# Image and Video Processing

## Programming Assignment 6

Image Sharpening & Edge Detection

Submitted by<br>
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## Implement a Laplacian filter for extracting edge information. Plot the laplacian output as well as the sharpened image. Implement an unsharp masking algorithm. Use a Gaussian filter of size 5 X 5 with $\sigma = 3$. Implement various edge detection algorithms without using inbuilt functions.

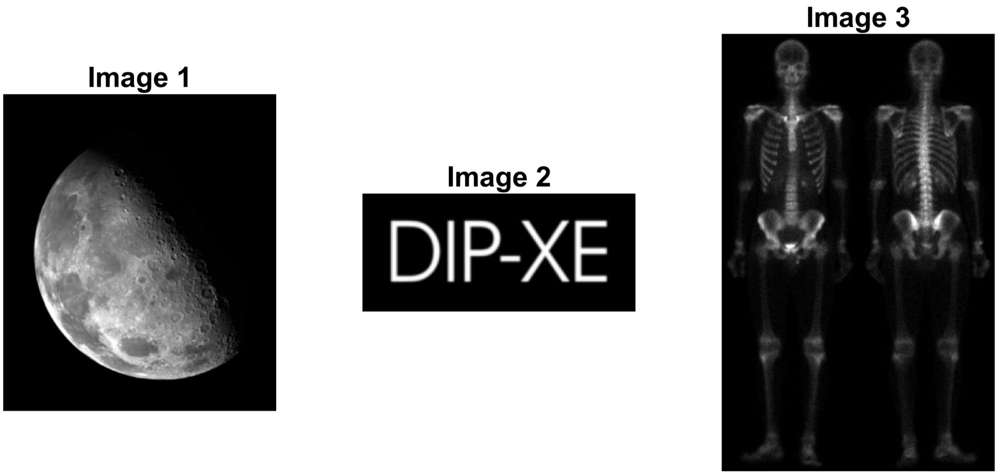
### Load images

```
blurry_moon = imread('Fig0338(a)(blurry_moon).tif');
dipxe_text = imread('Fig0340(a)(dipxe_text).tif');
skeleton_orig = imread('Fig0343(a)(skeleton_orig).tif');

figure;
subplot(1, 3, 1);
imshow(blurry_moon, []);
title('Image 1');

subplot(1, 3, 2);
imshow(dipxe_text, []);
title('Image 2');

subplot(1, 3, 3);
imshow(skeleton_orig, []);
title('Image 3');
```



### Laplacian Filter for Edge Detection (blurry_moon)

```
laplacian_filter = fspecial('laplacian');
laplacian_image = imfilter(blurry_moon, laplacian_filter);
```

### Sharpen the image by subtracting the Laplacian from the original image

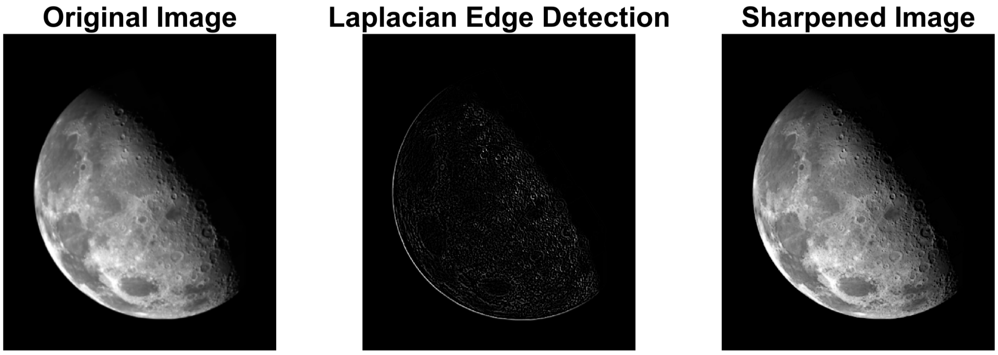
```
sharpened_image = blurry_moon - laplacian_image;
```

### Plot Laplacian output and sharpened image

```
figure;
subplot(1, 3, 1);
imshow(blurry_moon, []);
title('Original Image');

subplot(1, 3, 2);
imshow(laplacian_image, []);
title('Laplacian Edge Detection');

subplot(1, 3, 3);
imshow(sharpened_image, []);
title('Sharpened Image');
```



Original Image

Laplacian Edge Detection

Sharpened Image

### Unsharp Masking (dipxe__text)

Apply Gaussian blur to the image (sigma = 3)

```
gaussian_blurred = imgaussfilt(dipxe_text, 3);
```

### Subtract the blurred image from the original to get the mask

```
mask = dipxe_text - gaussian_blurred;
```

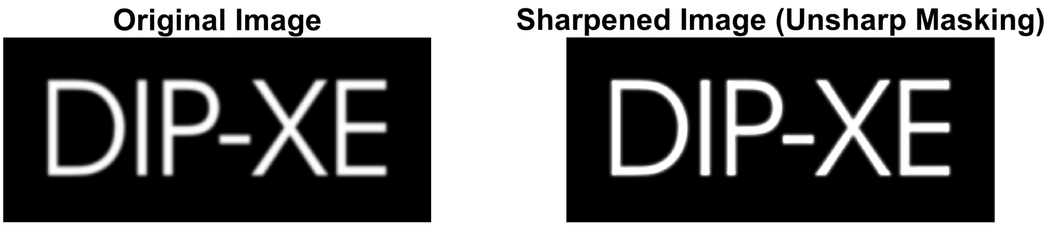
### Sharpen the image by adding the mask to the original

```
unsharp_masked_image = dipxe_text + mask;
```

### Plot the original and sharpened images

```
figure;
subplot(1, 2, 1);
imshow(dipxe_text, []);
title('Original Image');

subplot(1, 2, 2);
imshow(unsharp_masked_image, []);
title('Sharpened Image (Unsharp Masking)');
```



**Edge Detection Algorithms (skeleton_orig)**

Sobel Edge Detection

```
sobel_x = [-1 0 1; -2 0 2; -1 0 1];
sobel_y = [-1 -2 -1; 0 0 0; 1 2 1];

gradient_x = imfilter(double(skeleton_orig), sobel_x);
gradient_y = imfilter(double(skeleton_orig), sobel_y);
sobel_edge = sqrt(gradient_x.^2 + gradient_y.^2);
```

Prewitt Edge Detection

```
prewitt_x = [-1 0 1; -1 0 1; -1 0 1];
prewitt_y = [-1 -1 -1; 0 0 0; 1 1 1];

gradient_x_prewitt = imfilter(double(skeleton_orig), prewitt_x);
gradient_y_prewitt = imfilter(double(skeleton_orig), prewitt_y);
prewitt_edge = sqrt(gradient_x_prewitt.^2 + gradient_y_prewitt.^2);
```

Canny Edge Detection (using built-in function for comparison)

```
edges_canny = edge(skeleton_orig, 'Canny');
```

**Plot Sobel, Prewitt, and Canny edge detection results**

```
figure;
subplot(1, 4, 1);
imshow(skeleton_orig, []);
title('Original Image');

subplot(1, 4, 2);
imshow(sobel_edge, []);
title('Sobel Edge Detection');

subplot(1, 4, 3);
imshow(prewitt_edge, []);
title('Prewitt Edge Detection');
```

```
subplot(1, 4, 4);
imshow(edges_canny, []);
title('Canny Edge Detection');

set(gcf, 'Position', [100, 100, 1600, 400]);
```