal distance between its next point and previous point.

These Internal Energy terms when weighted and summed, form a energy function for each point updation.

### 2.1 Sobel Filter

The Sobel filter is implemented in two phases (x-direction and y-direction) and these values are squared and added to generate a Gradient matrix. This is then normalized for output, and subsequently used as the external energy metric.

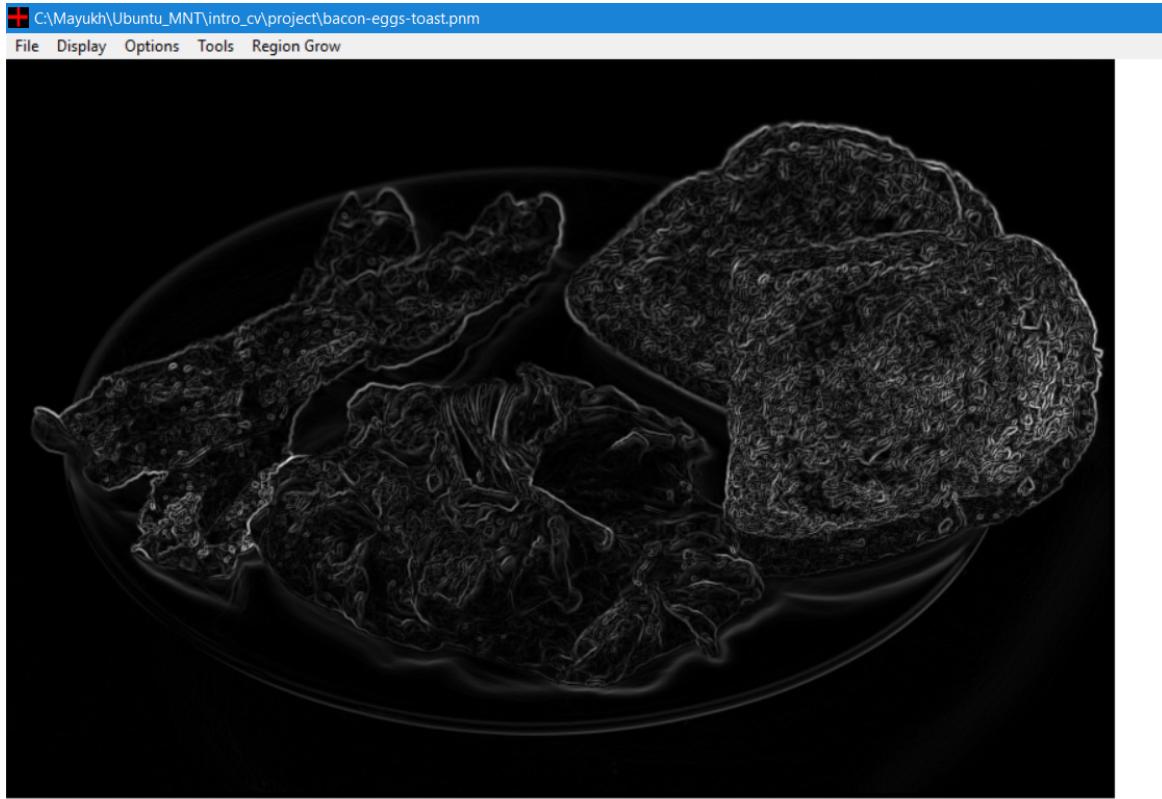


Figure 1: Sobel Filter Output

### 3 Results

Here are three scenarios shown in results.

First shown is the initialization and final positions of a collapsing contour.

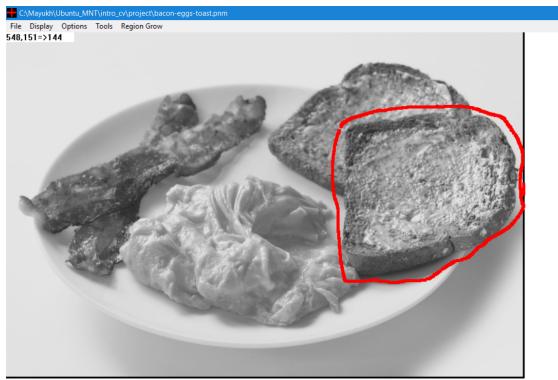


Figure 2: Collapsing Contour - Initialize

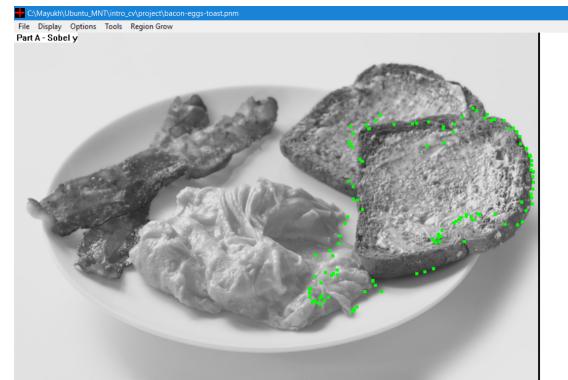


Figure 3: Collapsing Contour - Final

Next is the initialization and final positions of an expanding contour.

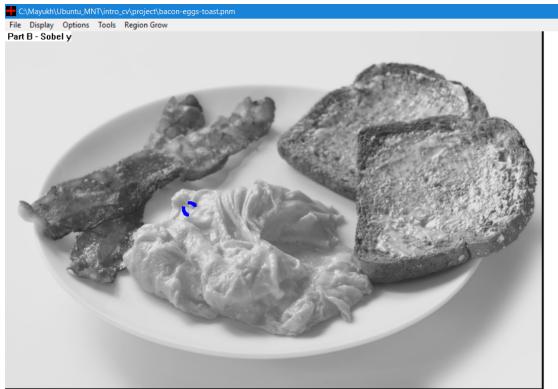


Figure 4: Expanding Contour - Initialize  
The lack of points here is due to few points to begin with and subsequent downsampling.

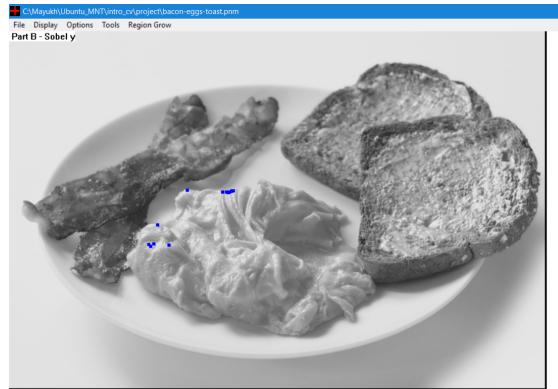


Figure 5: Expanding Contour - Final  
The lack of points here is due to few points to begin with and subsequent downsampling.

Shown here is the initialization and final positions of an open collapsing contour.

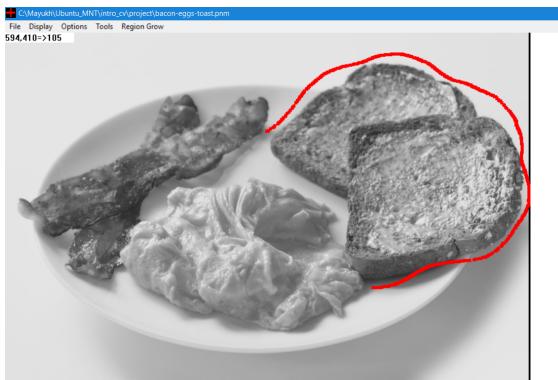


Figure 6: Collapsing Contour (Open) - Initial- Figure 7: Collapsing Contour (Open) - Final  
ize

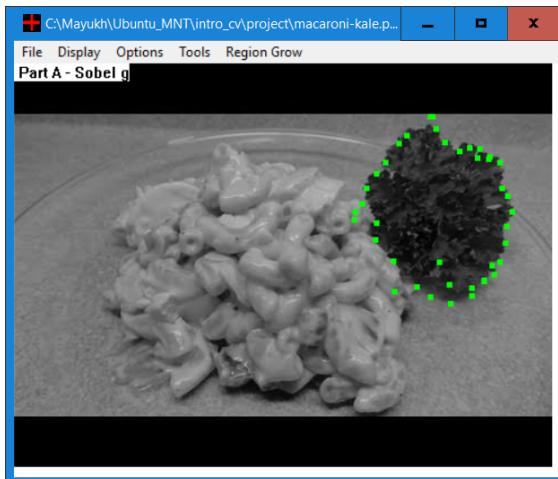
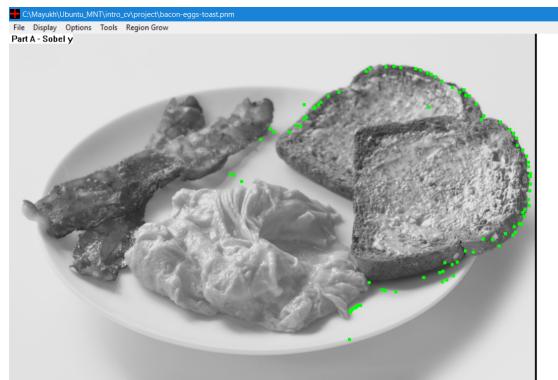


Figure 8: Kale and Mac Image



Figure 9: Kale and Mac Image

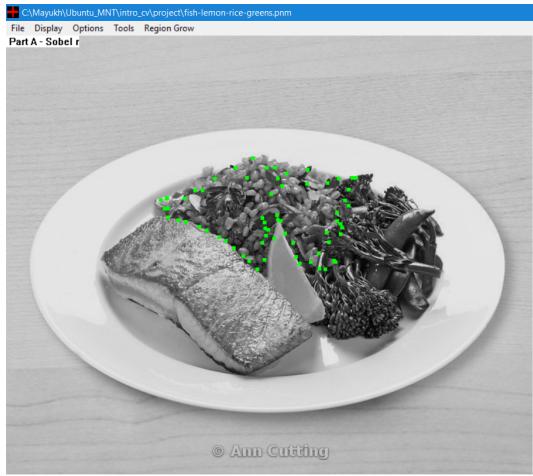


Figure 10: Fish and Rice Image

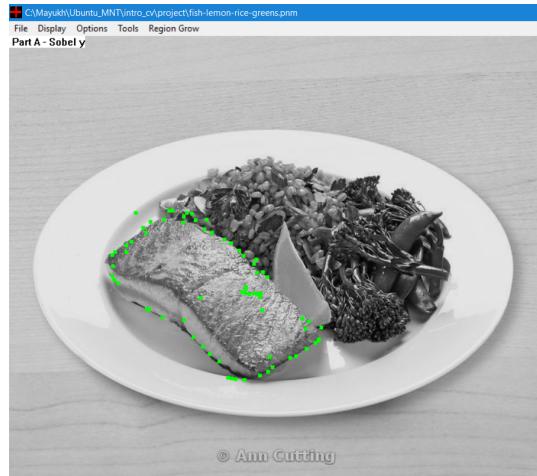


Figure 11: Fish and Rice Image

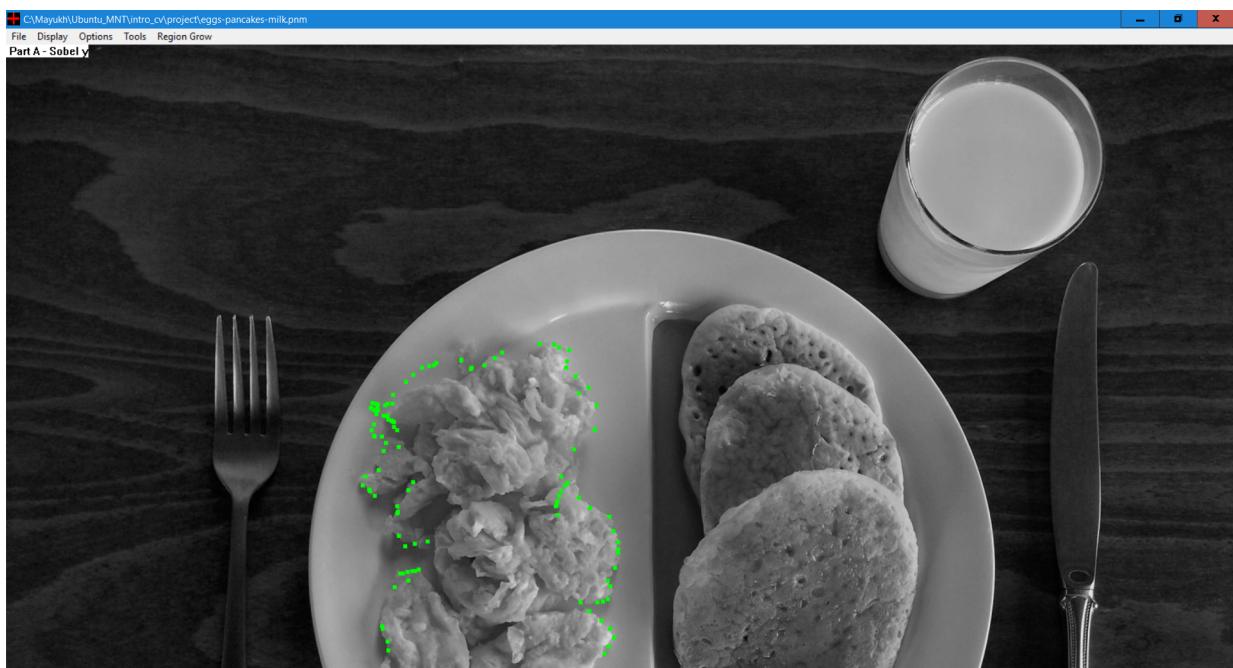


Figure 12: Eggs Image