Table of Contents

IVP Assignment 4

```
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```

Creating a new environment.

```
clc;
clear all;
close all;
```

Image Imports

```
orig_fingerprint = imread('C:\Chanakya\Projects\ivp-assignments
\Assignment-3\images\fingerprint.jpg');
fingerprint = rgb2gray(orig_fingerprint);
```

Adding Noise to the image

Noise is added to the image via the following distribution:

$$P(a)\ if\ a$$

$$P(b)\ if\ b$$

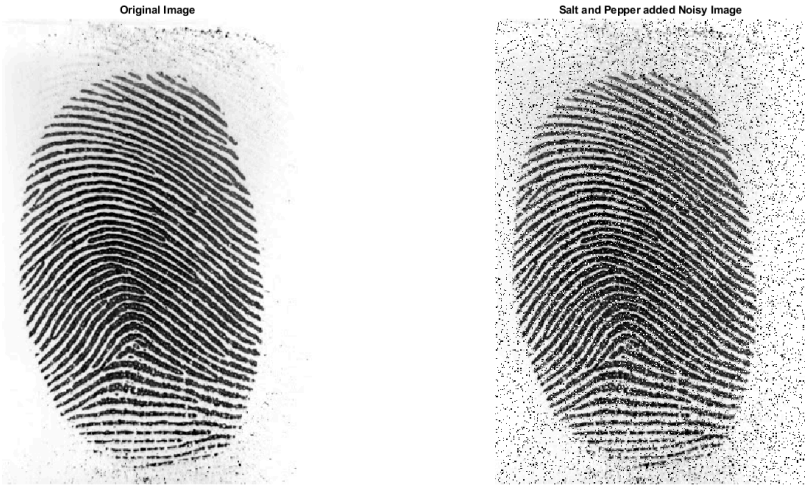
$$else\ 1 - P(a) - P(b)$$

```
[row, col] = size(fingerprint);
noise = randi(255, row, col);
noisy_image = fingerprint;
noisy_image(noise<=15)=0;
noisy_image(noise>=240) = 255;
```

```
% Plotting the images
figure('Name', 'Adding Noise to the Image', 'units', ...
    'normalized','outerposition', [0 0 1 1]);

subplot(1, 2, 1)
imshow(fingerprint);
title('Original Image');

subplot(1, 2, 2)
imshow(mat2gray(noisy_image));
title('Salt and Pepper added Noisy Image');
```



Using the Median Filter

The median filtered image is obtained by the following expression:

$$f(x,y) = median_{(s,t)\in S_{x,y}}(g(s,t))$$

```
median_filtered_image = median_filter(noisy_image, 3, 3);

figure('Name', 'Median Filtering', 'units', ...
    'normalized','outerposition', [0 0 1 1]);

subplot(1, 2, 1)
imshow(mat2gray(noisy_image));
title('Salt and Pepper added Noisy Image');

subplot(1, 2, 2)
imshow(mat2gray(median_filtered_image));
title('Median Filtered Image');
```

Using the Contraharmonic Filter

The contraharmonic filtered image is obtained via the following expression:

$$f(x,y) = \frac{\sum_{(s,t)\in S_{x,y}} g(s,t)^{(Q+1)}}{\sum_{(s,t)\in S_{x,y}} g(s,t)^{(Q)}}$$

```
contraharmonic_image_pos = contraharmonic_filter(noisy_image, 3, 3,
 1);
contraharmonic_image_neg = contraharmonic_filter(noisy_image, 3, 3,
 -1);

figure('Name', 'Contraharmonic Filtering', 'units', ...
    'normalized','outerposition', [0 0 1 1]);

subplot(1, 3, 1)
imshow(mat2gray(noisy_image));
title('Salt and Pepper added Noisy Image');

subplot(1, 3, 2)
imshow(mat2gray(contraharmonic_image_pos));
title('Contraharmonic Filtering (Q=1)');

subplot(1, 3, 3)
imshow(mat2gray(contraharmonic_image_neg));
title('Contraharmonic Filtering (Q=-1)');
```

Conclusion

Through this assignment, we observed how salt and pepper noise can be generated. We also observerved that the median filter is useful for elimating salt and pepper noise and the contraharmonic filter with a positive Q value elminates only pepper noise and with a negative Q value, elimanates only salt noise.

Published with MATLAB® R2020b