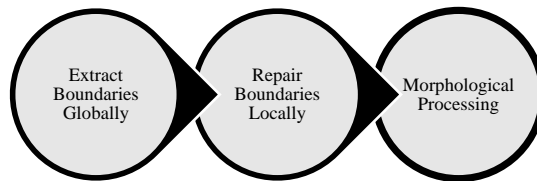


Final Project Proposal

Title	<i>Image Segmentation Based on Global Extraction and Local Repair of Boundaries</i>	
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Problem Statement:

Image segmentation is a process of partitioning a digital image into multiple segments. The goal is to represent the image into features, easier to analyze. There are two main techniques for image segmentation: Region-based techniques and Edge-based techniques. This project specifically discusses the principles of image segmentation based on Edges. Edges are great features to isolate Image subjects with boundaries, however it is difficult to obtain closed boundaries using edges typically. This project addresses the methods to address these incomplete boundaries. The Flow of techniques is described in the chart below.



The Image of interest is converted to grayscale and analyzed for edges, Canny operator is used to extract global boundaries in the image. It is not-uncommon to have edge images with open boundaries, so, in the next stage canny operator is applied to repair boundaries locally. Once the boundaries are repaired and a closed boundary is computed the boundary is used as a mask to isolate segments in the original image.

Approach:

The implementation is staged in 3 phases: **1.** *Extracting Global boundaries by computing edges with canny operator.* **2.** *Repairing local Boundaries to close the segment boundaries using canny operator with variable thresholds.* **3.** *Morphological processing to obtain a mask.*

Creating a Canny Operator:

Edge detection is used for gradient detection; however, they are sensitive to noise. To avoid the effects of noise a low-pass filter is used to attenuate the high frequency components in the image signal, in this instance Gaussian low-pass filter can be used as it has excellent performance in practice. So, the image signal is convolved with Gaussian low-pass filter, and a first order derivative to find image derivative. Which will compute edges.

Extracting Global Boundaries by computing edges with Canny Operator:

The goal in this phase is to obtain most of the main boundaries. This phase is implemented by using a custom Canny Operator as described above and detect edges and removing irrelevant edges. In a traditional canny operator same variance are used in first order derivative gaussian function for horizontal and vertical edges, so the processed images will be same in both directions. To obtain better features different variances are used to across horizontal and vertical derivatives. This phase will extract the global features and gets rid of small boundaries.

Repairing local Boundaries to complete the open boundaries:

The goal in this phase is to complete the open boundaries based on the edge map obtained from previous step. Repair operation is composed of two steps, detect discontinuous regions of the edge map row by row. Whenever a region needs restoration following repair steps are performed. Traverse through all the edge points that needs restoration and as a region of opened boundary is found the region is marked on the original image as a repair region. Apply canny operator to the region to extract edges with a larger variance value and remapped to the edge map after processing it across the entire image local boundaries are restored mostly and edges that couldn't be restored can be restored in morphological processing.

Morphological Processing to create a Mask (Image Segmentation):

The obtained image from previous step, the gaps after repairing local edges can be covered by morphological processing. By bridging the gaps, and filling holes in the edge mask. Which gives a binary mask. Subtract the mask from the original image. This gives the final segmentation. Adjusting the threshold and variance in the images can help isolating other segments in the image.

Data:

Static images with complex pixel data will be used, and appropriate threshold and variance values will be used in computing edges and repairs. This method can be applied to live feed as well.

References:

- [1]. <http://ieeexplore.ieee.org/document/5522821/>
- [2]. https://en.wikipedia.org/wiki/Image_segmentation