

BLG 453E Homework - 4

Harris Corner Detection and Segmentation of Tumor Region From A Magnetic Resonance (mr) Image

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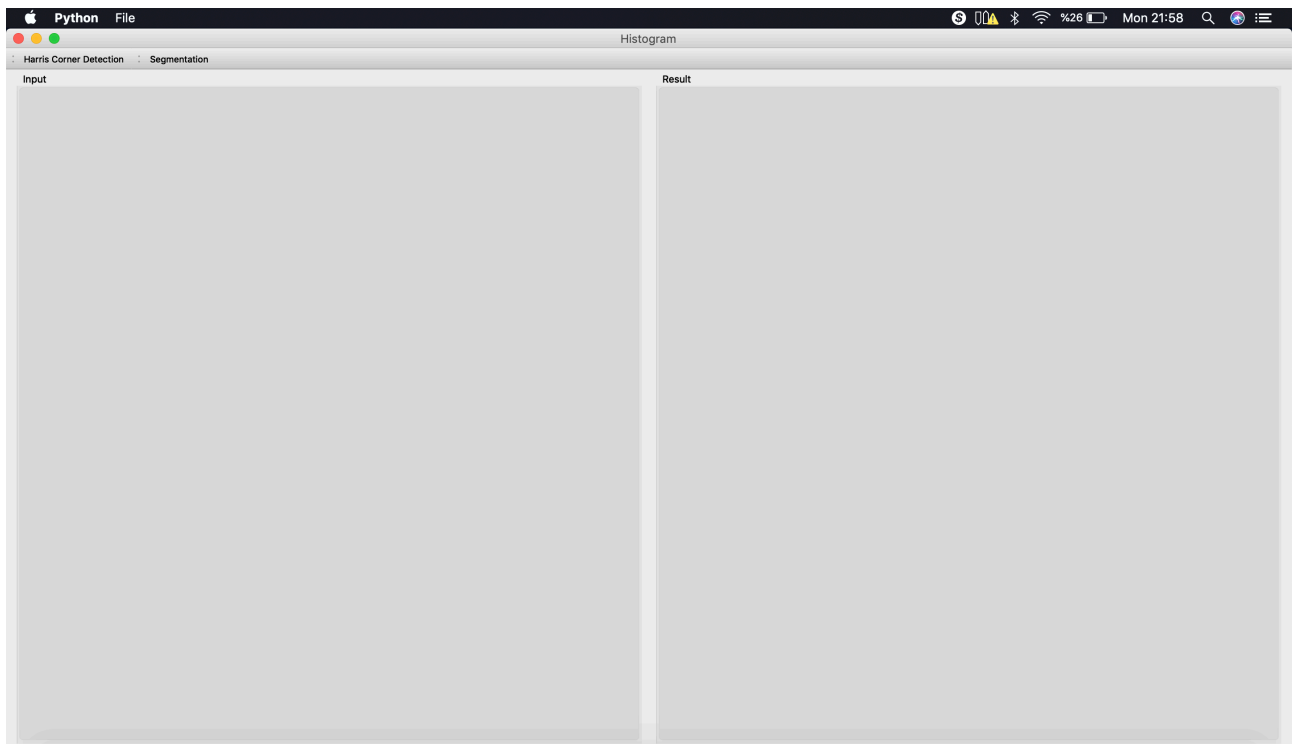
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Introduction

First of all, in this project, should understand how to find do Harris Corner Detection with using Harris equation and also do segmentation for find tumor on brain

Interface



Project's interface is like that;

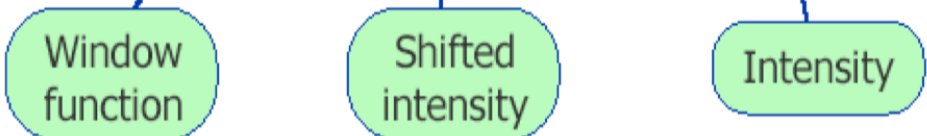
1. Making an interface for showing Input and Result images
Using Widget function to create widget then create QGroupBox widget to create 1 box for interface(Input). In the GroupBox, layout should be set because layout is needed that for upload image and plots to the interface.Finally, set these widget to the main widget

2. Creating menu bar

Using `menuBar()` function to create file bar and then create also toolbar. Toolbar has 2 actions; one of them is Harris Corner Detection, one of them is for Segmentation. If we press Harris Corner Detection. It provides us to do Harris Corner Detection on input image and show on result image box. If we press Segmentation, it provides us to do segment the boundaries of tumor region in an image by using k-means algorithm and some morphological operators.

3. Harris Corner Detection

First of all, need to choose size of window and then find derivative of Image for x and y. Then, use Harris equation for convolution window and derivative of image. As shown below;

$$E(u,v) = \sum_{x,y} w(x,y) [I(x+u,y+v) - I(x,y)]^2$$


The diagram illustrates the components of the Harris equation. A green rectangular box contains the equation $E(u,v) = \sum_{x,y} w(x,y) [I(x+u,y+v) - I(x,y)]^2$. Below the box, three light green rounded rectangles are arranged horizontally. The first is labeled 'Window function', the second 'Shifted intensity', and the third 'Intensity'. Blue arrows point from each label to its corresponding term in the equation: from 'Window function' to $w(x,y)$, from 'Shifted intensity' to $I(x+u,y+v)$, and from 'Intensity' to $I(x,y)$.

This equation help us to find R(corner response). Equation for R is $R = \det M - k(\text{Trace} M)^2$. Finally, find threshold for Input Image and then paint corners by checking threshold and corner response. Result is shown in Figure 1

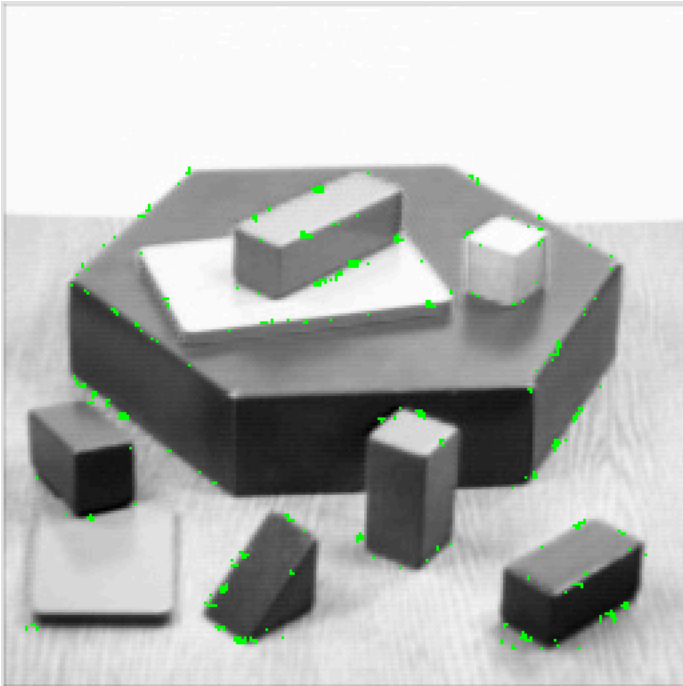


Figure 1 - Result of Harris Corner Detection

4. Segmentation of Tumor Region From A Magnetic Resonance (mr) Image

First we need to find load “mr.jpg” image by using mired function. And convert image to gray by using `Image = cv2.cvtColor(Image, cv2.COLOR_BGR2GRAY)`. Secondly, threshold the image using `threshold=120` to obtain a mask. As shown in Figure 2.

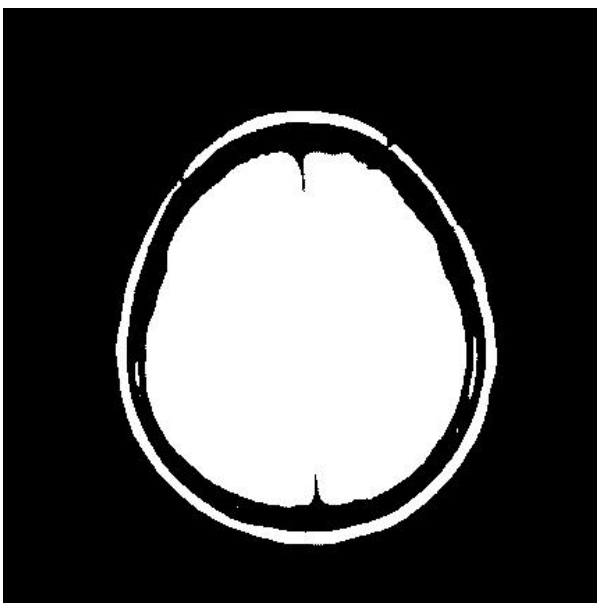


Figure 2 - Thresholded Image

Thirdly, implement erosion on thresholded Image for get rid of unnecessary boundary. My kernel size is 12*12 for erosion. As shown in Figure 3.

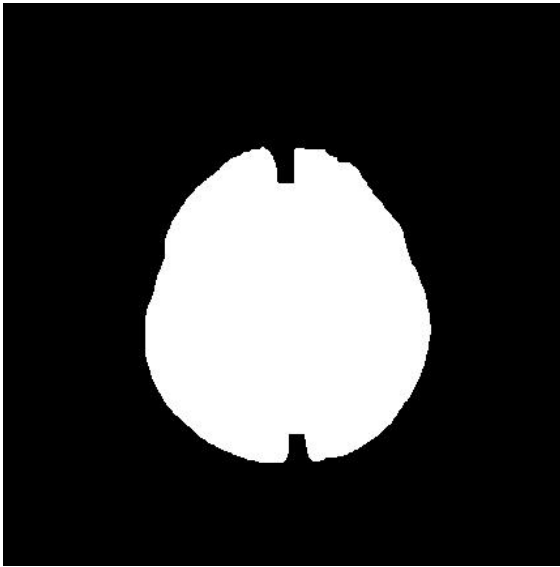


Figure 3 - After erosion

Finally, implement means and apply it only to the masked region by 2 clusters to segment the brain in the image. Result is shown in Figure 4.

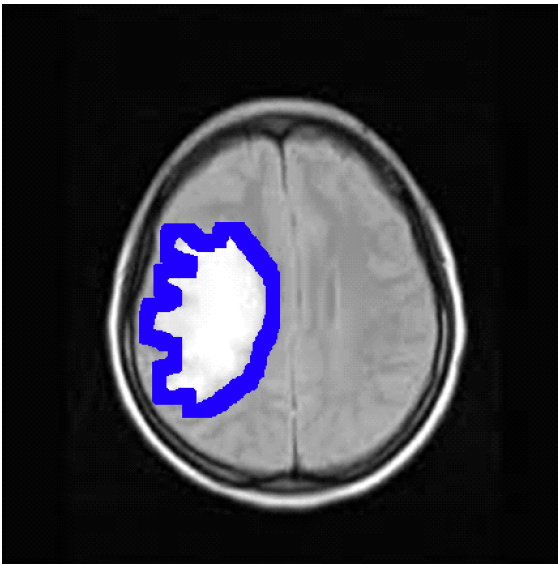


Figure 4 - Result of segmentation

Conclusion

The development of my skills such as "python", "opencv", "image processing" and "PYQT5" was very nice for me. At the same time, this project is really useful for understanding Harris Corner Detection and segmentation.