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## LAB SESSION 2

### IMAGE ENHANCEMENT

**Instructions:** Please do the following lab works. Provide evidences after you have completed for each task. First, you may copy those codes into MATLAB and then you can take screenshot/image/m-file of your work and embed/insert those under each section.

#### GRAY LEVEL TRANSFORMATIONS OPERATIONS

The simplest image enhancement technique that involves point or pixel-level processing is gray level transformation operations. These operations are applied on each pixel of an image  $f(x,y)$ , using one of the transformation function,  $T$ , producing a transformed pixel of the output image,  $g(x,y)$ . Transformation operation may be represented as,  $G(x,y) = T(f(x,y))$ . Some basic gray level transformations functions discussed in this section are negative, log, gamma correction, thresholding, contrast stretching, gray level slicing and bit-plane slicing.

#### **2.1 Image Negatives**

Negative or complement of an image is obtained by using the transformation function:

$G(x,y) = T(f(x,y))$ , where  $T = L-1 - f(x,y)$ ;  $L = \text{max gray level values}$

#### **LABWORK 2.1**

A grayscale image can be negated using the command `imcomplement()`. The following MATLAB commands will produce the image expected.

```
% Transforms image to its photographic negative.
i = imread('brain.jpg');
j = imcomplement(i);
```

Original



After



Work Proof:

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FILE VARIABLE CODE SIMULINK ENVIRONMENT RESOURCES

Current Folder: MATLAB Drive > DIP

- me.png
- sherlock.jpg
- starry.png

Name	Value	Size	Class
col	584	1x1	double
dim	1	1x1	double
i	485x584 ui...	485x584	uint8
j	369x600x3...	369x600x3	uint8
row	485	1x1	double
c	4	1x1	double

```

>> figure, imshow(undersampled_I)
>> i = imread('starry.png'); j = imcomplement(i);
>> figure, imshow(j);
>>
    
```

## 2.2 Log Transformation

When an image is visually enhanced using log transformation function. The function compresses the range of intensities using equation:

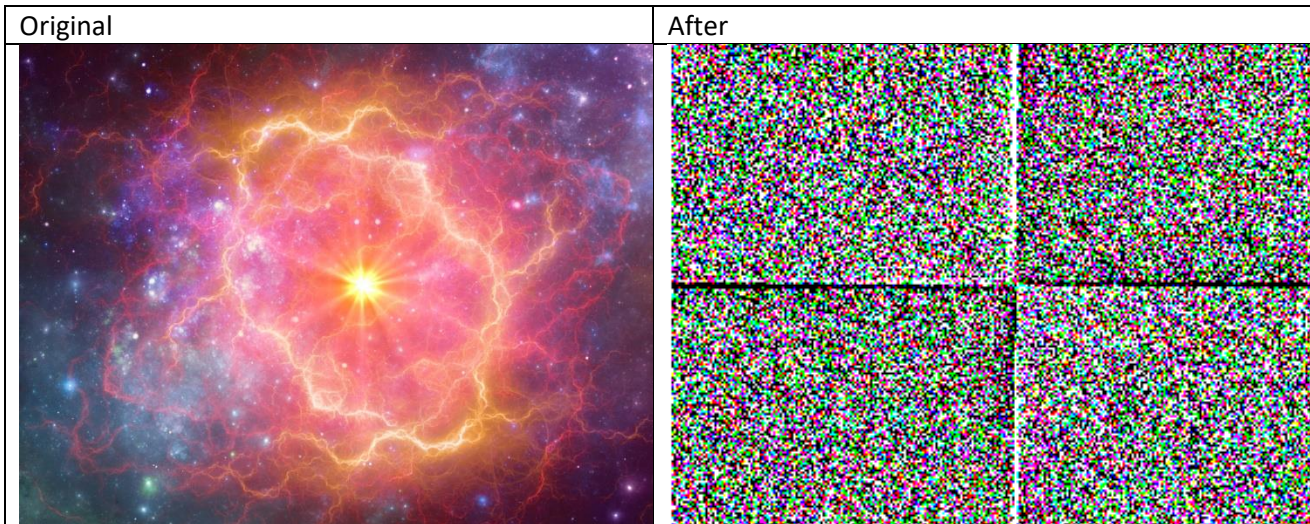
$$G(x,y) = T(f(x,y)), \text{ where } T = c \log(1+f(x,y)); c: \text{ constant}$$

### LABWORK 2.2

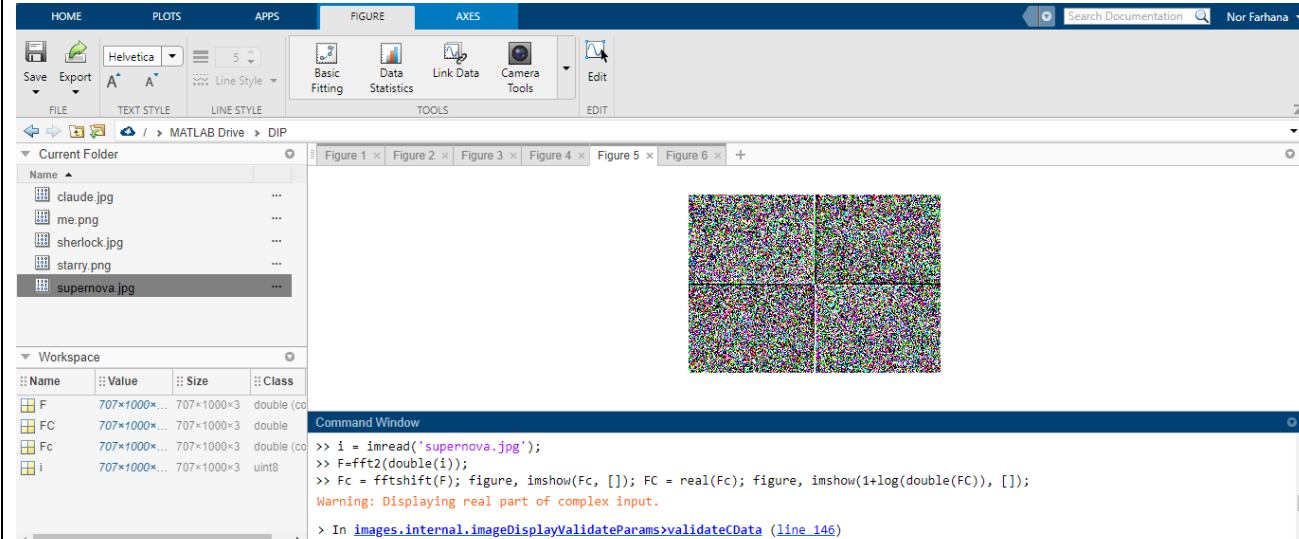
A `log()` function provided in MATLAB performs logarithmic process on the image. Therefore, an image intensities may be compressed by performing the following commands:

```
% Compress an image's intensities
i = imread('cameraman.tif');

% Convert to Fourier transform
F=fft2(double(i));
Fc = fftshift(F);
figure, imshow(Fc, []);
FC = real(Fc);
figure, imshow(1+log(double(FC)), []);
```



Work proof:



The screenshot shows the MATLAB environment. The workspace contains variables: F (707x1000x3 double), FC (707x1000x3 double), Fc (707x1000x3 double), and i (707x1000x3 uint8). The Command Window shows the following code:

```
>> i = imread('supernova.jpg');
>> F=fft2(double(i));
>> Fc = fftshift(F); figure, imshow(Fc, []); FC = real(Fc); figure, imshow(1+log(double(FC)), []);
Warning: Displaying real part of complex input.
> In images.internal.imageDisplayValidateParams>validateCData (line 146)
```

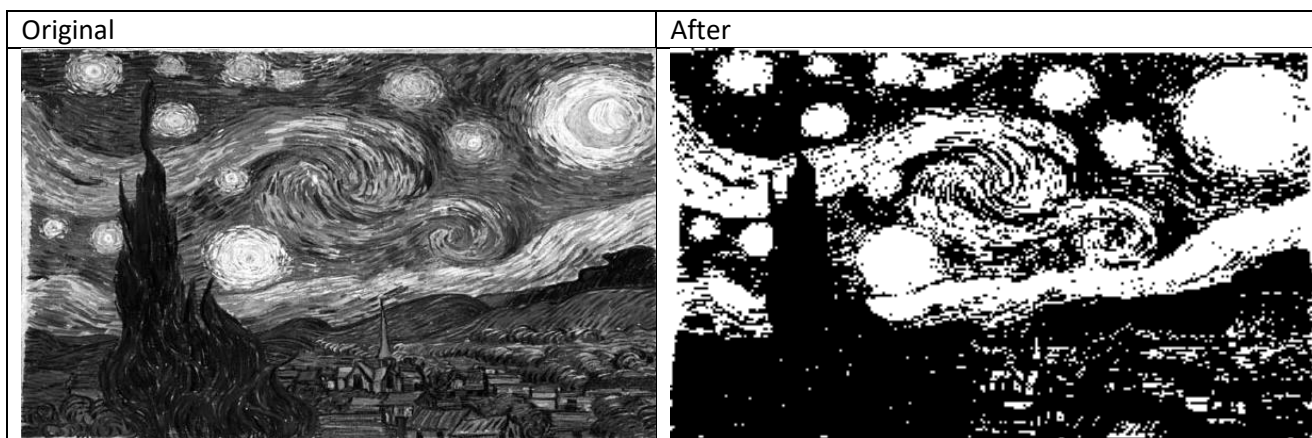
## 2.3 Thresholding

Thresholding is the process of creating a binary image from a grayscale image. A threshold value determines which pixels in the image is converted to black or white.

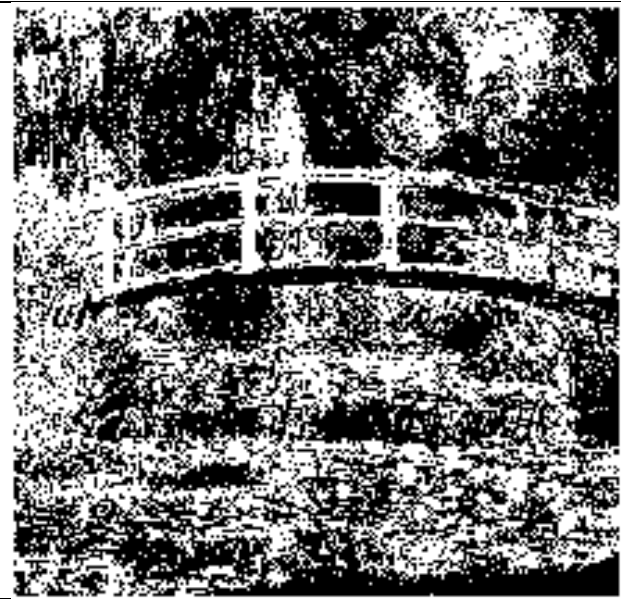
### LABWORK 2.3

A colour or grayscale image can be converted to binary image by using the `im2bw()` function.

```
% Converts an image to black and white.
i=imread('brain2.jpg');
j= im2bw(I, 102/255);
```







Work Proof:

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FILE VARIABLE CODE SIMULINK ENVIRONMENT RESOURCES

Current Folder: claud.jpg, me.png, sherlock.jpg, starry.png, **supernova.jpg**

Workspace:

Name	Value	Size	Class
F	707×1000×3	707×1000×3	double (co)
FC	707×1000×3	707×1000×3	double
Fc	707×1000×3	707×1000×3	double (co)
I	369×600×3	369×600×3	uint8
J	369×600 lo	369×600	logical

Command Window

```
>> i=imread('starry.png');
>> j= im2bw(I, 102/255);
Unrecognized function or variable 'I'.

Did you mean:
>> j= im2bw(i, 102/255);
>> figure, imshow(j)
```

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FILE VARIABLE CODE SIMULINK ENVIRONMENT RESOURCES

Current Folder: claud.jpg, me.png, sherlock.jpg, starry.png, **supernova.jpg**

Workspace:

Name	Value	Size	Class
F	707×1000×3	707×1000×3	double (co)
FC	707×1000×3	707×1000×3	double
Fc	707×1000×3	707×1000×3	double (co)
I	1166×1200	1166×1200×3	uint8
J	1166×1200	1166×1200	logical

Command Window

```
>> figure, imshow(j)
>> i=imread('claud.jpg');
>> j= im2bw(I, 102/255);
Unrecognized function or variable 'I'.

Did you mean:
>> j= im2bw(i, 102/255);
>> figure, imshow(j)
```

## 2.4 Contrast Stretching



Contrast stretching works by expanding the identified range of intensities,  $(r1, r2)$  in the input image so that it spans fully to the specified range,  $(s1, s2)$ . The process produces various degrees of spread in the gray levels of the output image, thus affecting its contrast.

### LABWORK 2.4

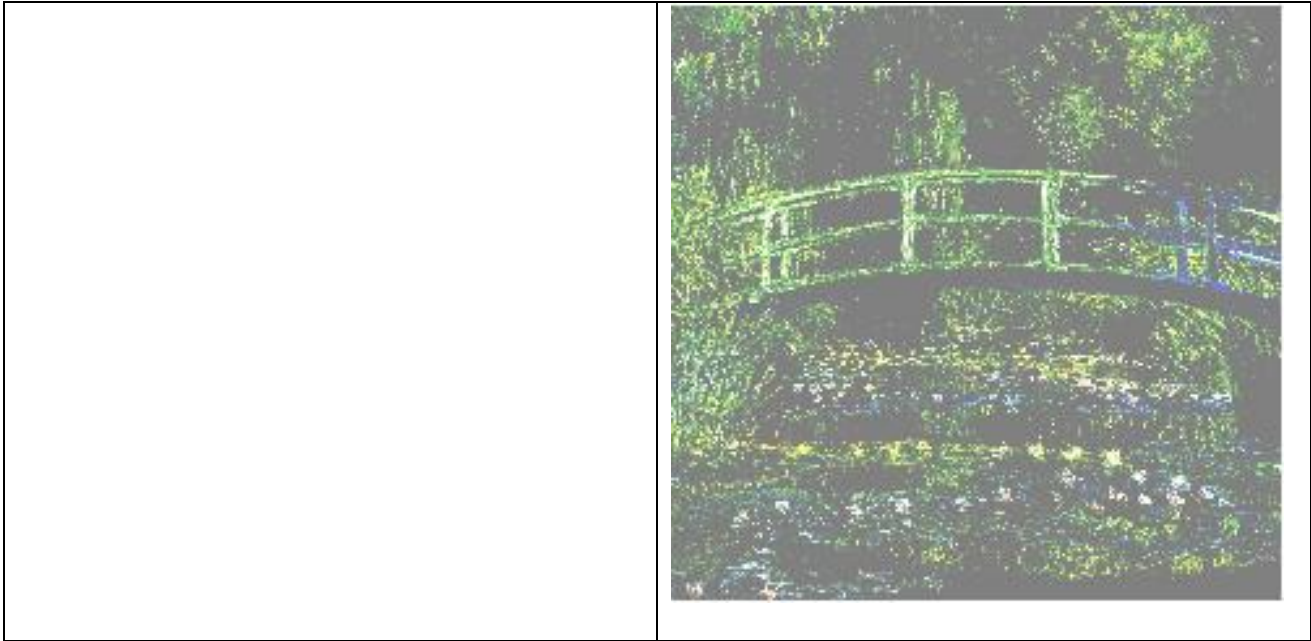
Gray level slicing and contrast stretching are both achieved using `imadjust()` function. The following commands sliced the brain tumor from the image brain by using the function and enhanced an image using contrast stretching.

```
% Performs gray level slicing to highlight the brain tumor (Fig. 3.6)
i=imread('brain3.jpg');
j=imadjust(i,[135/255 200/255],[0.5 1]);
figure,imshow(j);
```

```
% Performs contrast stretching.(Fig. 3.7)
i=imread('darksophia.jpg');
j=imadjust(i,[5/255 70/255],[0 1]);
figure,imshow(j);
```

Original	After
	<p>1. Using first command</p>  <p>2. Using second command</p>





Work proof:

Using first command:

The screenshot shows the MATLAB environment. The 'Current Folder' pane on the left lists several image files: apple.jpg, bird.png, claude.jpg, lemon.jpg, me.png, renga.jpg, sherlock.jpg, and starry.png. The 'Workspace' pane below it shows variables F, FC, Fc, i, and j with their respective dimensions and classes. The main figure window displays the image of the Japanese bridge. The Command Window at the bottom contains the following code:

```
>> i=imread('claude.jpg');
>> j=imadjust(i, [135/255 200/255],[0.5 1]);
>> figure,imshow(j);
>>
```

Using second command

# DBP30103: DIGITAL IMAGE PROCESSING

The image shows the MATLAB software interface. The top menu bar includes HOME, PLOTS, APPS, FIGURE, and AXES. Below the menu is a toolbar with icons for Save, Export, Text Style, Line Style, Basic Fitting, Data Statistics, Link Data, Camera Tools, and Edit. The main workspace is divided into three panes:

- Current Folder:** A file explorer showing a directory named 'MATLAB Drive > DIP'. The files listed are 'claude.jpg', 'me.png', 'sherlock.jpg', 'starry.png', and 'supernova.jpg'. 'supernova.jpg' is currently selected.
- Workspace:** A table listing variables in the workspace:

Name	Value	Size	Class
ans	1166*1200...	1166*1200*3	uint8
F	707*1000*...	707*1000*3	double (co
FC	707*1000*...	707*1000*3	double
Fc	707*1000*...	707*1000*3	double (co
i	1166*1200...	1166*1200*3	uint8
j	1166*1200...	1166*1200*3	uint8
- Command Window:** Displays an error message: "Invalid expression. When calling a function or indexing a variable, use parentheses. Otherwise, check for mismatched delimiters." Below the error, it suggests a correction: "Did you mean: >> i=imread('claude.jpg'); j=imadjust(i, [5/255 70/255],[0 1]); figure, imshow(j); >>".

In the center of the interface, a figure window titled 'Figure 4' displays a grayscale image of a bridge over a stream, which is the 'supernova.jpg' file.