Biomedical Image Investigation: Fall 2024

Homework 3

Due: **10/07 PM 2:10**

1. Please use image gradients to locate edges. Take a photo of a white piece of paper on a dark background using your phone. Read this photo by MATLAB and then apply any two of the edge detectors provided below to your own photo/image. Make sure the image is a grayscale image before any further processing. Document your results using the following steps.
   (a) Obtain x-gradient and y-gradient of the image.
   (b) Calculate gradient magnitude.
   (c) Apply thresholding to gradient magnitude to obtain edges.
   (d) State the differences of response between the applied detectors, mathematically and practically. Any idea about the advantages of the Frei-Chen edge detector?
   (e) BONUS: for those who implement any image enhancement method prior to edge detection which aids in better edge indication.

Prewitt

1	0	-1
1	0	-1
1	0	-1

-1	-1	-1
0	0	0
1	1	1

Sobel

1	0	-1
2	0	-2
1	0	-1

-1	-2	-1
0	0	0
1	2	1

Frei-Chen

1	0	-1
$\sqrt{2}$	0	$-\sqrt{2}$
1	0	-1

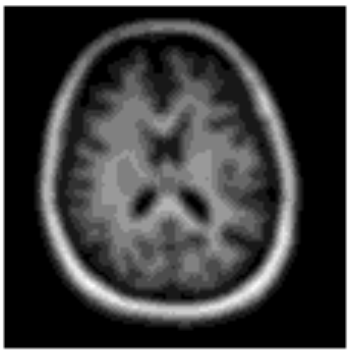
-1	$-\sqrt{2}$	-1
0	0	0
1	$\sqrt{2}$	1

Roberts

1	0
0	-1

0	1
-1	0

2. Please answer the following questions with the MR image provided in HW2.
   (a) Find the contour of the brain tissue by using Sobel operators or Laplacian filters mentioned in class. State the differences, if any, when histogram equalization is applied prior to filtering.
   (b) The figure below was obtained using several spatial imaging filters. Can you tell what they are? Try to repeat the style.



(Hint: To open the photo in MATLAB: img = imread('yourPhoto.jpg');)
(Hint2: The MATLAB codes you might use include: *hist*, *histeq*, *conv2*, *filter2*, *imfilter*, *fspecial* …)