Image Segmentation Based on Global Extraction and Local Repair of Boundaries

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Image Segmentation

- Process of partitioning a digital image into multiple segments
- Two main techniques for Image Segmentation:

1) Region based
2) **Edge based -** we focus on this in our project

- Edges computed based on intensity gradients in the image

Problem:

Difficulty to use the edge map and Poor Segmentation results because :

- Edge lines are not closed when obtained from Canny's edge detection operator
- Edge lines contains few edge lines having nothing to do with the target partition.

Solution:

- Combining global edge extraction with local edge repair in conjunction with the morphological processing
- We obtain closed edge lines and remove irrelevant edges.
- Finally compute a mask to isolate the most significant edges in the image

Implementation

- Extracting Global boundaries by computing edges with canny operator.
- Repairing Local boundaries to close the boundaries as much as possible.
- Morphological processing to obtain a mask to isolate the most significant boundaries based on the computed boundaries from above.

Methodology:

- Image converted into Grayscale to perform faster
- Image derivatives are sensitive to noise
- Hence smoothing is done before derivatives are computed
- We employ Gaussian Smoothing here

Original Image

Graysclale Image

Gaussian Smoothed Image

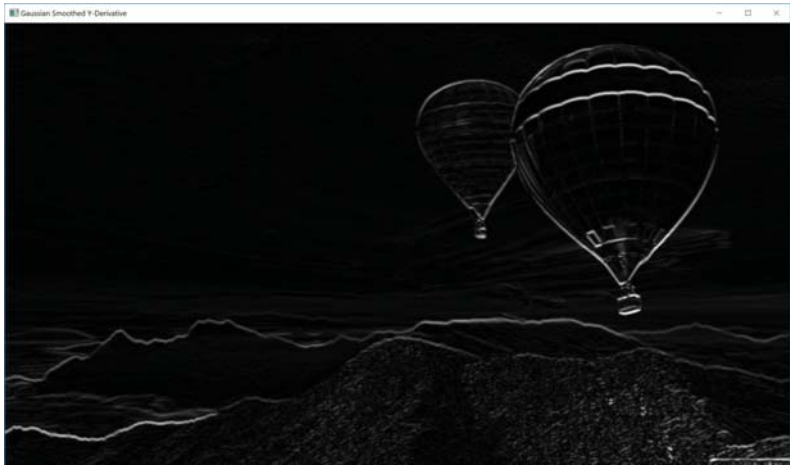
Computing Image Derivatives

- Image derivatives along both X and Y Axis are computed using the Sobel operator.
- image derivatives are re-smoothed with a Gaussian low pass filter with similar Kernel size 5, but with a variance of (1.5, 1.5) along x and y axis

X-Derivative (Sobel Operator)

Y-Derivative (Sobel Operator)

Gaussian Smoothed X-Derivative



Gaussian Smoothed Y-Derivative

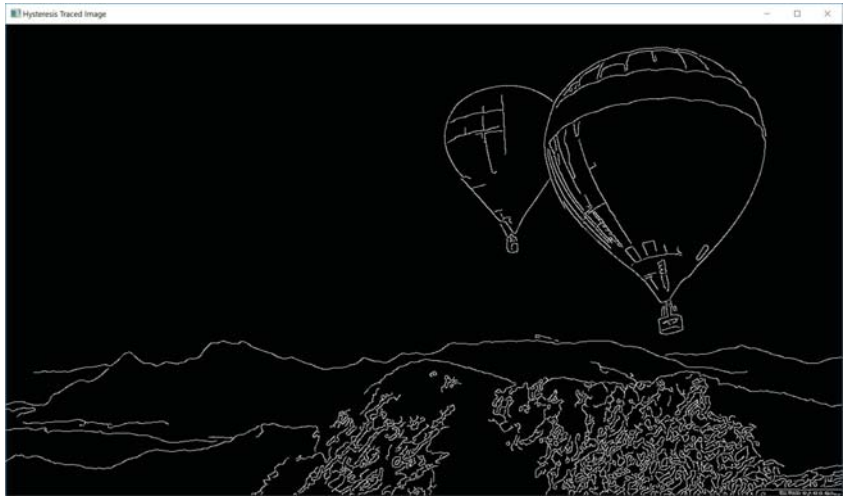
Computing Gradient Magnitude:

Non-maximum suppressed Image

Strong Edges after Thresholding

Weak-edges after Thresholding

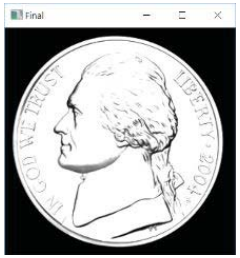
Combined edges after thresholding



Hysteresis Traced Image

Morphological Transformed Mask
Dilate + Bridge + FloodFill + Erode

Original Image with mask extracted from it

Original Image	Mask	Final Extract
		
		



Assumption:

- Derivatives have only intensity gradients
- Images do not have texture based gradients