CSCI 631 Foundation of Computer Vision
HW 02

First name: Ashwath Sreedhar
Last name: Halemane

1)

```
>> ver
-----------------------------------------------------------------------------------------------------
MATLAB Version: 9.13.0.2126072 (R2022b) Update 3
MATLAB License Number: 364896
Operating System: Microsoft Windows 11 Pro Version 10.0 (Build 22000)
Java Version: Java 1.8.0_202-b08 with Oracle Corporation Java HotSpot(TM) 64-Bit Server VM mixed mode
-----------------------------------------------------------------------------------------------------
MATLAB                                                Version 9.13        (R2022b)
Image Processing Toolbox                              Version 11.6        (R2022b)
>>
```

2) On your monitor, what happens to the details to the details in the image? Look at the jacket. Look at the sky.
What edges and details of the image can you now see better than you could when the image was normal?

Answer: When the image was inverted, the edges reveal more information about the image than when it was in grayscale we can see that there is a trace that appears like a pocket. The sky in specific does not reveal anything more when inverted.

3) Modified code:

```
%
%   ALWAYS USE A FUNCTION, NEVER USE A SCRIPT !!
%
function Gen_Fig_Showing_Image_to_Histogram_FOR_STUDENT_RELEASE()
% Show histogram figure that shows which pixels in the image map to which
bars on a histogram.
%
%  T.Kinsman -- Sept 08, 2022
```

```
%
FS                              = 20;
MIDDLE_GRAY                     = [1 1 1]*0.8;
places_to_split_the_colormap    = [ 64, 128 192, 255 ]; % Hand choosen
places_to_split_the_colormap    = [ 28, 88 192, 255 ]; % Hand choosen
   % Here are some favorite colors to use.
   % Colormaps use double numbers, in the range [0 to 1], inclusively.
   new_color_orders                = [  0,  0,    1 ;        % Blue
                                        1,  0,    0 ;        % Red.
                                        0,  0.8,  0 ;        % Dark Green
-- give better contrast.
                                        1,  1,    0 ];       % What is
this?


   im          = imread('cameraman.tif');
   edges       = 1:256;
   [counts,~]  = histc( im(:), edges );        % Get the bargraph data.

   % Create a big fig:
   figure( 'Position', [10 10 1200 513] );     % Hand choosen


   subplot(1,2,1);
   imagesc( im );
   colormap( gray(256) );
   colorbar;
   axis image;
   % Fill the space more with the axis:
   set(gca,'Position', [0.075 0.075 0.4 0.9]);
   axis_on_left = gca();

   disp('break here');

   % What does this command do?
   subplot(1,2,2);
   bar( edges, counts(:), 'FaceColor', 'k' );
   %
   %  Set the background of this graphics to a middle gray color:
   %
   set(gca,'Color', MIDDLE_GRAY );

   ylabel( 'Frequency of this bin', 'Fontsize', FS );
```

```
   xlabel( 'Pixel Value', 'FontSize', FS );
   set(gca,'Position', [0.575 0.075 0.4 0.9]);

   axis_on_right = gca();
   my_new_colormap_to_show_objects = gray(256);

   axis( axis_on_left );
   colormap( my_new_colormap_to_show_objects );

   disp('break here');

   axis( axis_on_right );
   hold on;                         % What does this do?

   color_counter                    = 1;
   left_hand_side_of_range          = 1;
   for right_hand_side_of_range     = places_to_split_the_colormap
       % Which range of the image values are you changing?
       histogram_range_to_change    = left_hand_side_of_range :
right_hand_side_of_range ;

       % How many levels are there here?
%          n_levels_here               = length( histogram_range_to_change
);
       n_levels_here                = (right_hand_side_of_range+1) -
(left_hand_side_of_range) + 1;
       % Get a temporary copy of the current color.
       selected_color               = new_color_orders( color_counter, : );
%          selected_color              = new_color_orders( color_counter, :
);
       multiple_copies_of_color     = repmat( selected_color,
n_levels_here, 1 );
       colormap_range_to_change     = left_hand_side_of_range :
(right_hand_side_of_range+1) ;
       my_new_colormap_to_show_objects( colormap_range_to_change, : )    =
multiple_copies_of_color;

       % Install the colormap:
       colormap( my_new_colormap_to_show_objects );
       bar( edges(histogram_range_to_change),
counts(histogram_range_to_change), ...
            'FaceColor', selected_color, ...
            'LineStyle', 'none' );
```

```
        % Force the axis to look good for this entire demonstration:
        % Otherwise, it only really looks good at the end.
        axis( [ 0, 256, 0, 1800 ] );
        % %%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
        %
        %  END OF LOOP CLEANUP and PREPARATION FOR NEXT ITERATION;
        %
        left_hand_side_of_range     = right_hand_side_of_range+1;
        color_counter               = color_counter + 1;

        % Force graphics to update:
        drawnow;
        pause(2);
    end

    %
    %  Set the background of this graphics to a middle gray color:
    %
    set(gca,'Color', MIDDLE_GRAY );
    save_curr_fig_to_file("cameraman_with_histogram.png");
end
```

By observing the histogram we can point out that the frequency of certain colors(pixel value) are high while others are low. This also tells us there is a huge room for contrast enhancement to perceive the image in better ways.

CSCI 631 Foundation of Computer Vision
HW 02

4)

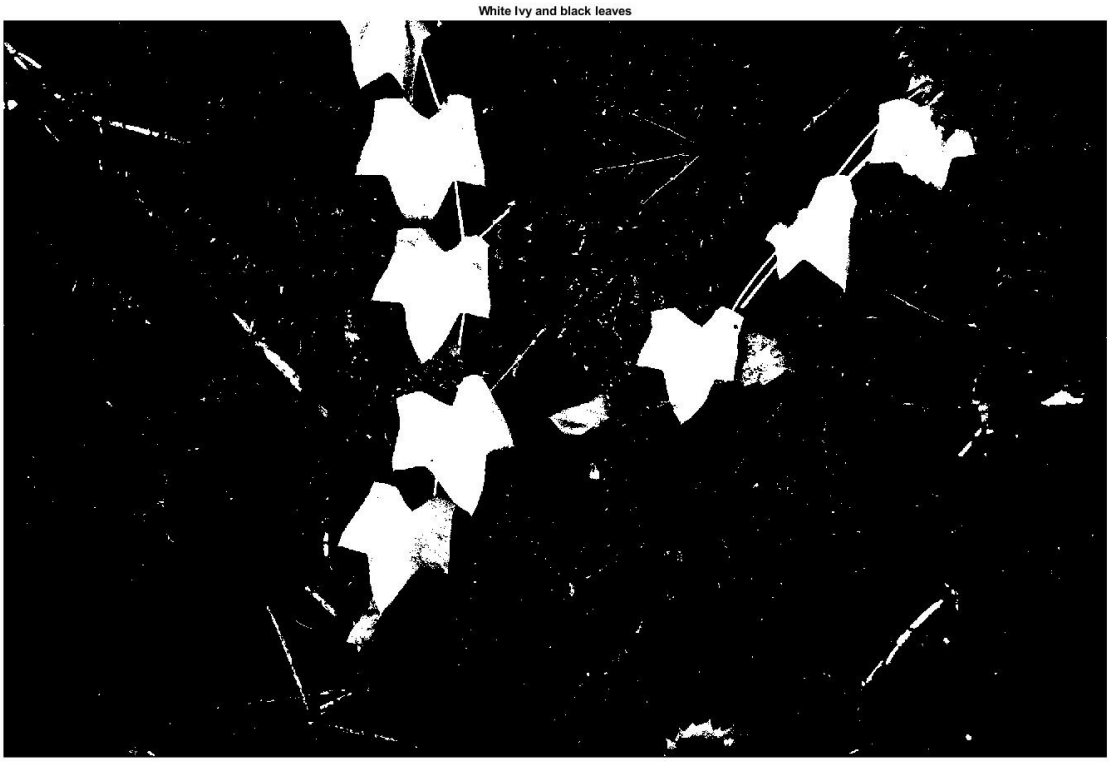
When I used graythresh(), which returned a threshold value for segmentation, the image turned out had non-black background. Hence, I had to tweak the threshold value to get the required output.

CSCI 631 Foundation of Computer Vision
HW 02

5)

I performed histogram equalization(help histeq) on a grayscale image to clearly see both signs.

6)



I went ahead and converted the image to grayscale, later I used imbinarize function passing the grayscale image and a threshold value to get white ivy leaves and black grape leaves.

CSCI 631 Foundation of Computer Vision
HW 02

7)

Since the original image's background is green, to separate deer(brown in color), we can use

```
im_whatever = ( im_db(:,:,1) + im_db(:,:,3) - 2 * im_db(:,:,2 ) )/ 2;
```

In this case, we are reducing green channel contribution and increasing red and blue channel contribution thereby making deer against the background which is primarily green.

8) Conclusion:

In this homework, I have learned how to enhance the image. To begin, I learned about the importance of inspecting images even though the original image doesn't reveal much information as in the case of Cameraman.tif. By changing the nature of the image we can discover some interesting facts about the image.
Later I refactored the code by reducing one redundant for loop and saved the output using another function called save_curr_fig_to_file('my_figure_name'). I also learned to understand images through their histogram. Then I learned image segmentation techniques like histogram equalization, adaptive histogram equalization, and so on.