INDIAN INSTITUTE OF INFORMATION TECHNOLOGY, BHOPAL (IIIT-BHOPAL)

Department of Information Technology

Digital Image Processing (IT - 312)
Vth – Semester

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Experiment 1:
Introduction to MATLAB Commands and Functions in Digital Image Processing

MATLAB is a high-level programming environment commonly used for numerical computing and image processing. Here's a brief overview of some essential commands and functions used in MATLAB for image processing:

Reading an Image

- Command: imread
- Description: Reads an image file and stores it in a variable.
- Example:
  ```
  img = imread('abcd.jpg');
  ```

Displaying an Image

- Command: imshow
- Description: Displays an image in a new figure window.
- Example:
  ```
  imshow(img);
  ```

Converting to Grayscale

- Command: rgb2gray
- Description: Converts a color image to a grayscale image.
- Example:
  ```
  grayImg = rgb2gray(img);
  ```

Creating Subplots

- Command: subplot
- Description: Divides the figure window into a grid and allows you to place multiple plots in different sections.

- Example:
  ```
  subplot(1, 2, 1); % Creates a subplot in a 1x2 grid, first position
  imshow(img); title('Original Image');
  subplot(1, 2, 2); % Creates a subplot in a 1x2 grid, second position
  imshow(grayImg); title('Grayscale Image');
  ```

Experiment 2:
Writing Programs to Read and Display Images Objective

Reading an Image

```
img = imread('filename.jpg');
```

-imread: Reads an image from a file.

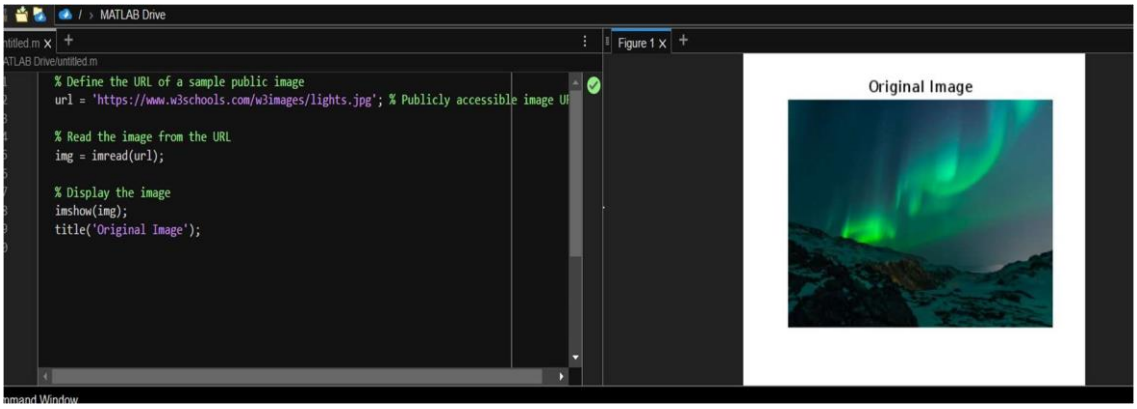
Displaying an Image

```
imshow(img);
```

-imshow: Displays the image in a window.

Example Program

```
img = imread('example.jpg');
imshow(img);
title('Original Image');
```



Experiment 3:
Writing Programs to Convert to Grayscale and Display Using Subplot

MATLAB Commands

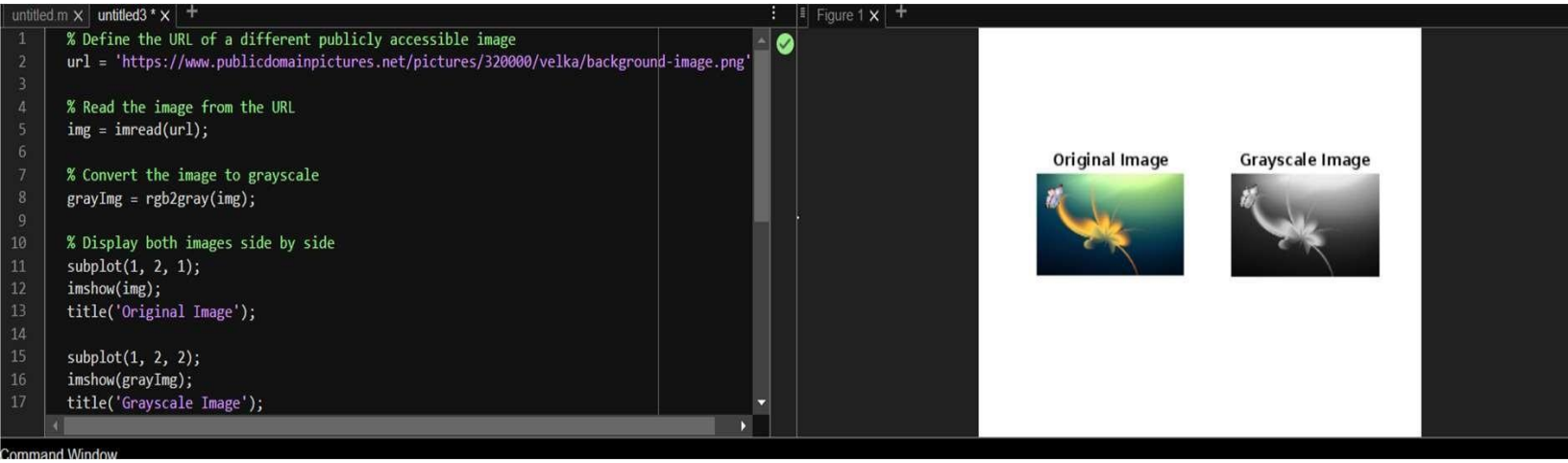
Convert to Grayscale grayImg
`rgb2gray(img);`
- rgb2gray: Converts a color image to grayscale.

Create Subplots
`subplot(m, n, p);`
- subplot: Divides the figure into a grid of subplots.

Displaying Images in Subplots
```
subplot(1, 2, 1); imshow(img); title('Original Image');
subplot(1, 2, 2); imshow(grayImg); title('Grayscale Image');
```

Example Program
```
url = 'https://www.publicdomainpictures.net/pictures/320000/velka/background-image.png';
img = imread(url); grayImg = rgb2gray(img);
subplot(1, 2, 1);
imshow(img); title('Original Image');
subplot(1, 2, 2); imshow(grayImg); title('Grayscale Image');
```

Conclusion
In this experiment, you have learned to:
Use MATLAB commands to read and display images.
Convert images to grayscale.
Utilize the subplot function to display multiple images in a single figure.
These basic skills form the foundation for more advanced image processing tasks in MATLAB.

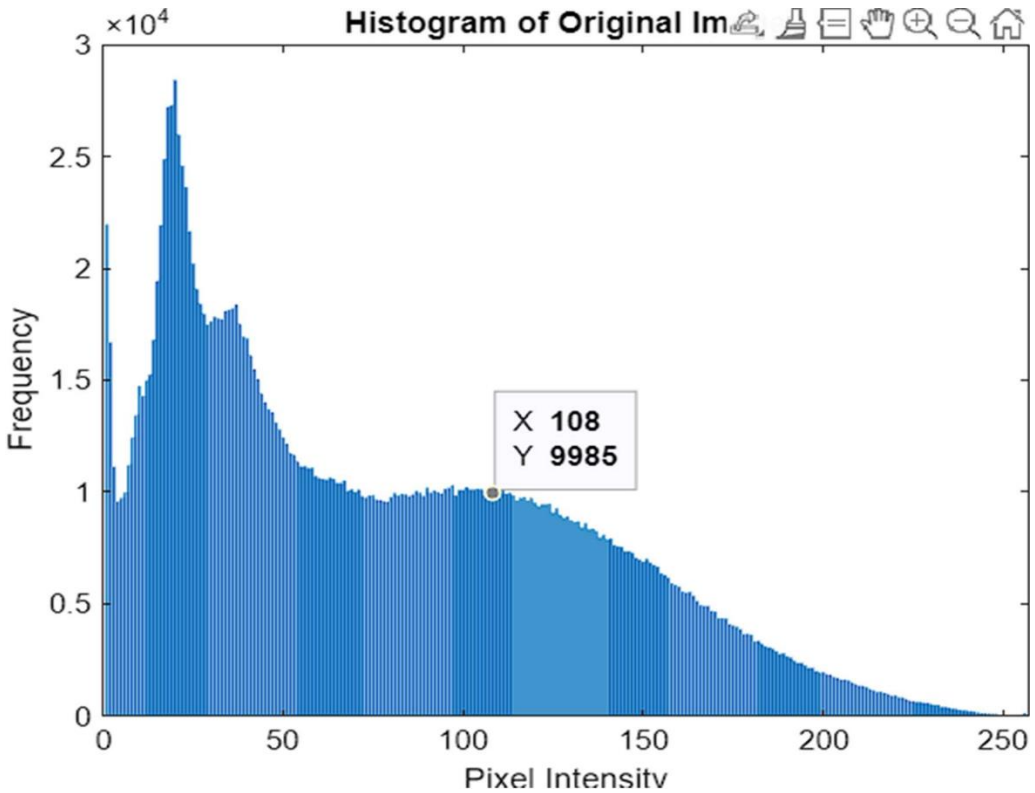


Experiment 4:

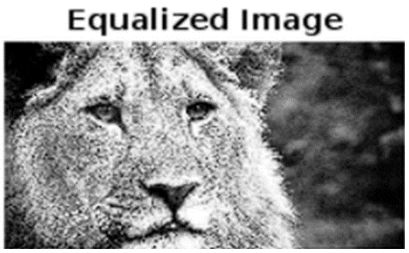
To write a program for histogram calculation and equilization

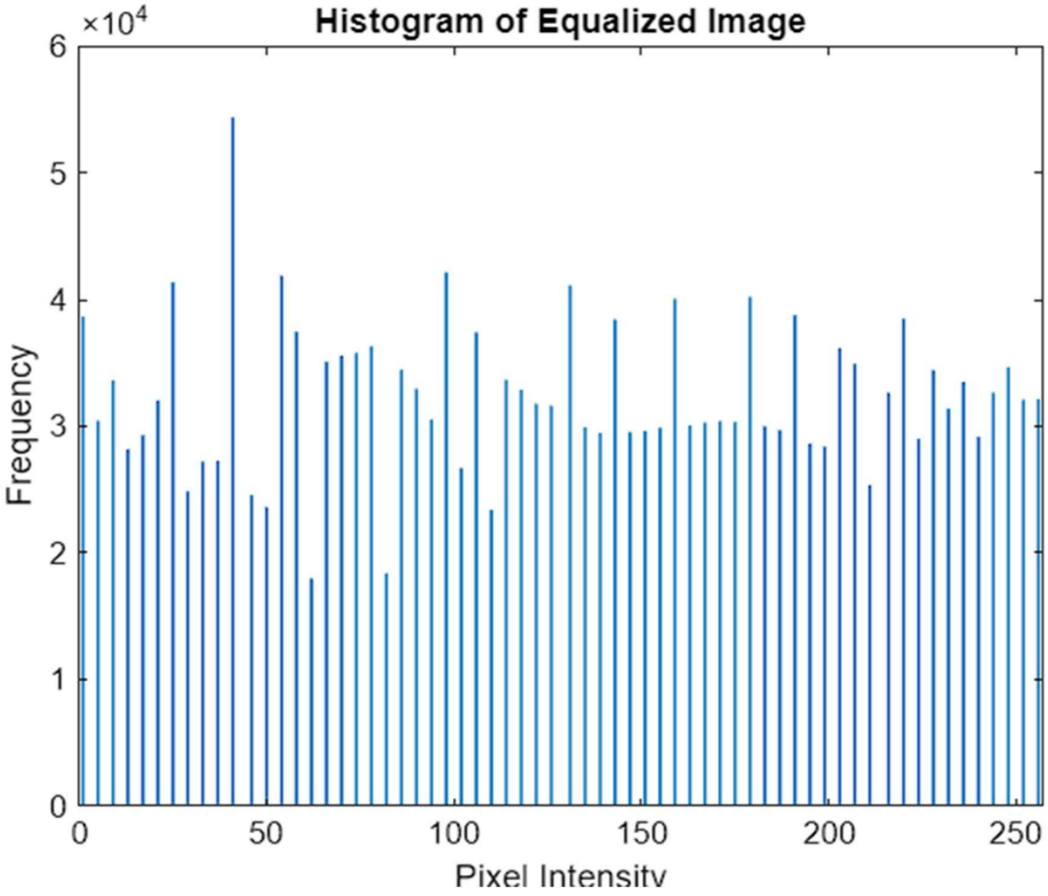
MATLAB code to calculate the histogram and perform histogram equalization on a grayscale image.

```
image = imread('https://wallpapercave.com/wp/wp3028175.jpg');
if size(image, 3) == 3
image = rgb2gray(image); end
figure; imshow(image);
title('Original Image');
hist_orig = imhist(image); figure;
bar(hist_orig);
title('Histogram of Original Image');
xlabel('Pixel Intensity');
ylabel('Frequency');
equalized_image = histeq(image);
figure; imshow(equalized_image);
title('Equalized Image');
hist_eq = imhist(equalized_image);
figure;
bar(hist_eq);
title('Histogram of Equalized Image');
xlabel('Pixel Intensity');
ylabel('Frequency');
figure; subplot(1, 2, 1);
imshow(image);
title('Original Image');
subplot(1, 2, 2);
imshow(equalized_image);
title('Equalized Image');
```


Histogram of Original Im
×10^4
Frequency
Pixel Intensity
X 108
Y 9985


Original Image


Equalized Image


Histogram of Equalized Image
×10^4
Frequency
Pixel Intensity

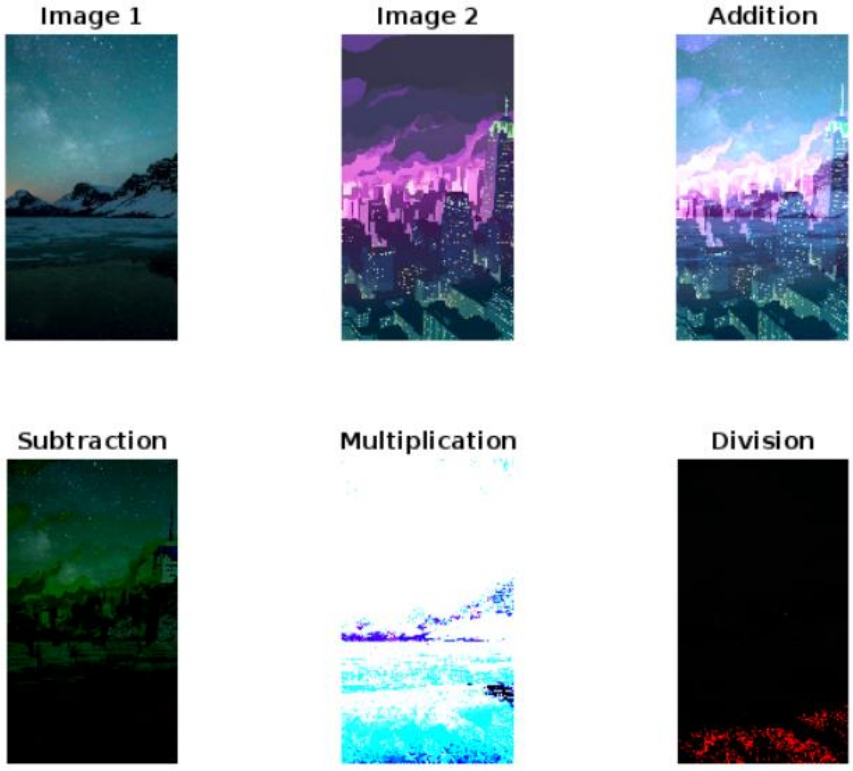
Experiment 5:

To write and execute programs for image arithmetic operations

MATLAB code for addition, subtraction, multiplication and division of two images.

```
img1 = imread('image1.jpg');
img2 = imread('image2.jpg');

img1 = double(img1);
img2 = double(img2);

%Addition
img_add = img1 + img2;
img_add = uint8(img_add);

% Subtraction
img_sub = img1 - img2;
img_sub = uint8(img_sub);

% Multiplication
img_mult = img1 .* img2;
img_mult = uint8(img_mult);

% Division
epsilon = 1e-6;
img_div = img1 ./ (img2 + epsilon);
img_div = uint8(img_div);

% Display the original and resulting images
figure;
subplot(2,3,1), imshow(uint8(img1)), title('Image 1');
subplot(2,3,2), imshow(uint8(img2)), title('Image 2');
subplot(2,3,3), imshow(img_add), title('Addition');
subplot(2,3,4), imshow(img_sub), title('Subtraction');
subplot(2,3,5), imshow(img_mult), title('Multiplication');
subplot(2,3,6), imshow(img_div), title('Division');
```

Output:

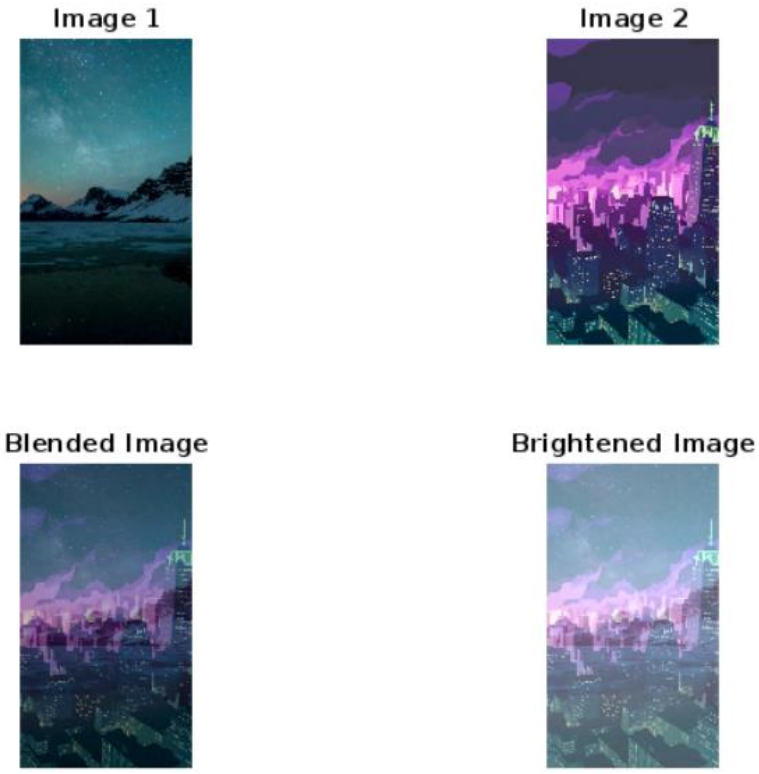


MATLAB code for executing image blending, calculating mean value and adjusting the brightness of the image by mean value.

```
img1 = imread('image1.jpg'); % Replace with your image file
img2 = imread('image2.jpg'); % Replace with your image file

img1 = double(img1);
img2 = double(img2);

% 1. Image Blending
alpha = 0.5;
blended_img = alpha * img1 + (1 - alpha) * img2;

blended_img = uint8(blended_img);

% 2. Calculating Mean Value of the Blended Image
mean_value = mean(blended_img(:));
fprintf('Mean pixel value of the blended image: %.2f\n',
mean_value);

% 3. Adjust brightness by changing the mean value
target_mean_value = 150;

current_mean_value = mean(blended_img(:));
```

```
brightness_adjustment_factor = target_mean_value -
current_mean_value;

brightened_img = blended_img + brightness_adjustment_factor;

brightened_img = min(max(brightened_img, 0), 255);

brightened_img = uint8(brightened_img);

% Display the original images, blended image, and brightened image
figure;
subplot(2,2,1), imshow(uint8(img1)), title('Image 1');
subplot(2,2,2), imshow(uint8(img2)), title('Image 2');
subplot(2,2,3), imshow(blended_img), title('Blended Image');
subplot(2,2,4), imshow(brightened_img), title('Brightened Image');
```

Output:



Experiment 6:

To write and execute programs for image logical operations

MATLAB code for executing AND, OR, NAND, NOR, EXOR, EXNOR and NOT operation on two images and calculating intersection of two images.

```
img1 = imread('image1.jpg');
img2 = imread('image2.jpg');

if size(img1, 3) == 3
    img1 = rgb2gray(img1);
end
if size(img2, 3) == 3
    img2 = rgb2gray(img2);
end

threshold = 128;
binary_img1 = imbinarize(img1, double(threshold) / 255);
binary_img2 = imbinarize(img2, double(threshold) / 255);

% 1. AND operation
and_img = binary_img1 & binary_img2;

% 2. OR operation
or_img = binary_img1 | binary_img2;

% 3. NAND operation
nand_img = ~(binary_img1 & binary_img2);

% 4. NOR operation
nor_img = ~(binary_img1 | binary_img2);

% 5. XOR (EXOR) operation
xor_img = xor(binary_img1, binary_img2);

% 6. XNOR (EXNOR) operation
xnor_img = ~(xor(binary_img1, binary_img2));

% 7. NOT operation (for img1)
not_img1 = ~binary_img1;

% 8. Intersection of two images (AND is often used to calculate
intersection)
intersection_img = and_img;

% Display the results
figure;
subplot(3, 3, 1), imshow(binary_img1), title('Binary Image 1');
subplot(3, 3, 2), imshow(binary_img2), title('Binary Image 2');
subplot(3, 3, 3), imshow(and_img), title('AND Operation');
```

```
subplot(3, 3, 4), imshow(or_img), title('OR Operation');
subplot(3, 3, 5), imshow(nand_img), title('NAND Operation');
subplot(3, 3, 6), imshow(nor_img), title('NOR Operation');
subplot(3, 3, 7), imshow(xor_img), title('XOR Operation');
subplot(3, 3, 8), imshow(xnor_img), title('XNOR Operation');
subplot(3, 3, 9), imshow(not_img1), title('NOT Operation (Image
1)');

figure;
imshow(intersection_img);
title('Intersection of Two Images (AND Operation)');
```

Output: