CMR UNIVERSITY
SCHOOL OF ENGINEERING AND TECHNOLOGY

Department of Electronics and Communication Engineering

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Designation	: Associate Professor and Head
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Image Enhancement:

Enhancing an image provides better contrast and a more detailed image as compare to non-enhanced image. Image enhancement has very applications. It is used to enhance medical images, images captured in remote sensing, images from satellite, etc.

The transformation function has been given below

s = T(r)

where r is the pixels of the input image and s is the pixels of the output image. T is a transformation function that maps each value of r to each value of s. Image enhancement can be done through gray level transformations which are discussed below.

Grey level transformation:

Grey-level transformation functions (also called, intensity functions), are considered the simplest of all image enhancement techniques. The value of pixels, before and after processing, will be denoted by r and s respectively.

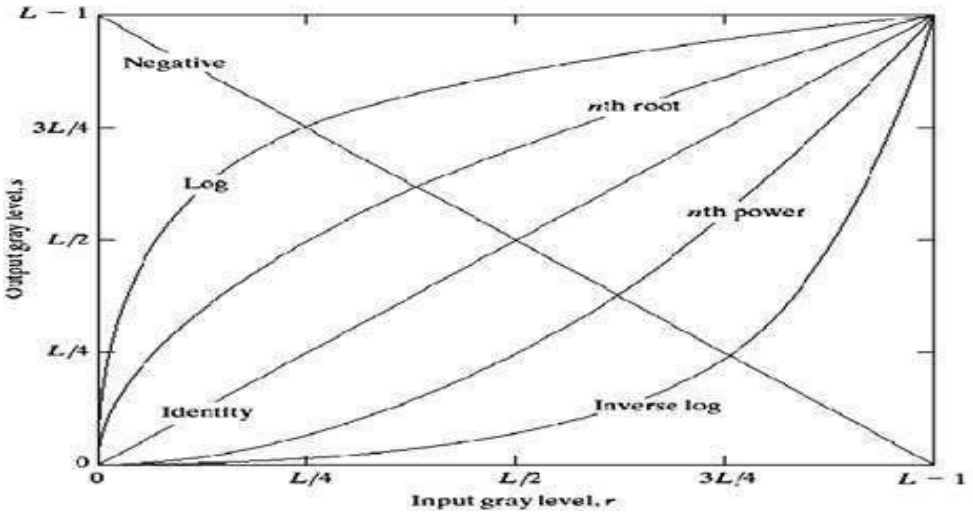
These values are related by the expression of the form:

$$s = T(r)$$

There are three basic gray level transformations.

- Linear
- Logarithmic
- Power – law

The overall graph of these transitions has been shown below.



Linear transformation

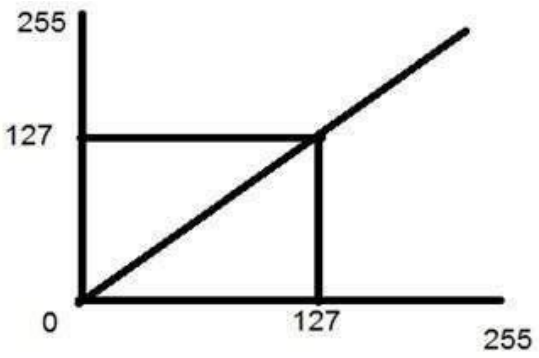
Here, we will look at the linear transformation. Linear transformation includes simple identity and negative transformation. Identity transformation has been discussed in our tutorial of image transformation, but a brief description of this transformation has been given here.

Identity transition is shown by a straight line. In this transition, each value of the input image is directly mapped to each other value of output image.

Expression identity transformation as follows:

$$s = r$$

That results in the same input image and output image. And hence is called identity transformation. It has been shown below:



Negative transformation

The second linear transformation is negative transformation, which is invert of identity transformation. In negative transformation, each value of the input image is subtracted from the L-1 and mapped onto the output image.

The negative of an image with grey level in the range [0, L-1], where L = Largest value in an image, is obtained by using the negative transformation's expression:

$$s = (L - 1) - r$$

Which reverses the intensity levels of an input image, in this manner produces the equivalent of a photographic negative.

The negative transformation is suitable for enhancing white or grey detail embedded in dark regions of an image, especially when the black areas are dominant in size.

MATLAB implementations

Here we have used the logic of negative transformation and implemented the matlab code for that and have been executed in the Octave platform. The comments for each line are been highlighted in the source code below.

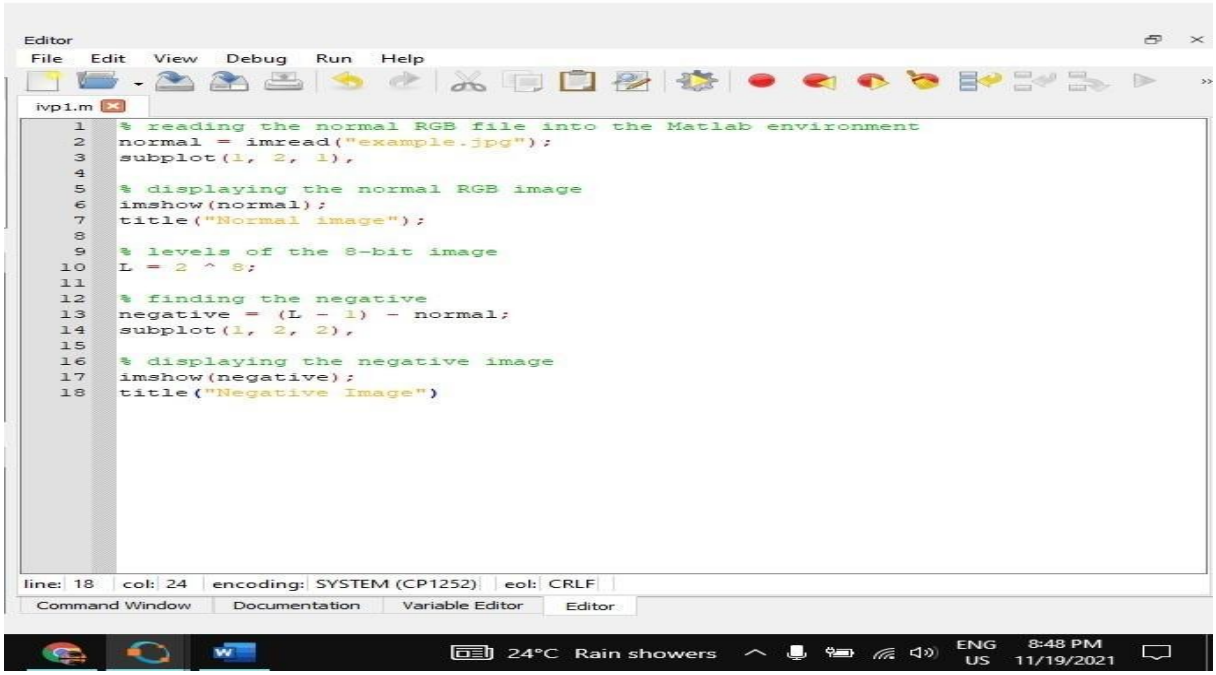
Source Code:

```
% reading the normal RGB file into the Matlab environment
normal = imread("butterfly.jpg");
subplot(1, 2, 1),
% displaying the normal RGB image
imshow(normal);
title("Normal image");
% levels of the 8-bit image
L = 2 ^ 8;
% finding the negative
negative = (L - 1) - normal;
subplot(1, 2, 2),
% displaying the negative image
imshow(neg);
```

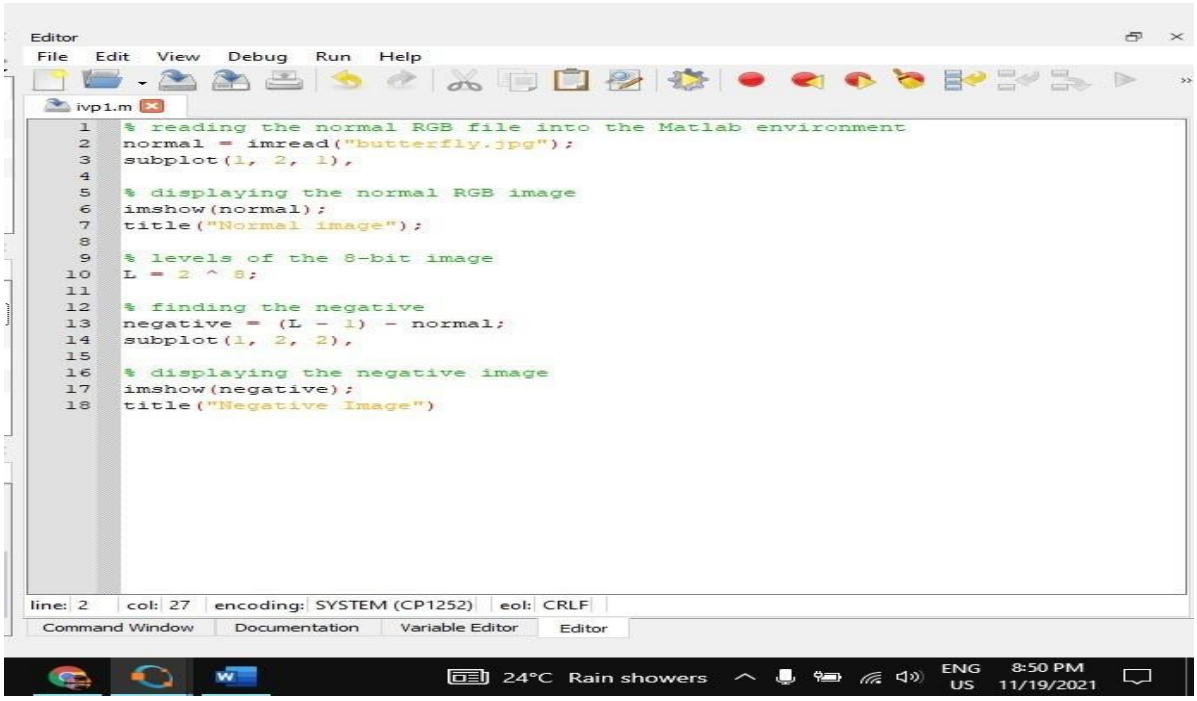
```
title("Negative Image")
```

Octave window:

Window 1:



Window 2:



Output:

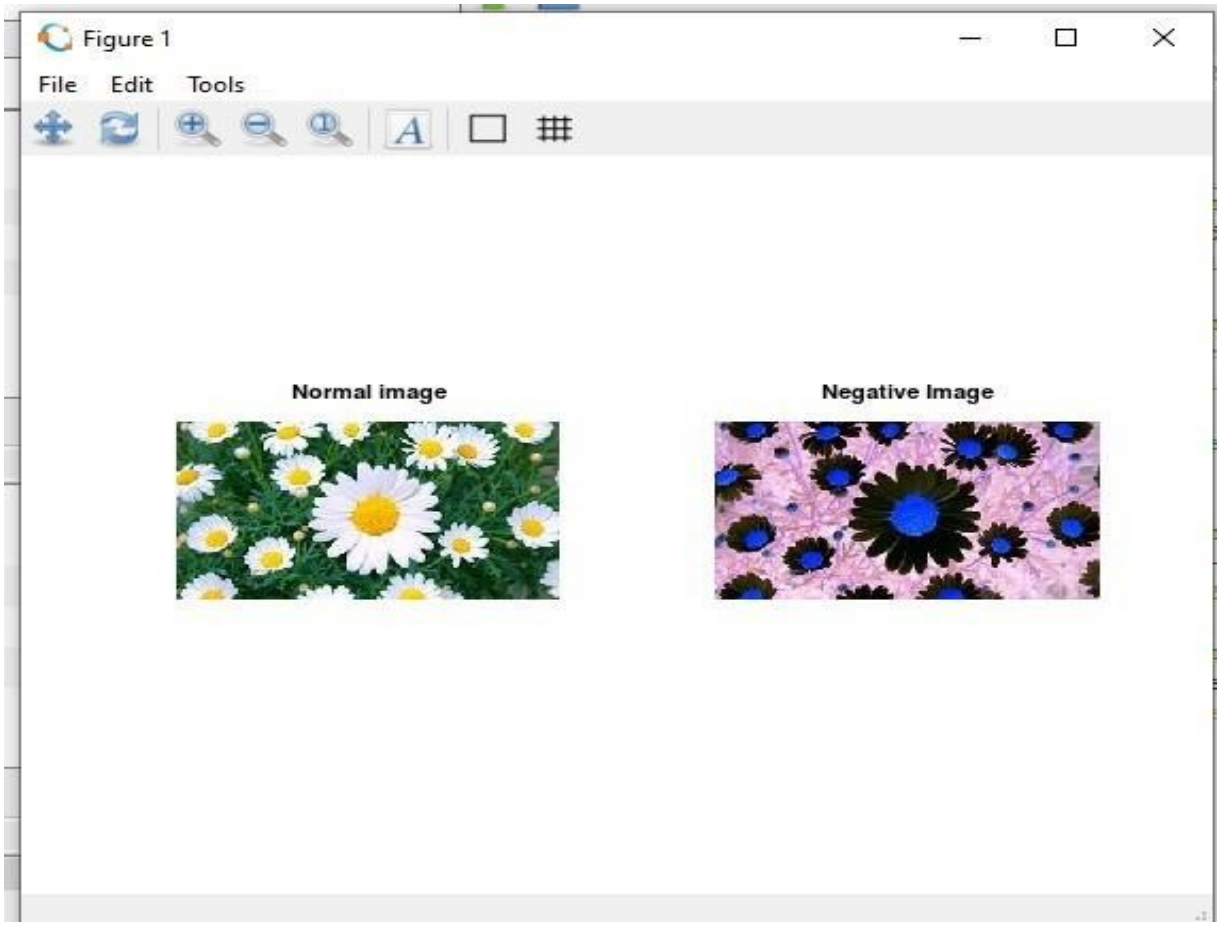


Figure A

Here an image(example.jpg) is having RGB colors. According to the source code in window 1, an image has underwent the negative transformation and the result is been displayed in Figure A.

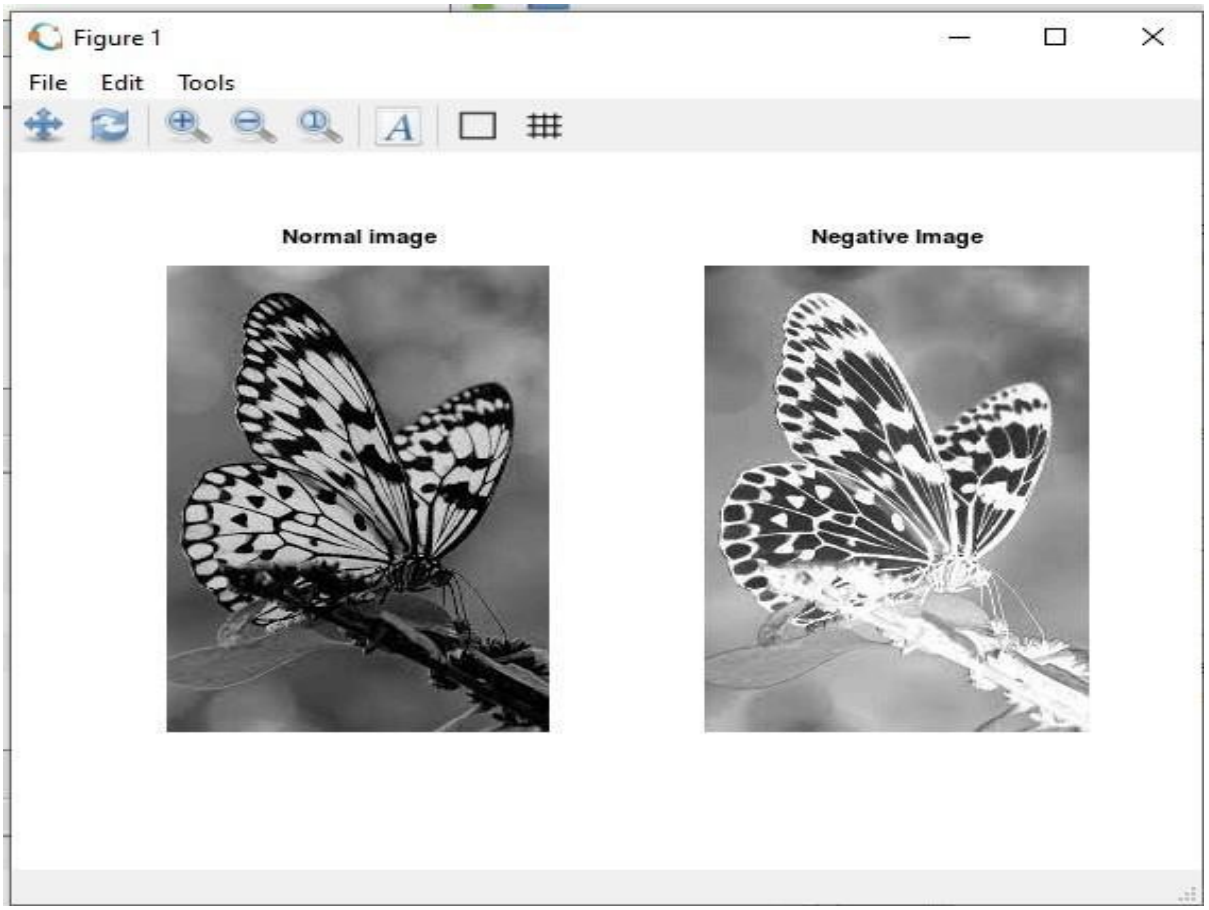


Figure B

Here an image(butterfly.jpg) has only black and white colors. According to the source code in window 2, this image has underwent the negative transformation and results has been displayed in Figure B.

References

1. https://www.tutorialspoint.com/dip/gray_level_transformations.htm
2. https://www.slideshare.net/InbaJustus/image-enhancement-117439830
3. https://www.philadelphia.edu.jo/academics/hhardan/uploads/Image_Processing-ch3_part_2.pdf
4. https://uotechnology.edu.iq/ce/lecture%202013n/4th%20Image%20Processing%20_Lectures/DIP_Lecture4.pdf