EE409 DIGITAL IMAGE PROCESSING

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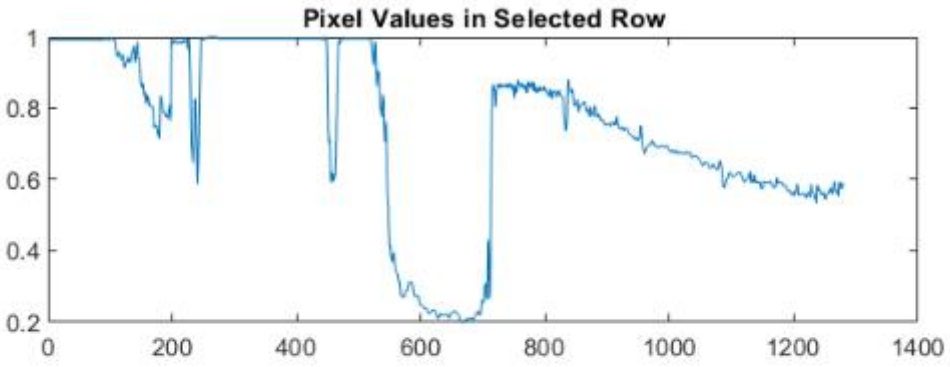
MINI PROJECT 3

1)

Q-1

```
% Read the double grayscale image
ahmet = imread('ahmet.jpg');
ahmet_gray = rgb2gray(ahmet);
ahmet_double = im2double(ahmet_gray);

% Choose a row to plot
selected_row = 150; % You can change this value to the desired row

% Plot the values of the pixels in the selected row
subplot(2, 1, 1);
plot(ahmet_double(selected_row, :));
title('Pixel Values in Selected Row');

% Find the pixel with the highest brightness
[max_brightness, max_index] = max(ahmet_double(selected_row, :));

% Highlight the row with the highest brightness
highlighted_ahmet = ahmet_double;
highlighted_ahmet(selected_row, :) = 1.0; % Set the entire row to white

% Display the highlighted image
subplot(2, 1, 2);
imshow(highlighted_ahmet);
title('Highlighted Row');
```



```
% Display the pixel with the highest brightness
fprintf('The pixel with the highest brightness in row %d is at index %d.\n', selected_row, max_index);
```

```
The pixel with the highest brightness in row 150 is at index 247.
```

```
fprintf('The brightness value is: %f.\n', max_brightness);
```

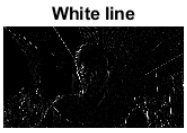
```
The brightness value is: 1.000000.
```

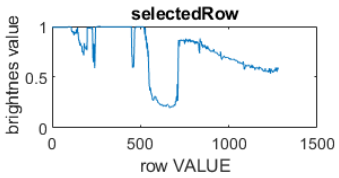
2)

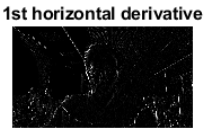
Q-2

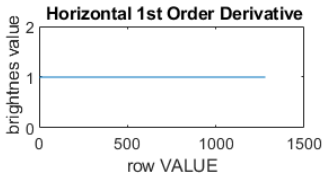
```
ahmet=imread('ahmet.jpg');
ahmet_c = rgb2gray(ahmet);
double_ahmet = im2double(ahmet_c);

[r, c] = size(double_ahmet);
selectedRow=floor(150); %selected row 259

filt=[1 0 -1;2 0 -2;1 0 -1];

ahmet1=zeros(size(double_ahmet));

for ra=2:r-1
    for ca=2:c-1

        ahmet2=double_ahmet(ra-1:ra+1, ca-1:ca+1);
        ahmet1(ra,ca)=sum(ahmet2(:).*filt(:));
    end
end
ahmet3=ahmet1;
ahmet3(selectedRow,:,:)= 1;

subplot(321);
imshow(ahmet3);
title('White line');

subplot(323);
imshow(double_ahmet);
title('original image');
```

```
subplot(324);
plot(double_ahmet(selectedRow,:,:));
title('selectedRow');
ylabel(' brightnes value');
xlabel('row VALUE');

subplot(325);
imshow(ahmet1);
title('1st horizontal derivative');

subplot(326);
plot(ahmet3(selectedRow,:,:));
title(' Horizontal 1st Order Derivative');
ylabel(' brightnes value');
xlabel('row VALUE');
```









What are the meanings of positive and negative derivative values?

The concept of derivatives plays a pivotal role in characterizing the behavior of functions, especially in the context of image processing. When considering the first derivative of a function, which denotes the instantaneous rate of change at a specific point, it becomes a valuable tool in analyzing variations in brightness within an image.

In the case of the derivative applied to a horizontal line in an image, it serves to quantify the alteration in brightness concerning the horizontal (x) direction. A positive value for the derivative signifies an augmentation in brightness from right to left along the line. Conversely, a negative derivative value denotes a brightness increase from left to right.

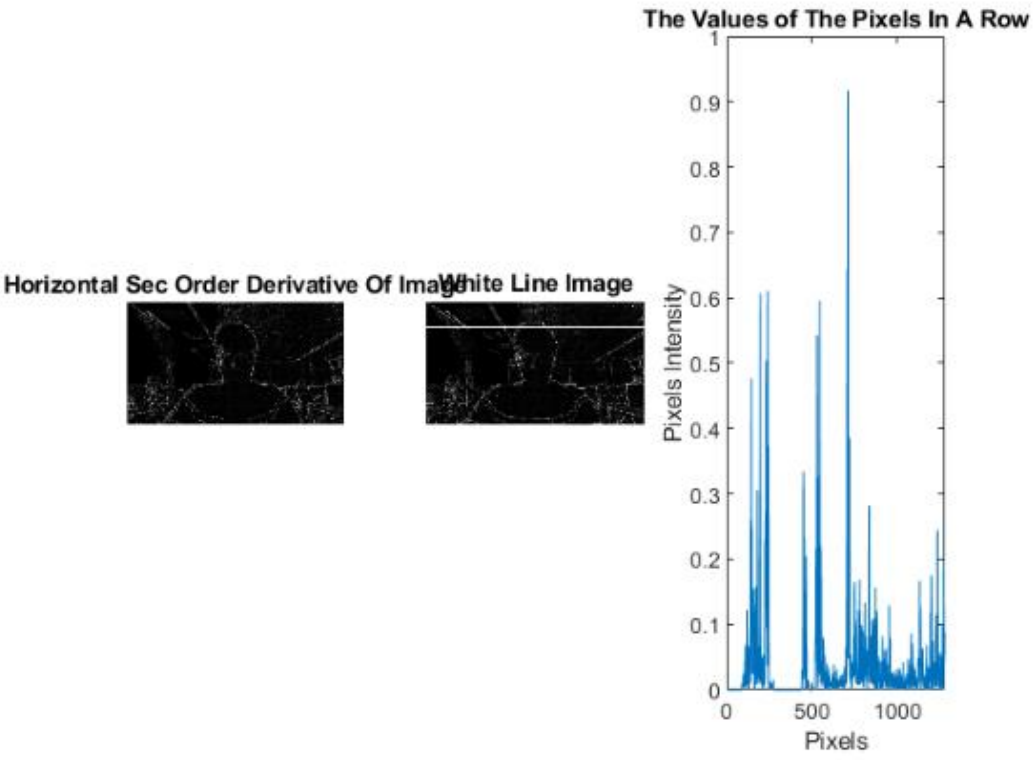
Extending this analysis to the second derivative introduces a nuanced understanding of the image's characteristics. A positive second derivative indicates a rapid ascent in brightness at a particular point, possibly signifying the presence of an edge. Conversely, a negative second derivative suggests a swift decline in brightness, often associated with the delineation of corners within the image.

In essence, interpreting positive and negative derivative values, whether in the first or second derivative, provides crucial insights into the spatial variations and structural elements present in the image, aiding in the identification of edges and corners. This analytical framework is particularly valuable in image processing applications where a detailed understanding of local variations in intensity is essential for meaningful interpretation and feature extraction.

3)

Q-3

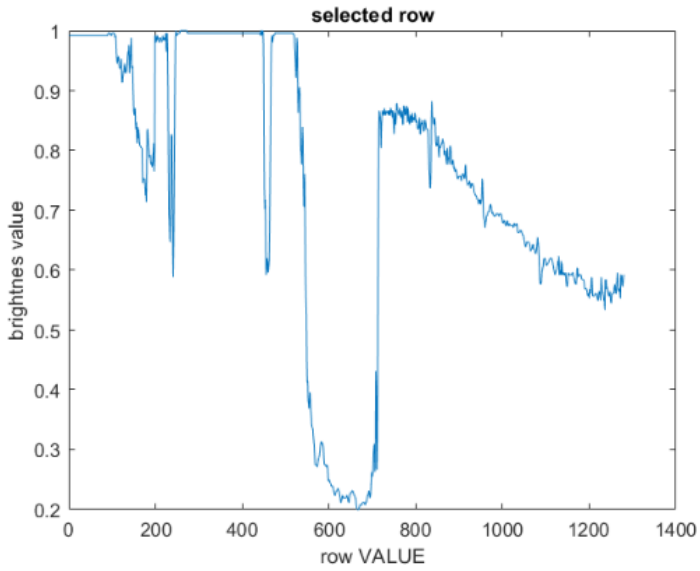
```
ahmet=imread('ahmet.jpg');
ahmet=im2double(ahmet);
ahmet_gray=rgb2gray(ahmet);


filter=[-1 -1 -1;-1 8 -1; -1 -1 -1];
image_second_derivative=imfilter(ahmet_gray,filter);
image_second_derivative=abs(image_second_derivative);
row_derivative=image_second_derivative(150,:);
derivative_whiteline=image_second_derivative;
derivative_whiteline(150,:)=1;
[a,b]=size(row_derivative);
a=1:b;

subplot(1,3,1)
imshow(image_second_derivative)
title('Horizontal Sec Order Derivative Of Image','fontsize', [10])

subplot(1,3,2)
imshow(derivative_whiteline)
title('White Line Image','fontsize', [10])

subplot(1,3,3)
plot(2:a(end)-1,row_derivative(2:b-1))
title('The Values of The Pixels In A Row','fontsize', [10])
xlabel('Pixels')
ylabel('Pixels Intensity')
```



```
[r, c] = size(double_ahmet);
selected_row=150;

filter=[0 -1 0 ; 0 2 0 ; 0 -1 0];

ahmet1=zeros(size(double_ahmet));

for ra=2:r-1
    for ca=2:c-1

        ahmet2=double_ahmet(ra-1:ra+1, ca-1:ca+1);
        ahmet1(ra,ca)=sum(ahmet2(:).*filter(:));
    end
end
ahmet3=ahmet1;
ahmet3(selected_row,:,:)= 1;


imshow(ahmet3);
title('White line');
```


```
imshow(double_ahmet);
title('original image');
```

```
plot(double_ahmet(selected_row,:,:));
title('selected row');
ylabel('brightnes value');
xlabel('row VALUE');

figure;
imshow(ahmet3);
```



4)

Q-4

```
ahmet=imread('ahmet.jpg');
ahmet_g=rgb2gray(im2double(ahmet));
lap_mask=[0 -1 0;-1 5 -1; 0 -1 0];
imlap=imfilter(ahmet_g,lap_mask);

subplot(1,2,1);
imshow(ahmet_g);
title('Original Image');

subplot(1,2,2);
imshow(imlap);
title('High-Boost Image');
```

5)

Q-5

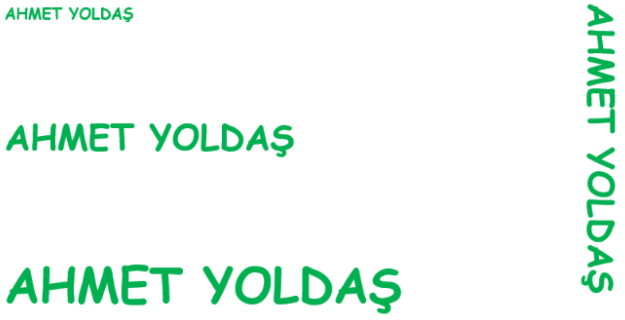
```
ahmet=imread('ahmet.jpg');
ahmet_g=rgb2gray(im2double(ahmet));

mask=ones(3,3);
masknorm=mask/sum(mask(:));

imavg=imfilter(ahmet_g,masknorm);
unsharp_ahmet_g=2*ahmet_g - imavg;

subplot(1,2,1);
imshow(ahmet_g);
title('Original Image');

subplot(1,2,2);
imshow(unsharp_ahmet_g);
title('Unsharp Image');
```

6)

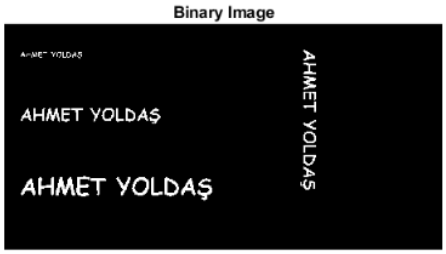
Q-6

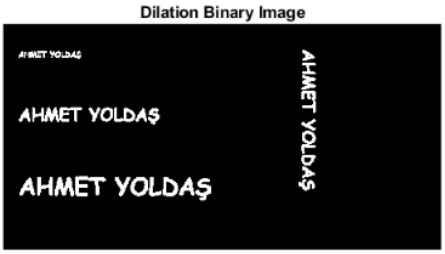
```
ahmet=imread('C:\Users\ahmet\Desktop\ahmet1.png');
figure;
imshow(ahmet);
title('ahmet1.png');
```

ahmet1.png




```
binary=im2bw(ahmet,0.5);
reverse_binary=~binary;
imfilter = binary * 0;
se1=[1 1 1; 1 1 1; 1 1 1];
for r=2:529
    for c=2:846
        patch = reverse_binary(r-1 : r+1, c-1:c+1);
         patchfilt = patch .* se1;
          patchfilt=sum(patchfilt(:));
             if (patchfilt > 0)
              imfilter(r,c) = 1;
             else
              imfilter(r,c) = 0;
        end

    end
end


subplot(1,2,1);
imshow(reverse_binary);
title('Binary Image','fontsize',[10])
subplot(1,2,2);
imshow(imfilter);
title('Dilation Binary Image','fontsize',[10])
```





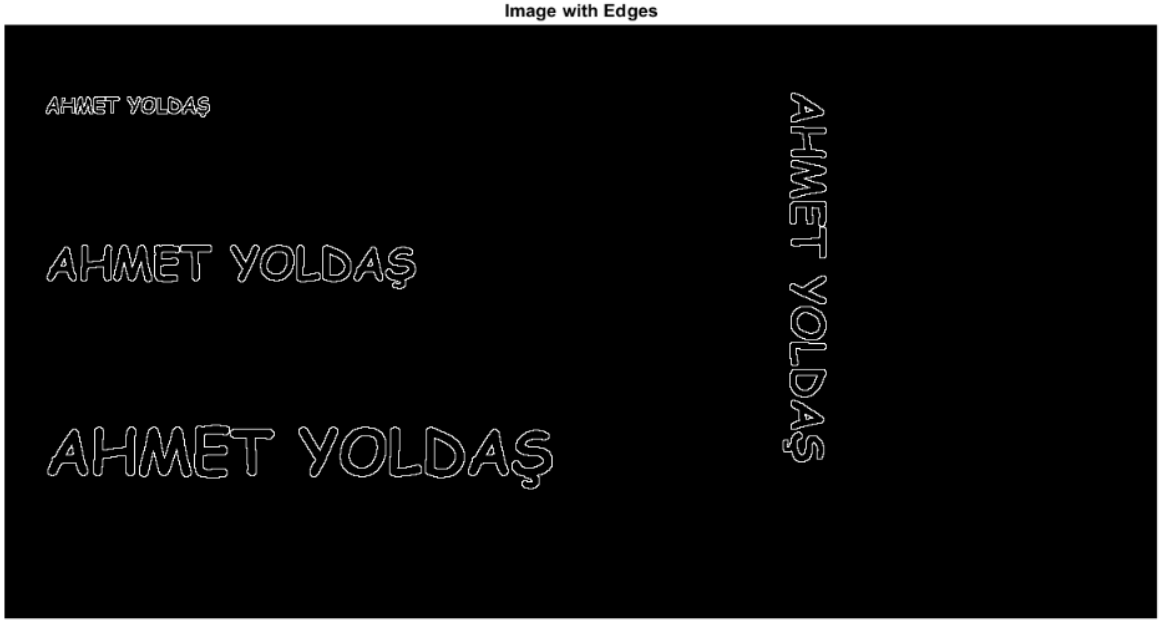
7)

In [7]:

```
ahmet=imread('C:\Users\ahmet\Desktop\ahmet1.png');
figure;
imshow(ahmet);
title('ahmet1.png');
```


```
binary=im2bw(ahmet,0.5);
reverse_binary=~binary;
imfilter = binary * 0;
se1=[1 1 1; 1 1 1; 1 1 1];
for r=2:529
    for c=2:846
        patch = reverse_binary(r-1 : r+1, c-1:c+1);
         patchfilt = patch .* se1;
          patchfilt=sum(patchfilt(:));
             if (patchfilt > 0)
              imfilter(r,c) = 1;
             else
              imfilter(r,c) = 0;
        end

    end
end



edge=imfilter-reverse_binary;
imshow(edge);
title("Image with Edges")
```

Image with Edges



8)

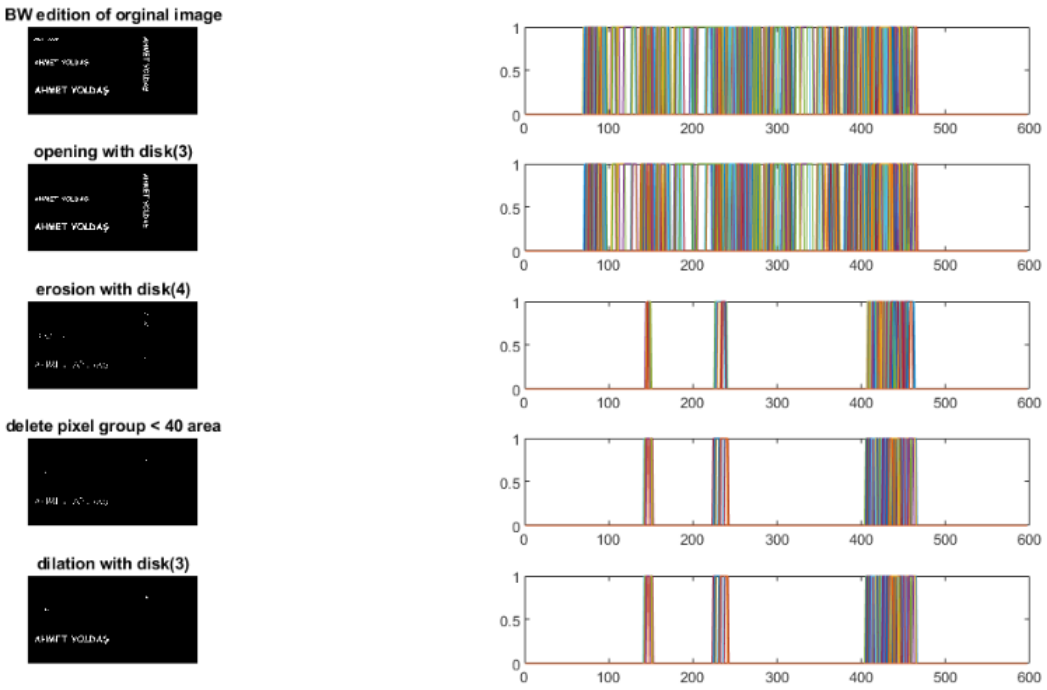
Q-8

```
ahmet=imread('C:\Users\ahmet\Desktop\ahmet1.png');
figure;
imshow(ahmet);
title('ahmet1.png');
```

ahmet1.png

```
b_ahmet=imbinarize(rgb2gray(im2double(ahmet)));
b_ahmet=abs(b_ahmet-1);

subplot(521)
imshow(b_ahmet);
title('BW edition of orginal image');
mask1= strel('disk',3);
small_ahmet=imopen(b_ahmet,mask1);
mask2 = strel('disk',4);

subplot(522)
plot(b_ahmet);
subplot(523)
imshow(small_ahmet);
title('opening with disk(3)');
medium_ahmet=imerode(b_ahmet,mask2);
subplot(524)
plot(small_ahmet);

subplot(525)
imshow(medium_ahmet);
title('erosion with disk(4)');
medium_ahmet=bwareaopen(medium_ahmet,40);

subplot(526)
plot(medium_ahmet);

subplot(527)
imshow(medium_ahmet);
title('delete pixel group < 40 area');
medium_ahmet=imdilate(medium_ahmet,mask1);

subplot(528)
plot(medium_ahmet);

subplot(529)
imshow(medium_ahmet);
title('dilation with disk(3)');
```

```
subplot(5,2,10)
plot(medium_ahmet);
```



9)

Q-9

```
ahmet=imread('C:\Users\ahmet\Desktop\ahmet1.png');
figure;
imshow(ahmet);
title('ahmet1.png');
```

ahmet1.png


```
gray_ahmet=rgb2gray(ahmet);
th_value=128;
ahmet_bin=gray_ahmet>th_value;
% imshow(ahmet_bin);
rahmet_bin=~ahmet_bin
```

```
rahmet_bin = 597×1157 logical array
     0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0
     0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0
     0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0
     0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0
     0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0
     0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0
     0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0
     0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0
     0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0
     0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0
       ⋮
```

```
[rows cols]=size(rahmet_bin)
```

```
rows = 597
cols = 1157
```

```
se3=strel("diamond",2);
 ahmet1=imopen(rahmet_bin,se3);
 se4=strel("rectangle",[10 25]);
 ahmet2=imclose(ahmet1,se4);
 se5=strel("rectangle",[10 150]);
 ahmet3=imopen(ahmet2,se5);
 ahmet4=imreconstruct(ahmet3,rahmet_bin);
 figure;
 imshow(ahmet4)
```

10)

Q-10

```
ahmet=imread('C:\Users\ahmet\Desktop\ahmet1.png');
figure;
imshow(ahmet);
title('ahmet1.png');
```

ahmet1.png

```
ahmet_b=imbinarize(rgb2gray(im2double(ahmet)));
ahmet_b=imcomplement(ahmet_b);

mask1 = strel('disk',4);
mask2 = strel('rectangle', [60 20]);

im1=imopen(ahmet_b,mask1);
im2=imclose(im1, mask2);
im3=imopen(im2, mask2);
im4=imreconstruct(im3,ahmet_b);

subplot(231)
imshow(ahmet_b);
title("Original Image");

subplot(232)
imshow(im1);
title("Opening of Image");

subplot(234)
imshow(im2);
title("Closing of Image");

subplot(235)
imshow(im3);
title("Opening of Image");

subplot(2,3,[3 6])
imshow(im4);
title("Reconstract to Image");
```