SECV3213-02 ASAS PEMPROSESAN IMEJ (FUNDAMENTAL OF IMAGE PROCESSING)

SECTION 02

Assignment 2: Image Restoration / Enhancement

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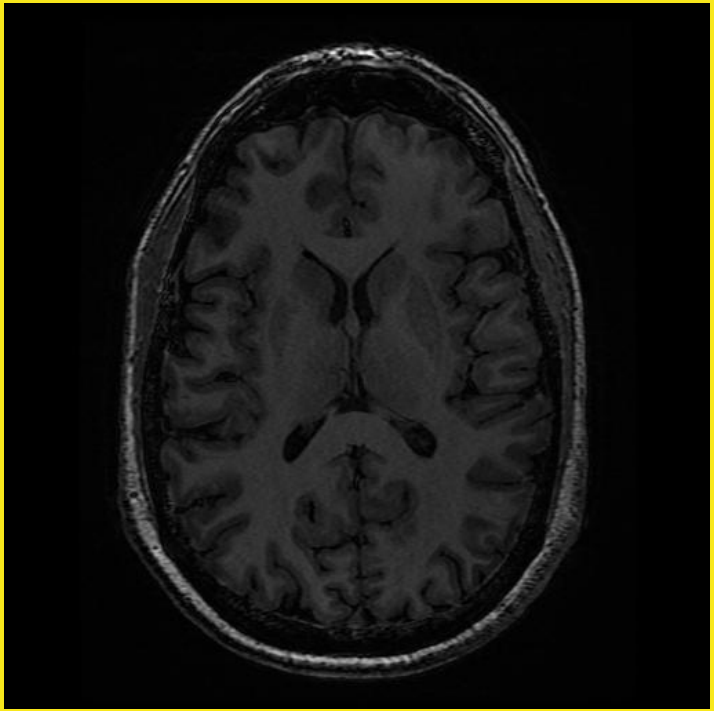
IMAGE 1 WITH IMAGE PROBLEMS

The image with image problems chosen is an example of MRI (Magnetic Resonance Imaging) images.

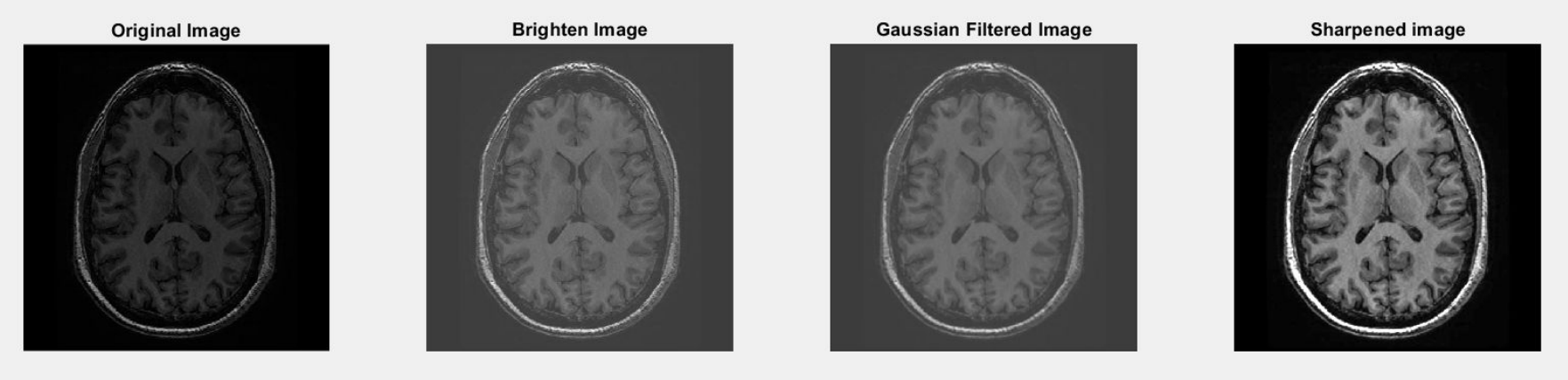
As shown figure at right, the medical image chosen is consisting a few problems. The image is too dark causing the details of the image is not clear. Image processing methods that chosen to solve the problem will first solving the problem of the brightness of the image.

Beside, the image enhancement such as sharpen filter will be implemented to make the image more clearer. The image processing algorithms chosen are used to improve the image quality, enhance the visual effects, hence, the true situation of the patient can be showed clearly.



RESTORATION / ENHANCEMENT (IMAGE 1)

PROCESS FLOW OF SOLUTION



Read the Image → Normal Brightening Image → Gaussian Smoothing the Image → Sharpen filtering the Image

EXPLANATION OF PROCESS

Based on the script of this assignment 2, there are a several algorithms used for restoration and enhancement on the first image chosen that has image problems. The first algorithm used is the logic operation of addition of *imadd()* function. The imadd() function is used to add the number of 60 into the image to increase the intensity of the image. This function will help to enhance the image by increasing its brightness.

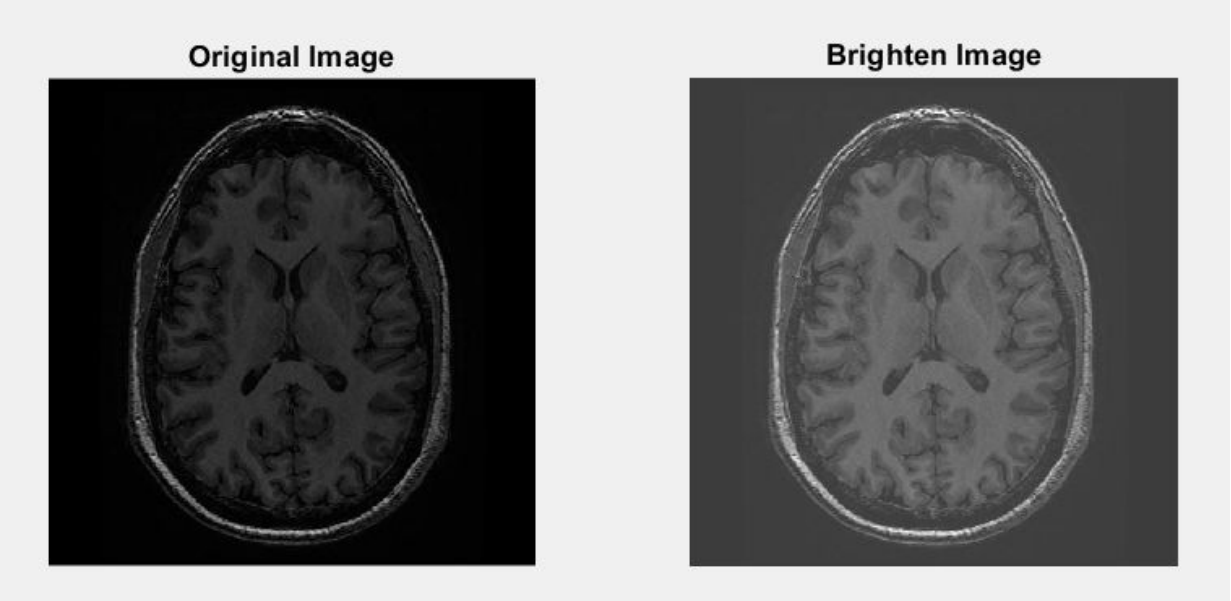
The next step is applying the smoothing filtering on the image. The smoothing filter used is *Gaussian Filter*. As the output after brightening process causing a small amount of noises to the image. This algorithm is used to reduce noise appeared on the image and also smoothing the image. For Gaussian filter, fn initialized by using the fspecial() function which is used to return a rotationally symmetric Gaussian lowpass filter of size 3X3 with standard deviation sigma of 1. The bigger the size, the larger the neighborhood are filtering over, and the larger the sigma, the larger the spread of the filter in that neighborhood.Then, the imfilter() function is used to apply the filter to the image.This algorithm helps to smoothing and minimized the noise on the image.

The final step is about sharpen filtering the image. Since the output of the smoothen image is a little blurry. The image is sharpened by using the *Histogram stretching* function. In this process, stretchlim is used to compute the lower and upper limits that can be used for contrast stretching image. And the limits are returned in img_limits. The image is assigned to the value of imadjust(img_limits) which is used to map the intensity values in this grayscale image chosen. This operation show a clear image output by increasing the contrast of the output image.

STEP 1

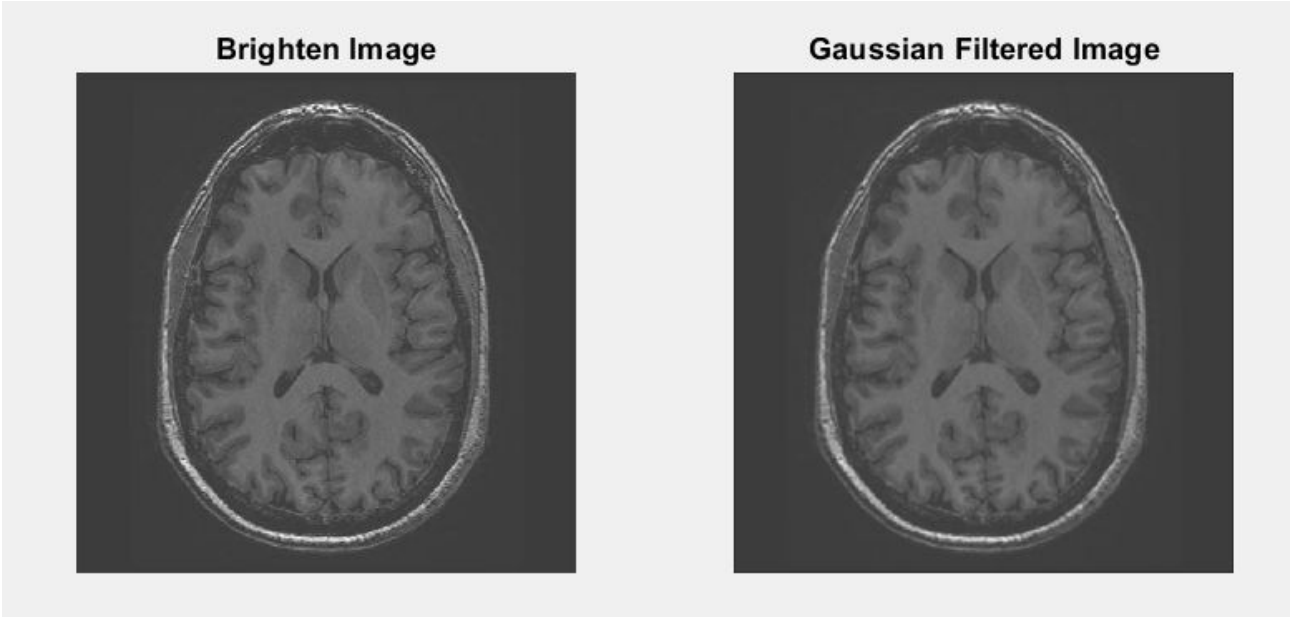
```
A = imread('imageproblem1.jpg');
figure(1);
imshow(A);
subplot(1,4,1),imshow(A), title('Original Image');
```

STEP 2



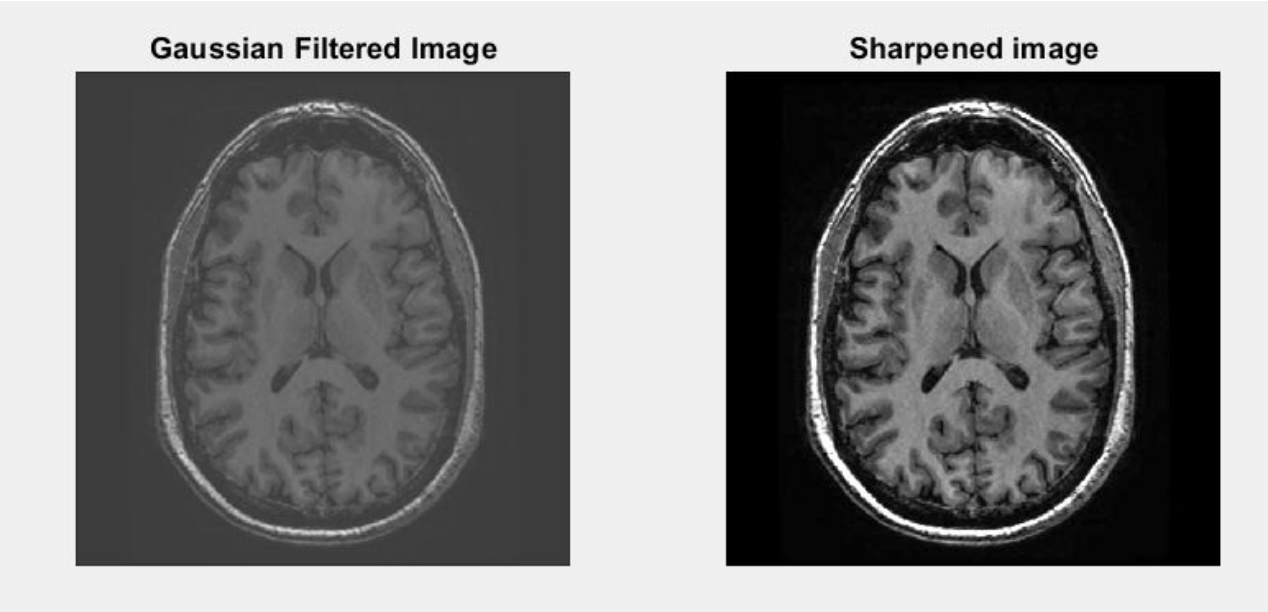

```
figure(2)
B = imadd(A,60);
subplot(1,4,2), imshow(B), title('Brighter Image');
```

STEP 3




```
fn = fspecial('gaussian', [3 3], 1);
C = imfilter(B,fn);
subplot(1,4,3), imshow(C), title('Gaussian Filtered Image');
```

STEP 4




```
Id = im2double(C);

img_limits = stretchlim(Id);

D = imadjust(Id,img_limits,[]);

subplot(1,4,4), imshow(D), title(' Sharpened Image')
```

IMAGE RESULTS

BEFORE

AFTER

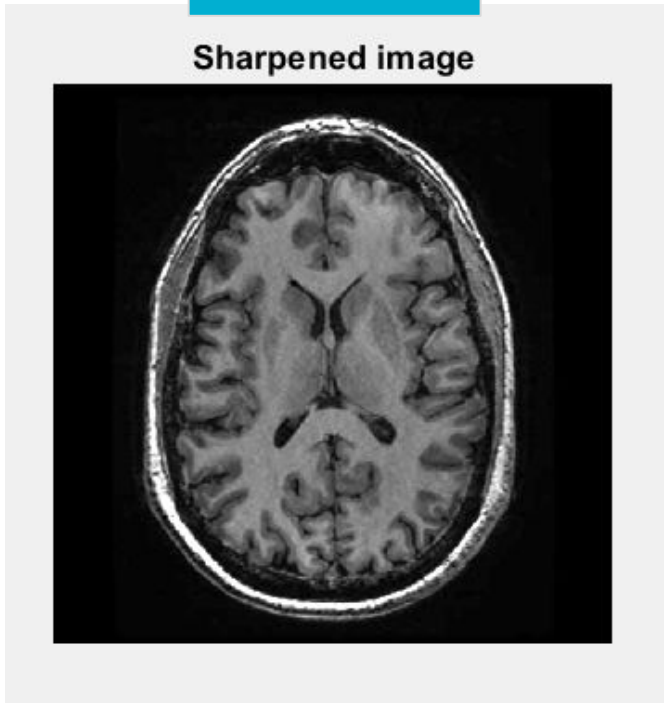
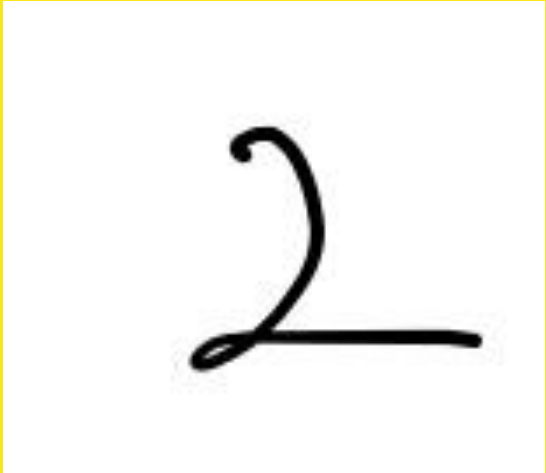


IMAGE 2 WITH IMAGE PROBLEMS

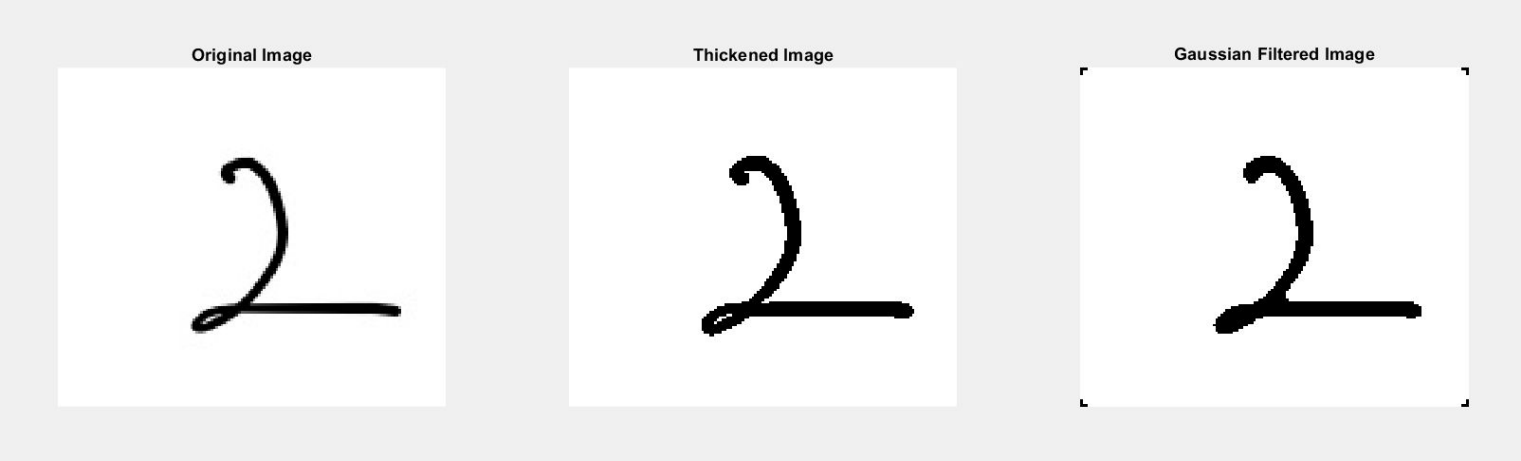
The second image with image problems chosen is a handwritten digit image selected from the Kaggle.com for our project purpose.

As shown figure at right, the digit image chosen is not clear. The image will initially thin and blur. The enhancement can be done by thickening the pixel of the digit and remove the blurriness.



RESTORATION / ENHANCEMENT (IMAGE 2)

PROCESS FLOW OF SOLUTION



EXPLANATION OF PROCESS

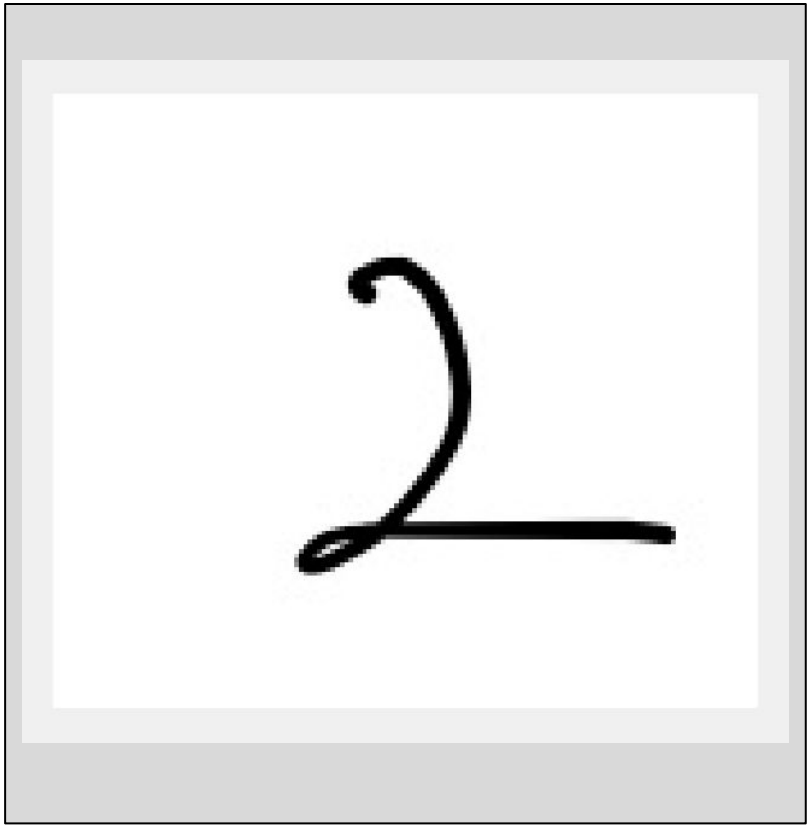
For the image problem 2, the algorithms used for restoration and enhancement included thickening and smoothing filter on the image.

The first step is thickening the image by using the bwmorph() function which involved the morphological operation of 'thicken'. First, initialized the value of level = graythresh(A) where A is the original image. Then,applied the value in the im2bw(A,level) which is addressed as BW. The image is computed into its complement before thickening process. Then the bwmorph() function is used with the 'thicken' operation and complement again. The digit in the image is thickened as shown in the output.

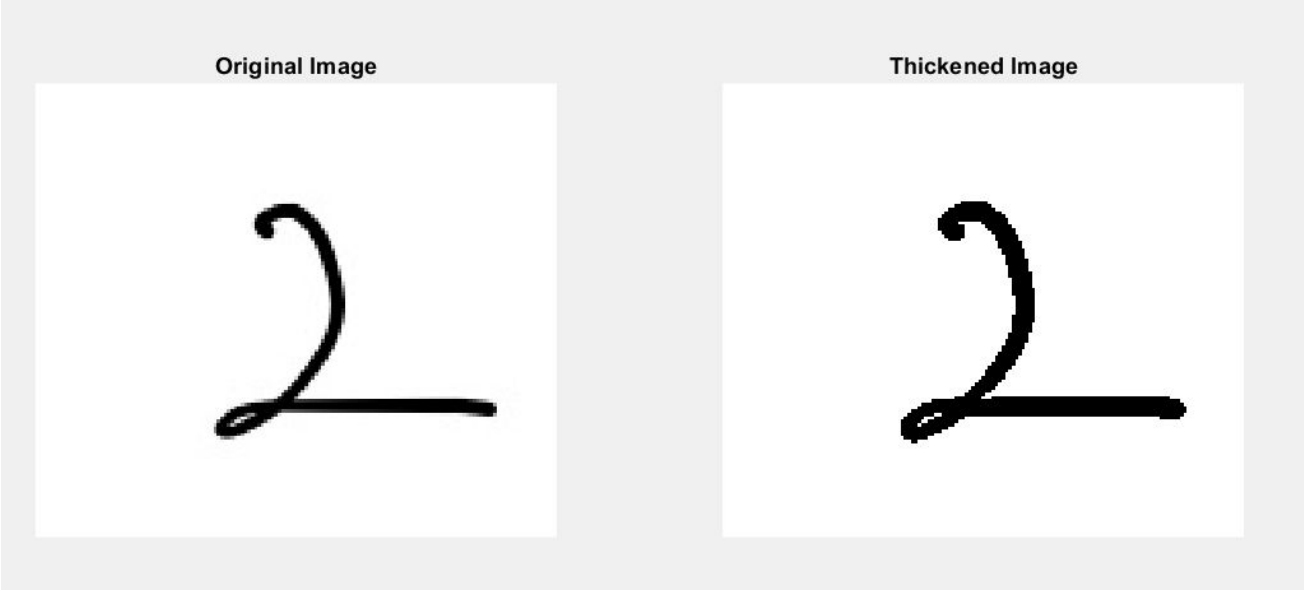
The next step is applying the smoothing filtering. The smoothing filter used is *Gaussian Filter*. The Gaussian filter applied is able to remove the noise especially the detail of the digit. Same as the step used in image problem 1, fn initialized by using the fspecial() function which is used to return a rotationally symmetric Gaussian lowpass filter of size 9X9 with standard deviation sigma of 2. Then, the imfilter() function is used to apply the filter to the image. As shown in the final output of the image, this algorithm is able to smoothing and reduce the details of the image.

STEP 1

```
A = imread('imageproblem2.jpg');
figure(1);
imshow(A);
subplot(1,3,1),imshow(A), title('Original Image');
```



STEP 2



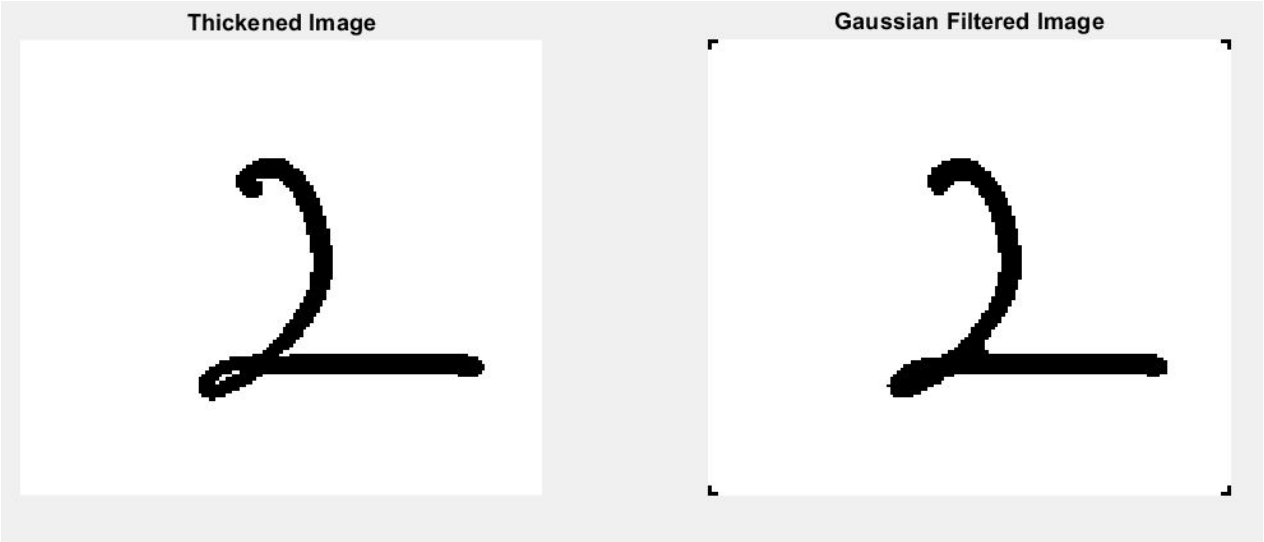

```
level = graythresh(A);  bw = im2bw(A,level);

BW = imcomplement(bw);

b = bwmorph(BW,'thicken');

B = imcomplement(b);  subplot(1,3,2), imshow(B), title('Thickened Image');
```

STEP 3




```
fn = fspecial('gaussian', [9 9], 3);
C = imfilter(B,fn);
subplot(1,3,3), imshow(C), title('Gaussian Filtered Image');
```

IMAGE RESULTS

BEFORE

Original Image

AFTER

Gaussian Filtered Image

THANK YOU