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DEPARTMENT OF MASTER OF COMPUTER APPLICATIONS

Artificial Intelligence.

20MCA341

Image Segmentation

Assignment report

submitted by

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ABSTRACT

Image Segmentation is the process by which a digital image is partitioned into various subgroups (of pixels) called Image Objects. The goal of segmentation is to simplify and/or change the representation of an image into something that is more meaningful and easier to analyze.Image segmentation is typically used to locate objects and boundaries in images.

Some Applications of Image Segmentation:

- Improved Quality of MRI/Medical images for better detection of diseases and problems
- Segmenting images can help to improve robot vision
- Image segmentation can also be applied to satellite images in order to get better object detection
- Self-driving vehicle autonomous cars must be able to perceive and understand their environment in order to drive safely. Relevant classes of objects include other vehicles, buildings, and pedestrians. Semantic segmentation enables self-driving cars to recognize which areas in an image are safe to drive.
- Iris recognition is a form of biometric identification that recognizes the complex patterns of an iris. It uses automated pattern recognition to analyze video images of a person’s eye.
- Face recognition identifies an individual in a frame from a video source. This technology compares selected facial features from an input image with faces in a database.

As well as many other applications are also possible to be implemented with the help of image segmentation.Our group will try to implement some of these applications of image segmentation.

1.Introduction

In digital image processing and computer vision, image segmentation is the process of partitioning a digital image into multiple segments

(sets of pixels, also known as image objects). The goal of segmentation is to simplify and/or change the representation of an image into something that is more meaningful and easier to analyze. Image segmentation is typically used to locate objects and boundaries (lines, curves, etc.) in images. More precisely, image segmentation is the process of assigning a label to every pixel in an image such that pixels with the same label share certain characteristics.

The result of image segmentation is a set of segments that collectively cover the entire image, or a set of contours extracted from the image (see edge detection). Each of the pixels in a region are similar with respect to some characteristic or computed property, such

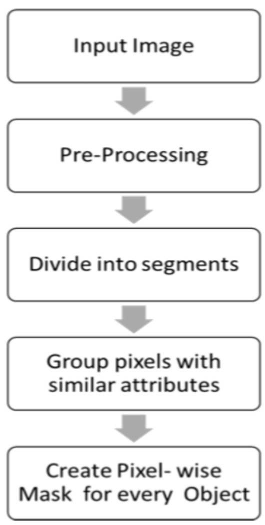
as color, intensity, or texture. Adjacent regions are significantly different with respect to the same characteristic(s).When applied to a stack of images, typical in medical imaging, the resulting contours after image segmentation can be used to create 3D reconstructions with the help of interpolation algorithms like marching cubes.

Basically segmentation is not just a simple procedure, it includes and executes multiple chores. The images that are laid open to the process of segmentation are segregated into manifold divisions, and the valuable insights would be obtained as a result either as texture, intensity or color. In addition from this the segmentation takes an important part in recognizing the images.

Several techniques are available and more new techniques are devised to perform the procedures of segmentation. But the available and the devised methodologies prove to be less efficient as they are practically incompatible over all sorts of images. So there arises a necessity to identify an effective segmentation procedure, to enhance the performance of the image processing.

The segmentation procedure scopes in simplifying the examination process into eloquent and easily analyzable form. It is vital and the initial procedure in analyzing an image. The main purpose of the segmentation process is to segregate the images to have the similar

attributes. It is an essential first step in many of the application like object detection and recognition, retrieval of image based on the content, video surveillance, medical imaging etc. Apart from this the segmentation is the first and the foremost step in developing a multi label classifier construction to classify more than one object found in the image. For this it works by segregating the image into multiple sections and groups the same attributes pixels and creates a pixel-wise mask for all the objects in the image. The figure below shows the stages in the **segmentation process**.



Basically the segmentation process could be classified into two fundamental kinds as local and global segmentation and further based on the image properties as discontinuity detection strategy and similarity detection strategy.The former types of segmentations mentioned are concerned about the particular section or the area of an image and whole image that is encompassed with the huge set of pixels. The later segmentation types based on the image properties segment the images into regions based on the discontinuity and similarity respectively. The several segmentation methods of the image are listed below in figure.2

There are more than a few prevailing practices that are utilized for segmenting images. These methods have their own significance. These modus operandi could come within reach of dualistic elementary methods of segmentation i.e. region based or the edge based, every single procedure can be applied on dissimilar images to accomplish the necessary segmentation. All these techniques could be classified based on three categories. As (i) structural: works on the structure of the region, (ii) Stochastic: works on the discrete pixel values and (iii) hybrid: Combines both the structural and the stochastic.

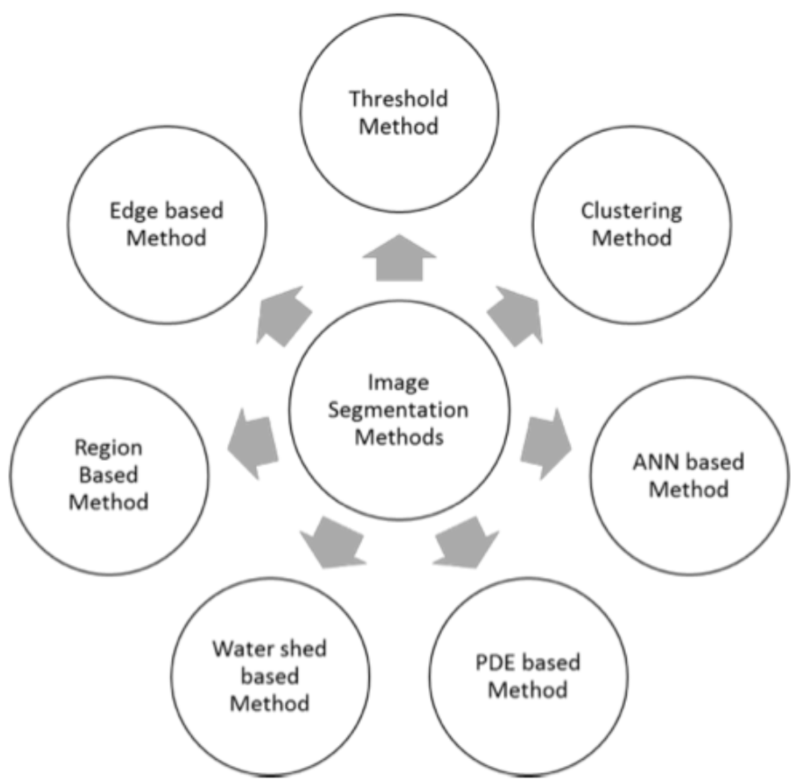


Figure. Image Segmentation Methods

As the digital images acquired are projected to multitudes of distortions that deteriorates the quality of the image, an effective segmentation process becomes a necessary requisite for retaining the valuable data of the images especially in medical imaging.

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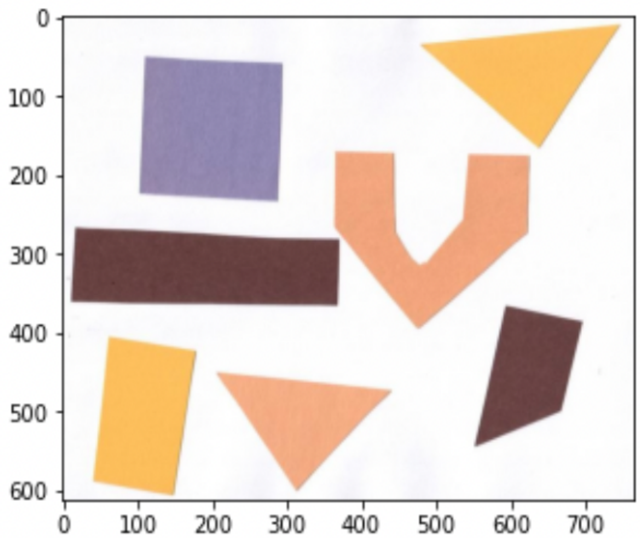
Here we have implemented

- Threshold method of Segmentation.
- Edge detection method of Segmentation.

Threshold Method:

In [1]:

```
image=skimage.io.imread("sample1.png")

plt.imshow(image) plt.show()
```



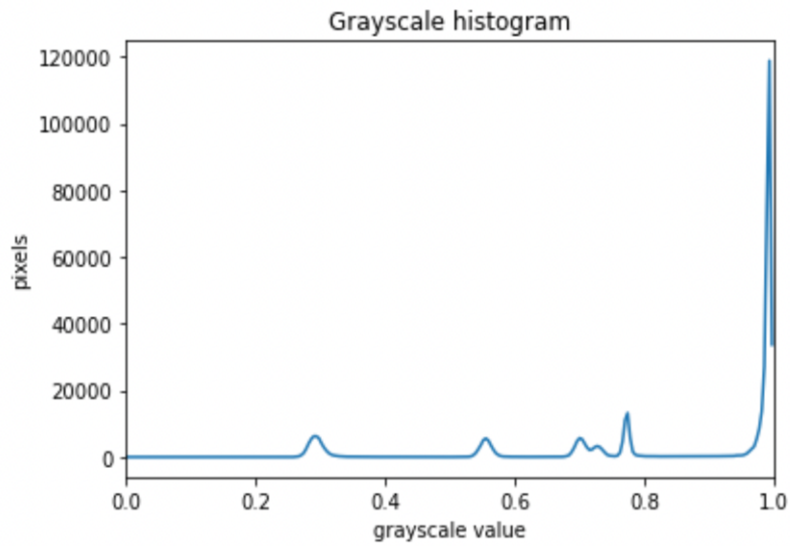
In [4]:

In [11]:

```
histogram,bin_edges=np.histogram(blurred_image,bins=256,range=(0.0,1.
0))

plt.plot(bin_edges[0:-1],histogram)

plt.title("Grayscale histogram")

 plt.xlabel("grayscale value")
```

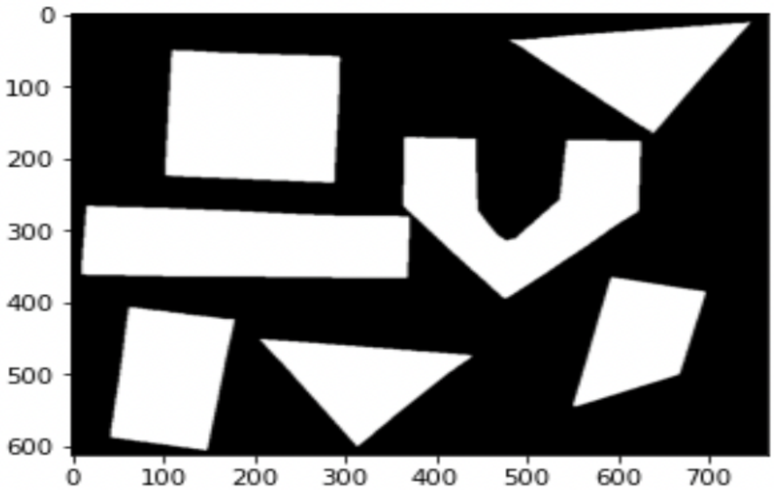
```
plt.ylabel("pixels") plt.xlim(0,1,0)

plt.show()
```

In [12]:



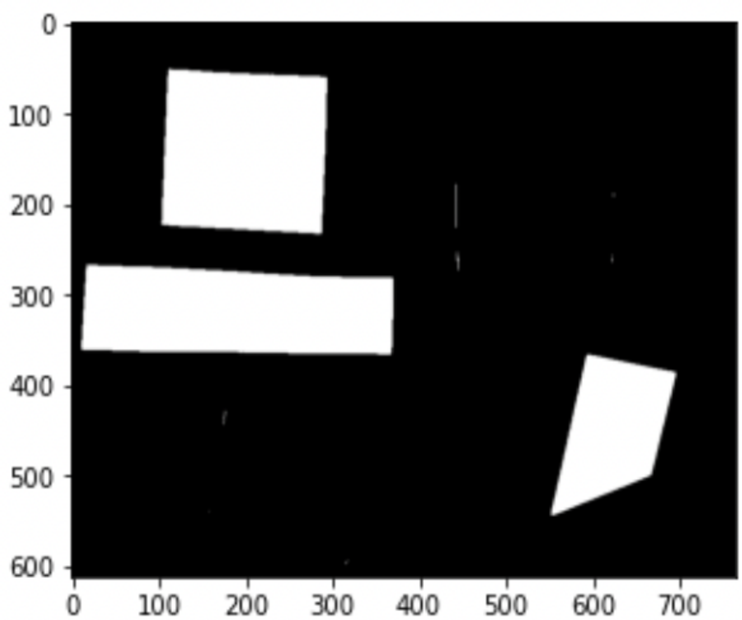

```
t=0.8

binary_mask=blurred_image < t #white-1 and black -0
plt.imshow(binary_mask,cmap="gray")

plt.show()
```

In [24]:




```
t=skimage.filters.threshold_otsu(blurred_image)
binary_mask1=blurred_image<t

plt.imshow(binary_mask1,cmap="gray")

plt.show()
```

In [22]:



Edge based Method:

```
import numpy as np

import matplotlib.pyplot as plt

from scipy import ndimage as ndi

from skimage import feature
```

In [21]:

```
im = np.zeros((128, 128)) im[32:-32, 32:-32] = 1

im_noisy = ndi.rotate(im, 15, mode='constant')

im_noisy = ndi.gaussian_filter(im_noisy, 4)

im_noisy += 0.2 * np.random.random(im_noisy.shape)
```

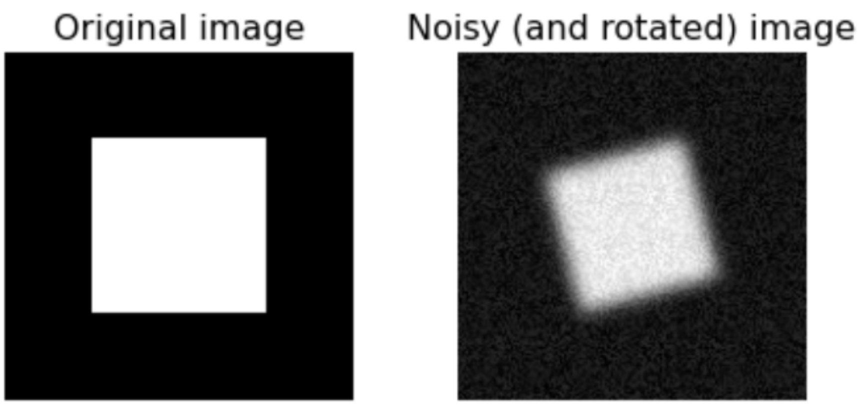
In [22]:

In [27]:

```
fig, (ax1, ax2) = plt.subplots(nrows=1, ncols=2, figsize=(7, 3))

ax1.imshow(im, cmap=plt.cm.gray) ax1.axis('off')

ax1.set_title('Original image', fontsize=16)

ax2.imshow(im_noisy, cmap=plt.cm.gray)

ax2.axis('off')

ax2.set_title('Noisy (and rotated) image', fontsize=16)
```

```
plt.show()
```

In [24]:



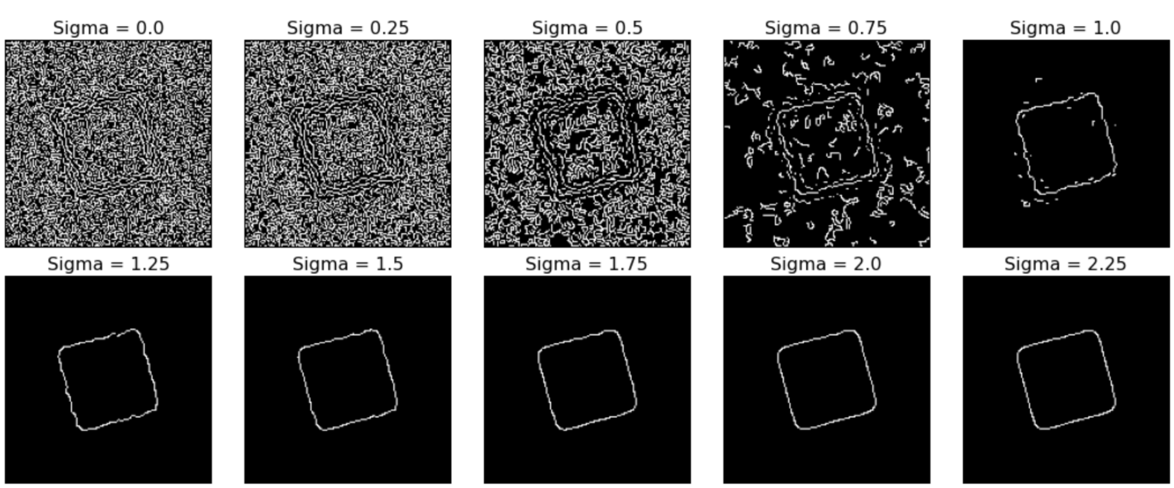
In [25]:

```
edges1 = feature.canny(im_noisy, sigma=1)

edges2 = feature.canny(im_noisy, sigma=3)
```

```
fig, (ax1, ax2, ax3) = plt.subplots(nrows=1, ncols=3, figsize=(8, 3),
sharex=True, sharey=True)

ax1.imshow(im_noisy, cmap=plt.cm.gray) ax1.axis('off')

ax1.set_title('Noisy image', fontsize=16)

ax2.imshow(edges1, cmap=plt.cm.gray)

ax2.axis('off')

ax2.set_title('Canny filter, $\sigma=1$', fontsize=16)

ax3.imshow(edges2, cmap=plt.cm.gray)

ax3.axis('off')
```

```
ax3.set_title('Canny filter, $\sigma=3$', fontsize=16)

fig.tight_layout() plt.show()

edges =[]

for i in [0.25*i for i in range(1,11)]:

        edges.append(feature.canny(im_noisy, sigma=i))

fig, axes = plt.subplots(figsize=(15,6),nrows=2, ncols=5, sharex=True,
sharey=True)

for i in range(10):

        axes.flat[i].imshow(edges[i],cmap=plt.cm.gray)

        axes.flat[i].set_axis_off()

        axes.flat[i].set_title("Sigma = {}".format(0.25*i),fontsize=16)

        fig.tight_layout()

        plt.show()
```

In [26]:



References:

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https://datacarpentry.org/image-processing/edge-detection/index.html

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https://www.cs.toronto.edu/~vmnih/docs/Mnih_Volodymyr_PhD_T hesis.pdf

https://arxiv.org/pdf/1505.04597.pdf