ECE 114
Computer Assignment 7
Image Enhancement

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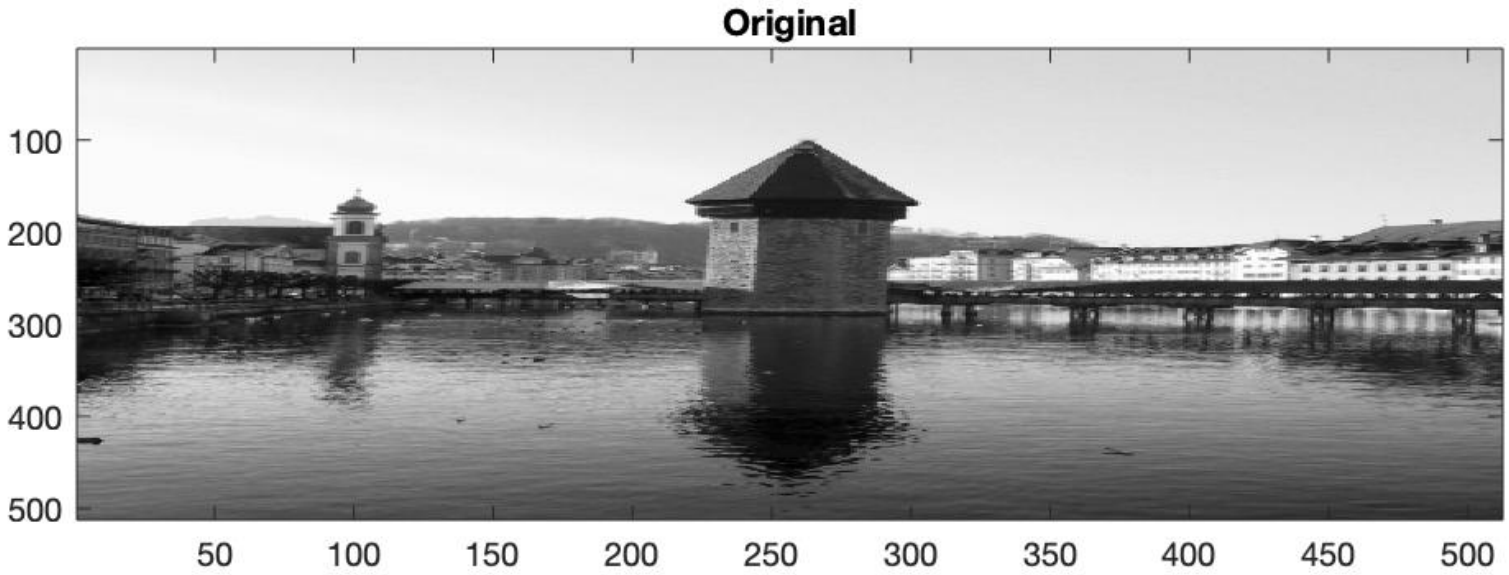
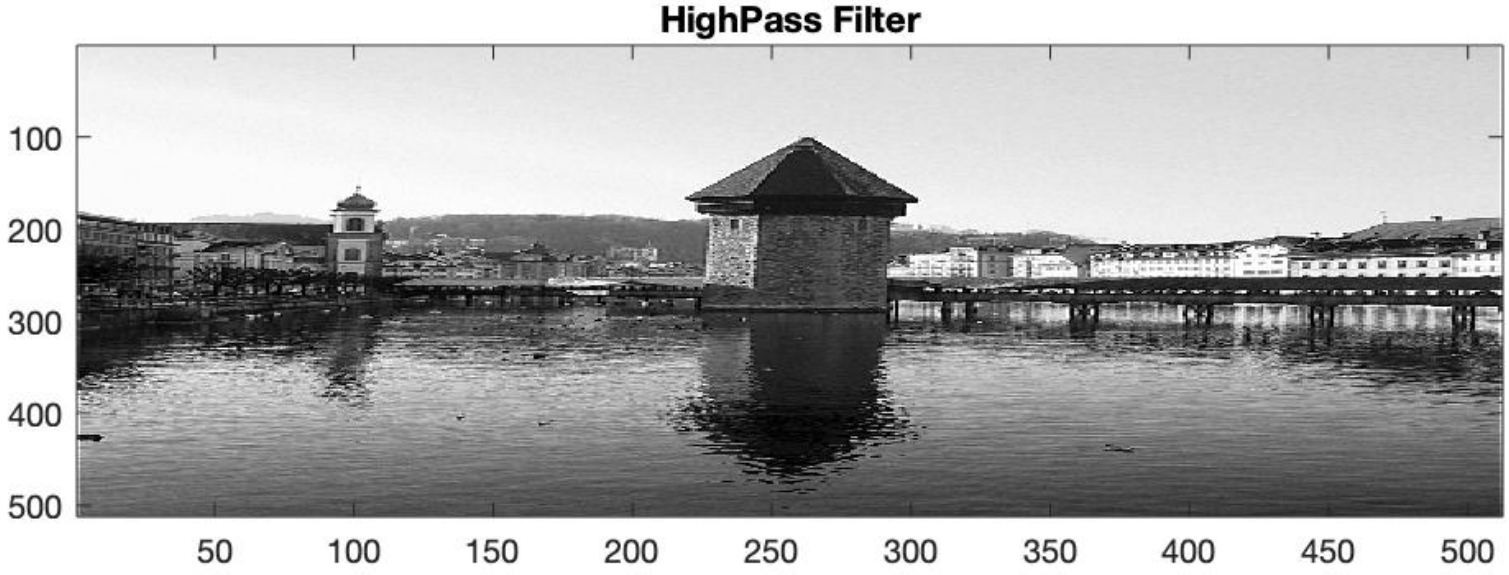
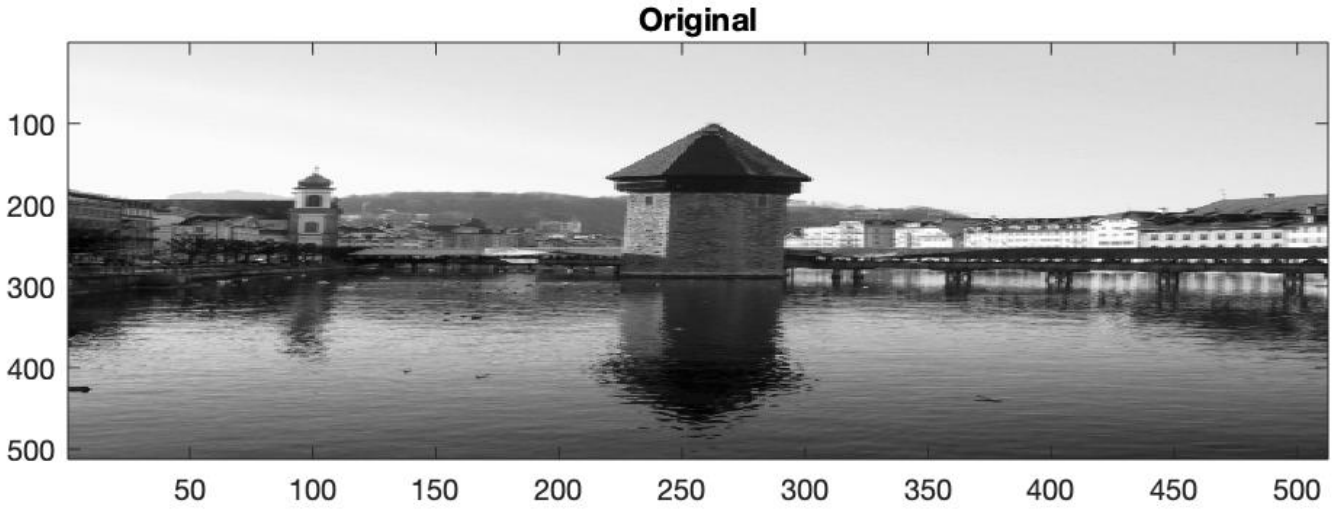
Abstract: For this assignment, we used various image enhancement tools to enhance images with noise. For this we used the image from last lab and made versions of the image that had gaussian noise and salt and pepper noise using functions in MATLAB.
(MATLAB code at the end)

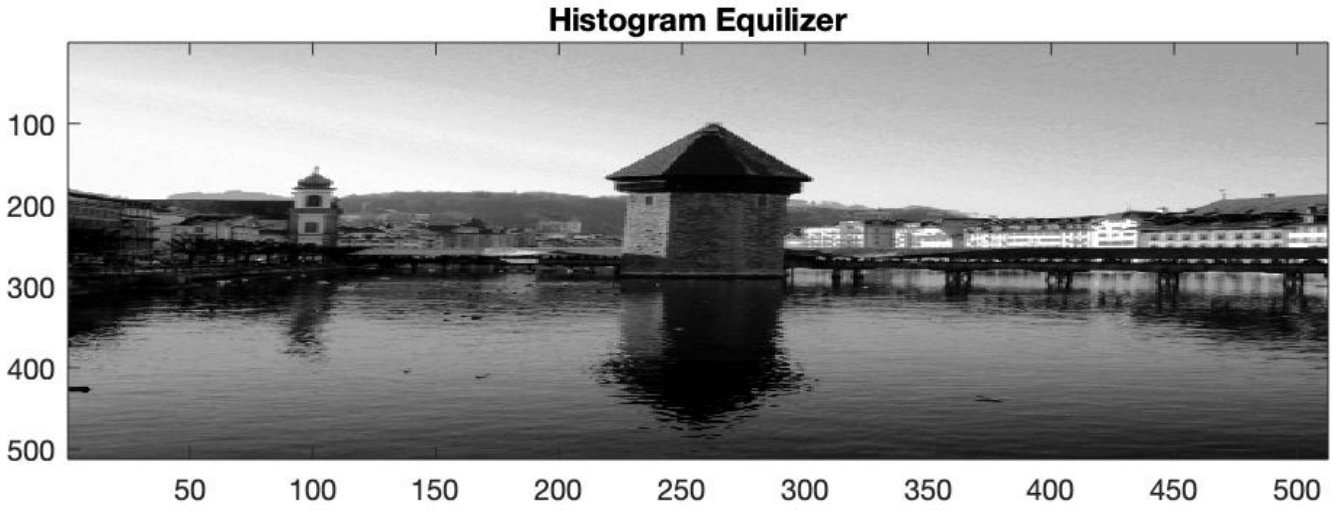
Task 1:
We used the given High-Pass filter matrix given to filter the original image. The resulting image was much sharper than the original image. The edges became more clear.



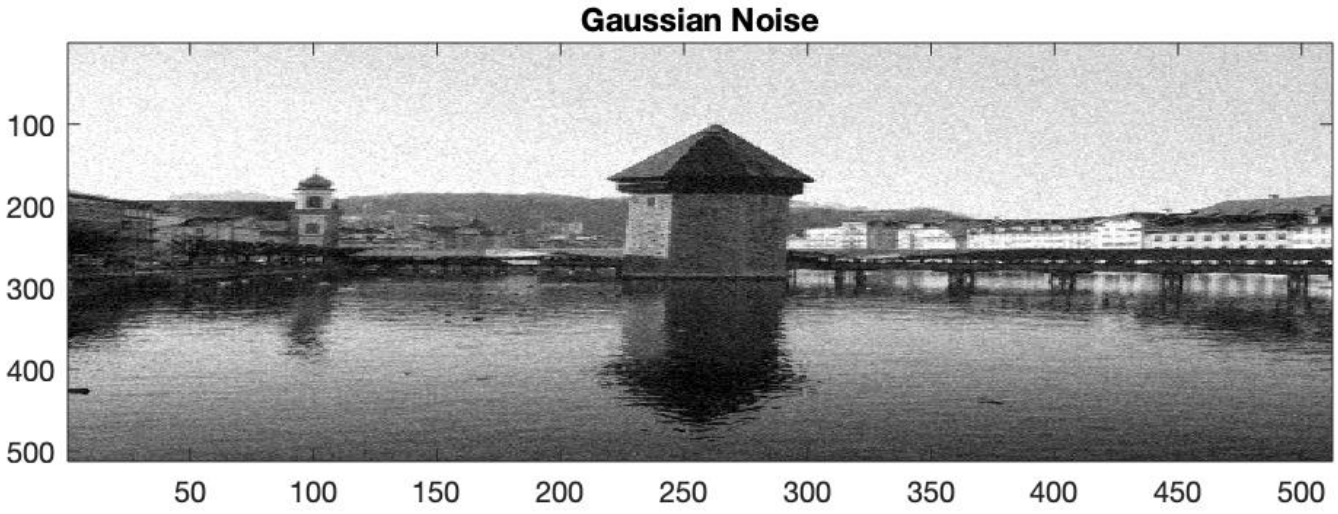


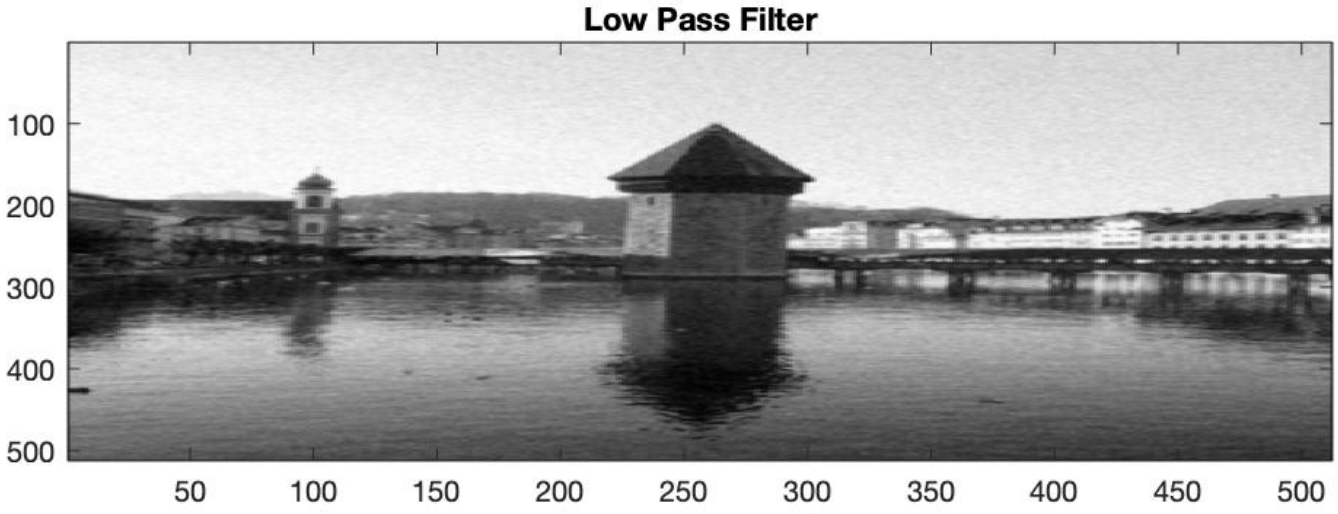
Task 2:
Using the built in function, we created an Histogram-Equalized version of the original image. In comparison with the original this version had better contrast.





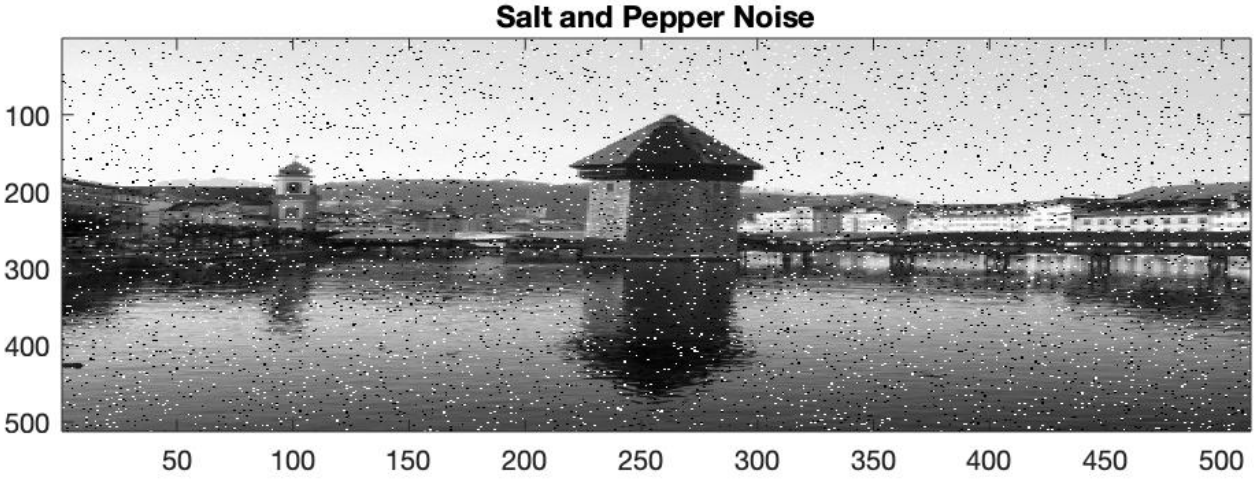
Task 3:
Using the imfilter tool, we used a low-pass filter on the image with added gaussian noise. The low-pass filtering has reduced the amount of high frequency noise on this image. It still has some noise but mostly filtered out.

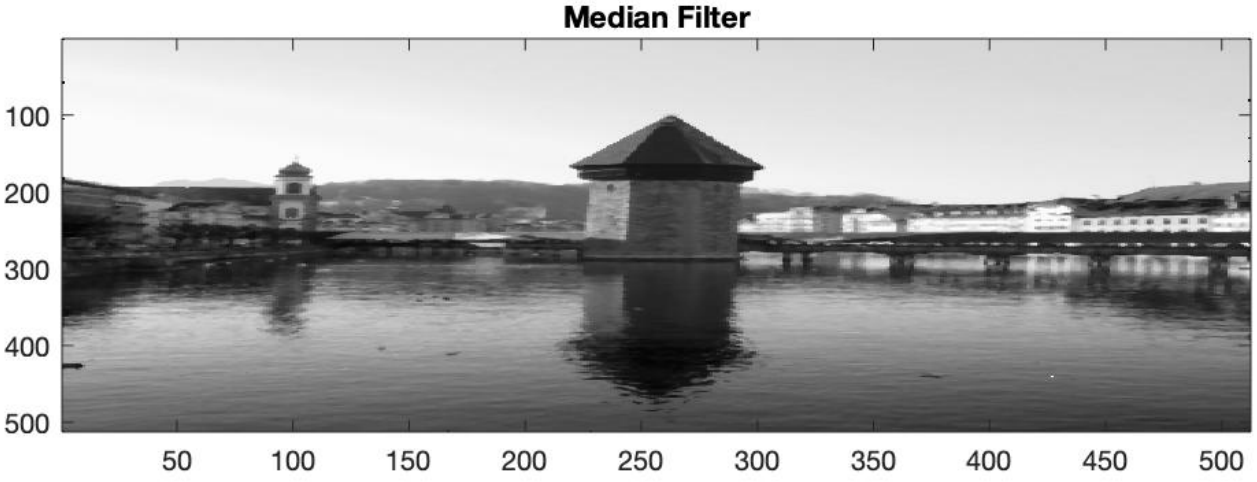




Task 4:

Using the built-in function medfilt2(), we applied median filtering on the image with added salt and pepper noise. Salt and pepper noise is characterized to have significant white specks on the image and using the median filter, we were able to remove most of the noise by taking the median of the pixels around the specks.





Source Code:

```
U = imread("ca6_image.tiff");

% generating a noisy version of the image using Gaussian Noise
Ug = imnoise(U,'gaussian',0,0.002);

%Generating a salt and pepper noisy version
Us = imnoise(U,'salt & pepper');

%High pass filter h_H
h_H = (1./7).*[-1 -2 -1; -2 19 -2; -1 -2 -1];

%Using a High Pass filter on the original image
Uh = imfilter(U,h_H);

%Plotting the filtered image in contrast with the original to compare.
figure();
subplot(2,1,1);
imagesc(U);
title('Original');
subplot(2,1,2);
imagesc(Uh);
title('HighPass Filter');
colormap(gray);

% Histogram Equilizer
Ue = histeq(U);

%Plotting the equalized image in contrast with the original to compare.
figure();
subplot(2,1,1);
imagesc(U);
title('Original');
subplot(2,1,2);
imagesc(Ue);
title('Histogram Equilizer');
colormap(gray);

%LowPass Filter
h_L = (1./10).*[1 1 1; 1 2 1; 1 1 1];

Ul = imfilter(Ug,h_L);

figure();
subplot(2,1,1);
imagesc(Ug);
title('Gaussian Noise');
subplot(2,1,2);
imagesc(Ul);
title('Low Pass Filter');
colormap(gray);

%Median filter to salt and pepper noise image
Um = medfilt2(Us);
```