

# Multiscale and Multi-channel Image Segmentation Algorithm

24 Fall ECE549 project proposal

## Group members

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## Project description and goals

### Project Description:

This project focuses on enhancing traditional image segmentation techniques by incorporating multiscale and multichannel processing. Traditional segmentation typically involves pre-processing, edge detection, morphological processing, and region segmentation to delineate objects within images. By leveraging multiscale analysis, we can capture features at various sizes, improving the detection of both large and small objects. Additionally, utilizing multiple color channels allows for a richer representation of image data, facilitating more accurate segmentation. These improvements aim to create a robust image segmentation algorithm capable of effectively handling complex visual scenes, ultimately benefiting applications in areas like medical imaging, autonomous vehicles, and environmental monitoring.

### Project Goal:

The primary goal of this project is to evaluate the effectiveness of different segmentation approaches on image data. We plan to implement and compare a conventional segmentation algorithm, a multiscale segmentation algorithm, a multichannel segmentation algorithm, and a multiscale multichannel segmentation algorithm. By analyzing the performance of these methods, we aim to demonstrate that incorporating multiscale and multichannel techniques will enhance segmentation accuracy and robustness, particularly in complex visual scenarios.

## Member roles

Zhihua Gong will be responsible for the code and Weijie Liang will fine tune the code with hyperparameters and do experiments.

## **Resources**

### **Dataset:**

Oxford Pets Dataset/ CamVid/VOC (PASCAL Visual Object Classes) /MS COCO (Common Objects in Context)

### **Implementation platform:**

Personal laptop with GPU RTX 3070

### **Reference:**

S. Mukhopadhyay and B. Chanda, "Multiscale morphological segmentation of gray-scale images," in IEEE Transactions on Image Processing, vol. 12, no. 5, pp. 533-549, May 2003, doi: 10.1109/TIP.2003.810757. keywords: {Image segmentation;Gray-scale;Image reconstruction;Merging;Poles and towers;Image edge detection;Surface morphology;Surface reconstruction;Surface topography;Testing}

## **Reservations**

In this project, several challenges may arise during the implementation and testing phases. One significant difficulty will be selecting appropriate hyperparameters for each of the segmentation algorithms, as the performance of these methods can be highly sensitive to their settings. Additionally, designing an effective strategy to integrate the results from different color channels and various scales after edge detection will be crucial for achieving optimal segmentation outcomes. These complexities may pose potential stumbling blocks, but they will not deter us from pursuing a more ambitious project. Our realistic minimum goal will be to successfully implement the conventional segmentation algorithm and establish a baseline performance, ensuring we have a solid foundation before exploring more advanced multiscale and multichannel approaches.

## **Relationship to your background**

This proposed project closely relate to our background and current studies in the computer vision course. We will utilize fundamental algorithms learned in class, such as filtering and edge detection, to implement segmentation tasks. In addition, we will explore ways to improve these algorithms to enhance segmentation performance. This work will deepen our understanding of these vision algorithms while also validating our innovative approaches.

Through this project, we aim to integrate the concepts and techniques covered in our coursework with new ideas, particularly in the areas of multiscale and multichannel processing. This will allow us to experiment with integrating results from different color channels and scales, further enriching our knowledge and skills in image segmentation. Ultimately, we hope this project will contribute to our ongoing research interests and enhance our capabilities in applying advanced segmentation strategies.