EE604A: Image Processing

Assignment 3 Q4-swq4q

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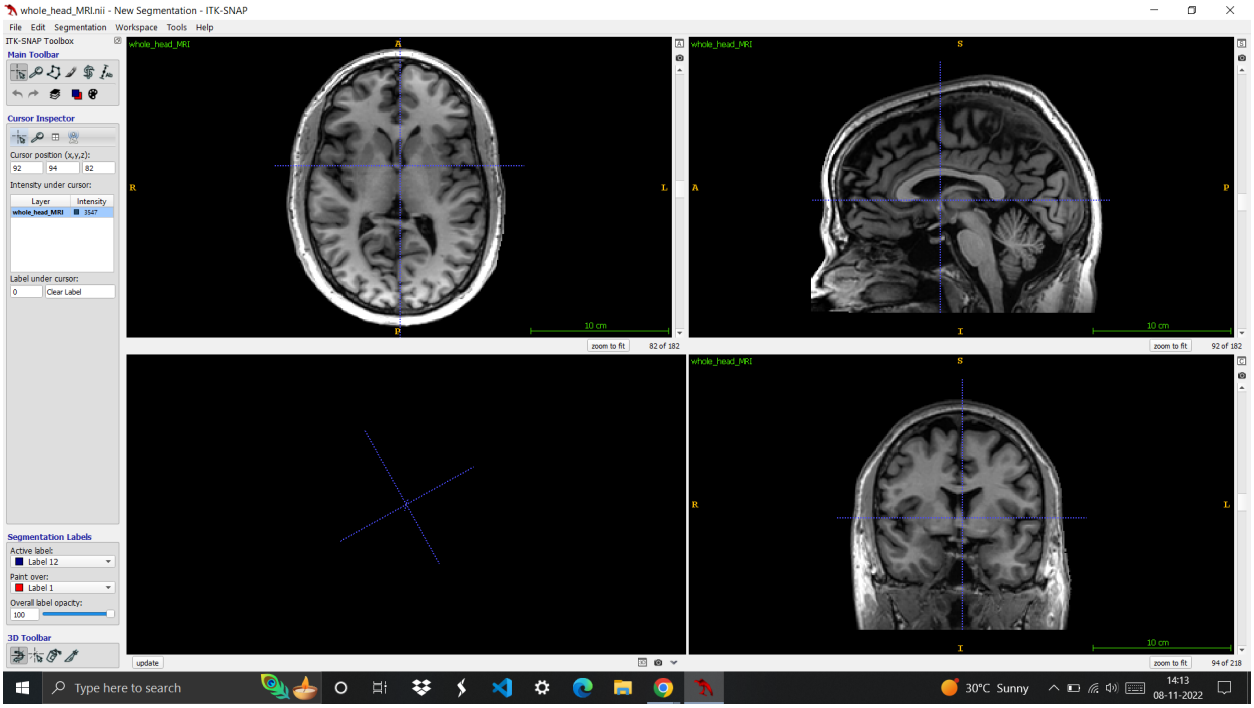
- **SW**

  Software : ITK SNAP

  URL : http://www.itksnap.org/pmwiki/pmwiki.php

  ITK Snap is a software application predominantly intended for the medical and biological field. One of the most important and useful features of ITK Snap is Image Segmentation. It is an interactive software that allows us to navigate three-dimensional medical images and perform both manual and automatic image segmentation. It is extensively used with MRI and CT scan datasets.

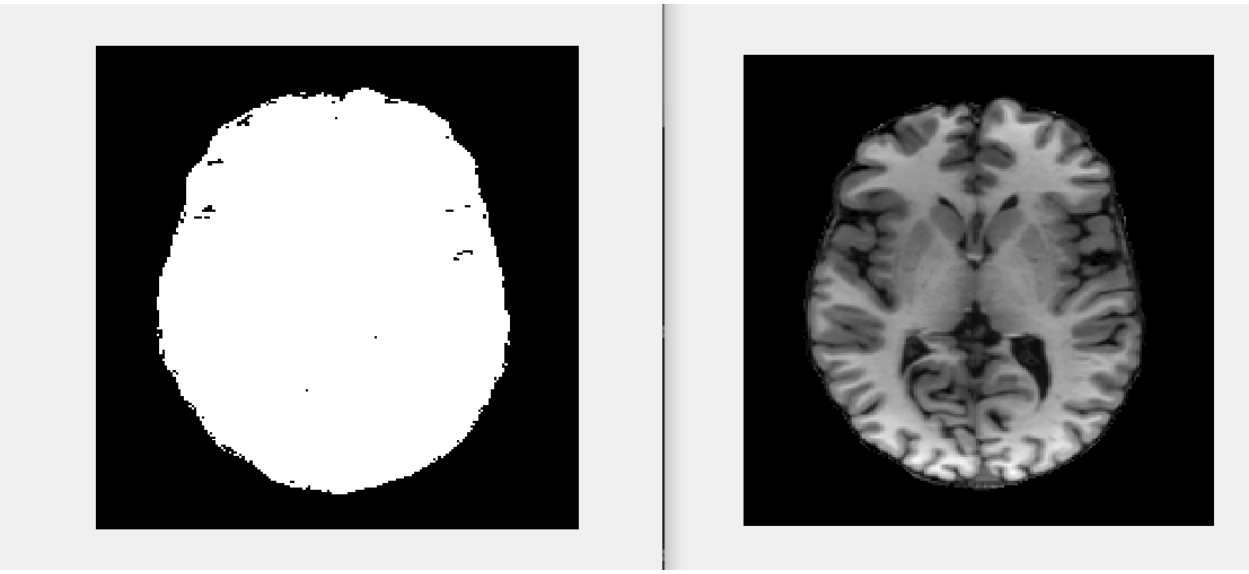


Running ITK Snap Software

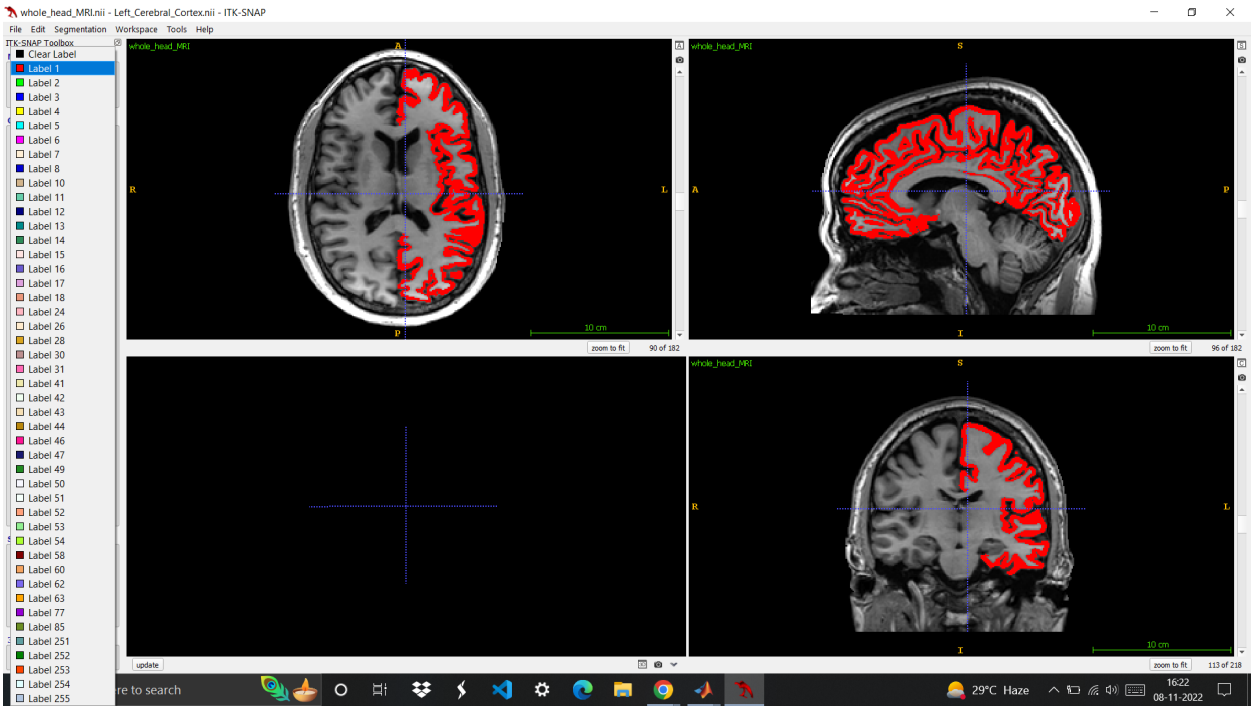
IP Concept - Image Segmentation and Masking

Image Segmentation is the process of dividing an image into various segments or regions based on some similar characteristic in order to make it easier to analyze. Masking is using a spatial filter over the image.

ITK Snap allows us to create *multiple labels* and group pixels according to these labels. This allows users to label different regions of the 3D image for better and a more in depth analysis. It also allows us to *create masks* and observe and analyze certain segments of the image better. We can also *analyze certain slices* of the 3D images using masking feature



Left: 2D Image Mask - Right: Masked Image



Segmenting and Observing the Left Cerebral Cortex using labels

- **q4q- mcq1**

In order to travel interspaces, connect the codes in vault A to their matching codes in vault B. The vault A contains RGB values, while the vault B contains their interspaces counterparts. Wire up the connections properly in order to get this spaceship going. Note: Nodes can be connected to more than one nodes as well

Vault A	**Vault B**
a) [R,G,B]=[1,10,100]	A) [0.99,0.9,0.0,0.61]
b) [R,G,B]=[200,128,63]	B) [0.5,0.0,0.5,0.81]
c) [R,G,B]=[24,48,24]	C) [0.0,0.36,0.69,0.22]
	D) [235˚,0.99,0.39]
	E) [120˚,0.5,0.18]
	F) [28˚,0.68,0.78]

i) a-A,B b-C,D c-E,F
ii) a-A,D b-C,F c-B,E
iii) a-B,E b- D,A c-C,F
iv) a-C,D b-B,E a-A,F
v) a-B,D b-A,E c-C,F

Solution: ii) a-A,D b-C,F c-B,E

Explanation:

$$R' = R/255$$

$$G' = G/255$$

$$B' = B/255$$

$$Cmax = \max(R', G', B')$$

$$Cmin = \min(R', G', B')$$

$$\Delta = Cmax - Cmin$$

The black key (K) color is calculated from the red (R'), green (G') and blue (B') colors:

$$K = 1\text{-}\max(R', G', B')$$

The cyan color (C) is calculated from the red (R') and black (K) colors:

$$C = (1\text{-}R'\text{-}K) / (1\text{-}K)$$

The magenta color (M) is calculated from the green (G') and black (K) colors:

$$M = (1\text{-}G'\text{-}K) / (1\text{-}K)$$

The yellow color (Y) is calculated from the blue (B') and black (K) colors:

$$Y = (1\text{-}B'\text{-}K) / (1\text{-}K)$$

Saturation calculation:

$$S = \begin{cases} 0 & , C_{max} = 0 \\ \frac{\Delta}{C_{max}} & , C_{max} \neq 0 \end{cases}$$

Hue calculation:

$$H = \begin{cases} 0^\circ & \Delta = 0 \\ 60^\circ \times \left(\frac{G'-B'}{\Delta} mod 6\right) & , C_{max} = R' \\ 60^\circ \times \left(\frac{B'-R'}{\Delta} + 2\right) & , C_{max} = G' \\ 60^\circ \times \left(\frac{R'-G'}{\Delta} + 4\right) & , C_{max} = B' \end{cases}$$

Value calculation:

$$V = Cmax$$

- **q4q- mcq2**

A young budding photographer living in a busy city wants to try to capture images of the peaceful night sky. Choose the most appropriate options

a) Low aperture
b) High aperture
c) High ISO
d) Medium ISO
e) Longer Shutter Speed
f) Shorter Shutter Speed
g) Device mounted on tripod
h) Device continuously stabilized by hand

Solution: b), c), e), g)

Explanation:
The widest aperture possible is advisable in order to receive more light
For areas with more light pollution, like a city, very high ISOs are not advisable in order to reduce noise in the image.
Longer Shutter speeds help capture even the faintest light from the stars.
As shutter has to stay open for longer time, so the slightest movement will make the result photo blurry .Hence, a sturdy tripod is advisable.

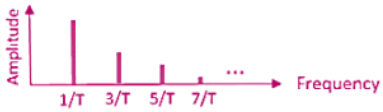
- **q4q-analytical**

For the following signal representations in the Frequency domain, try sketching their possible Time domain counterparts.

a)

b)

c)



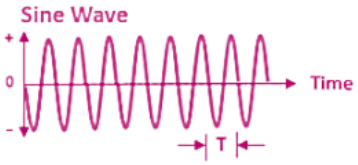
d)

e)

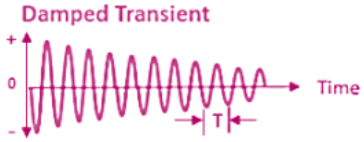
f)

Solution

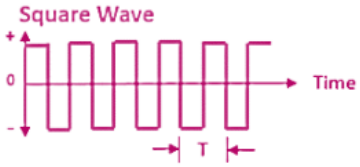
a)



b)



c)



d)

e)

f)

Explanation

a) The figure shows a single frequency with fixed amplitude in the Frequency domain. The corresponding time domain function can be represented by a sine wave of the given amplitude and frequency
b) In the Frequency domain, with increasing frequency, amplitude decreases, thus giving rise to a damped wave in the Time domain

c) Square waves are equivalent to a sine wave at the same fundamental frequency added to an infinite series of odd-multiple sine wave harmonics at decreasing amplitudes. Given figure shows infinite odd-multiple harmonics 1/T,3/T,5/T.. with decreasing amplitude, hence a square wave is the best Time domain approximations.

d) A horizontal line in the fourier domain can be represented by equal amounts and amplitudes of sinusoids of all frequencies. Hence a delta function makes up the signal in the time domain.

e) As the signal in the Frequency domain showcases a delta function at frequency of xero, therefore in the Time domain there will be a constant frequency of zero signifies by horizontal line

f) As the frequency distribution is varying and uneven amplitude with change in frequency, the Time domain signal can be represented by a noisy random signal