IMAGE PROCESSING

LAB 6

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AIM: To synthesize images and add gaussian, salt and pepper and exponential noise to it.

EXERCISE:

1. **Synthesize the image of a chess board. (use intensity 50 for dark block and 170 for bright block). Add gamma noise and exponential noise (both separately) and generate noisy image. Show and comment on histogram of the noisy images.**

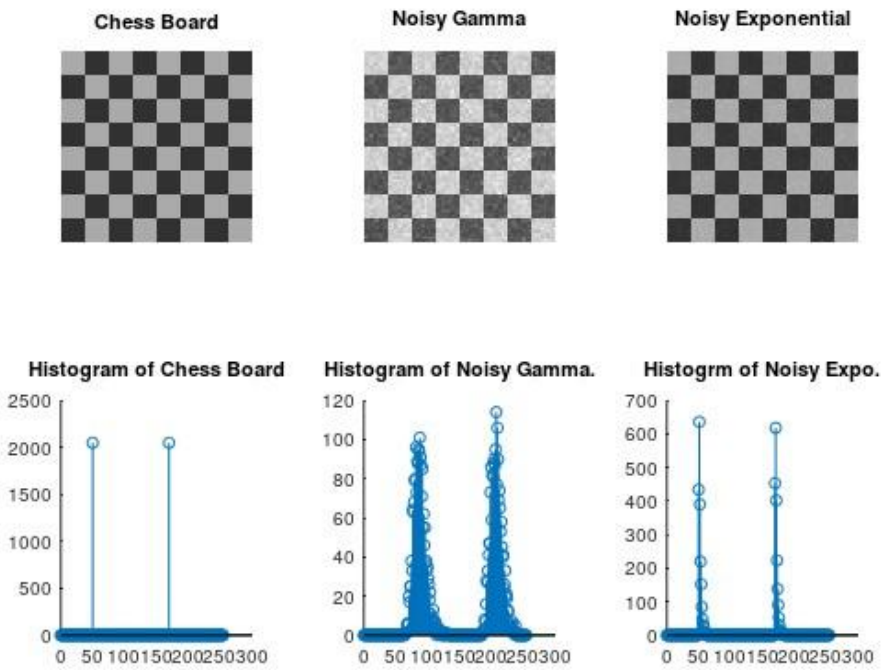
   Code:

```
pkg load image
board = uint8(zeros(64,64));
block = 0;
blockm = 8,blockn = 8;
mr=1,nr=8;
mc=1,nc=8;
black = 50,white = 170;
for ib=1:8 %block row
  for jb=1:8 %block coloum
    if(mod(block,2)==0)
         board(mr:nr,mc:nc)= white;
    elseif(mod(block,2)==1)
        board(mr:nr,mc:nc)=black;
    endif
    mc = mc+blockm;
    nc = nc+blockn;
    block = block+1;
  endfor
  block = block-1;
  mc=1;
  nc=8;
  mr = mr+blockm;
  nr = nr+blockn;
endfor
img = board;
subplot(2,3,1)
imshow(img)
title("Chess Board");
subplot(2,3,4)
stem(0:255,imhist(img));
title("Histogram of Chess Board");
[M,N] = size(img);
a=0.5;
b=19;
```

```
%gamma noise
k=-1/a;
n=zeros(M,N);
for i=1:b
  n=n+k*log(1-rand(M,N));
endfor
noisy = img+n;
subplot(2,3,2)
imshow(noisy);
title("Noisy Gamma");
subplot(2,3,5)
stem(0:255,imhist(noisy));
title("Histogram of Noisy Gamma.");
```

```
%exponential noise;
k=-1/a;
n=k*log(1-rand(M,N));
noisy = img+n;
subplot(2,3,3)
imshow(noisy);
title("Noisy Exponential");
subplot(2,3,6)
stem(0:255,imhist(noisy));
title("Histogrm of Noisy Expo.");
```

Output:



O After performing this exercise, we can conclude that both the noisy images have different histograms as per their characteristics.

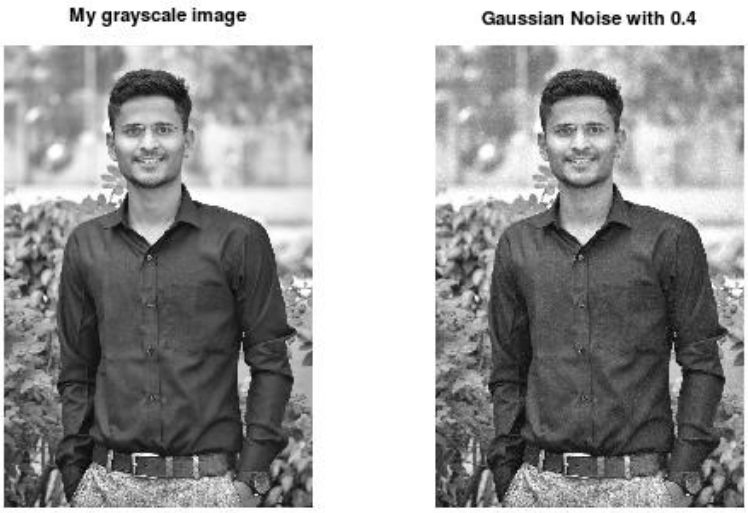
2. Take your Gray scale photo and generate noisy photo with:

- **Gaussian noise with probability 0.4 using randn function.**

```
pkg load image
img = imread('images/my_img.jpg');
subplot(1,2,1)
imshow(img);
title('My grayscale image');
[M,N] = size(img);
sigma=10;
mean=5;
prob=0.4;
noisy = Gaussian(img,sigma,mean,prob);
subplot(1,2,2)
imshow(noisy);
title('Gaussian Noise with 0.4');
```

Gaussian Function:

```
function noisy = Gaussian(img,sigma,mean,prob)
  [M,N]=size(img);
  mask = rand(M,N)<prob;
  n = round(sigma*randn(M,N))+mean;
  n = n.*mask;
  noisy = img+n;
endfunction
```

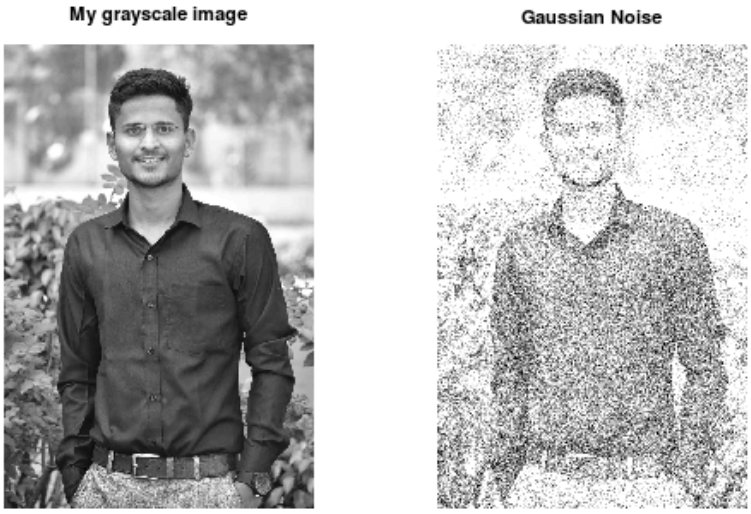


- **Gaussian noise with mean 2 and variance 0.06 using imnoise function.**

Code:

```
pkg load image
img = imread('images/my_img.jpg');
subplot(1,2,1)
imshow(img);
title('My grayscale image');
variance=0.06;
mean=1;
noisy =  imnoise(img,'gaussian',mean,variance);
subplot(1,2,2)
imshow(noisy);
title("Gaussian Noise");
```

Output:



- **Salt and paper noise with probability 0.2 using your user defined function.**

Code:

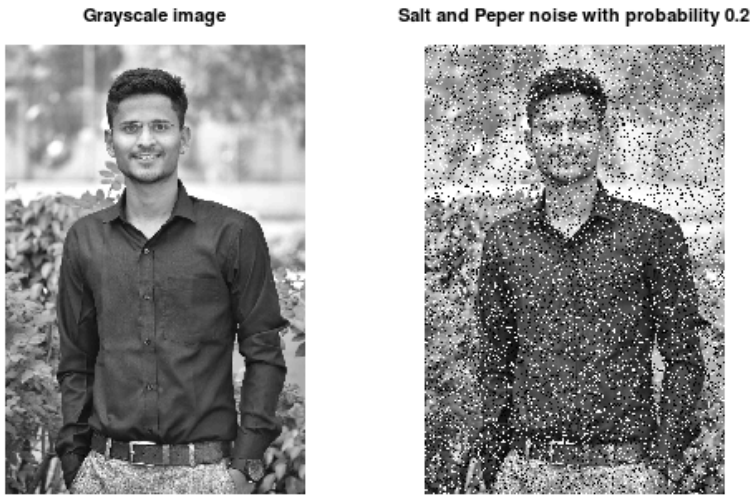
```
pkg load image
img = imread('images/my_img.jpg');
subplot(1,2,1)
imshow(img);
title('Grayscale image');

prob =  0.2;
noisy = saltpaper(img,prob);
subplot(1,2,2)
imshow(noisy);
title("Salt and Peper noise with probability 0.2");
```

saltpaper function:

```
function noisy = saltpaper(img,prob)
  [M,N]=size(img);
  for i=1:(M*N*prob)
    p = round(1+(M-1)*rand());
    q = round(1+(N-1)*rand());
    if(round(rand()) == 0)
      img(p,q) = 255;
    else
      img(p,q) = 0;
    endif
  endfor
  noisy = img;
endfunction
```

Output:



- **Salt noise with probability 0.5 using your user defined function.**

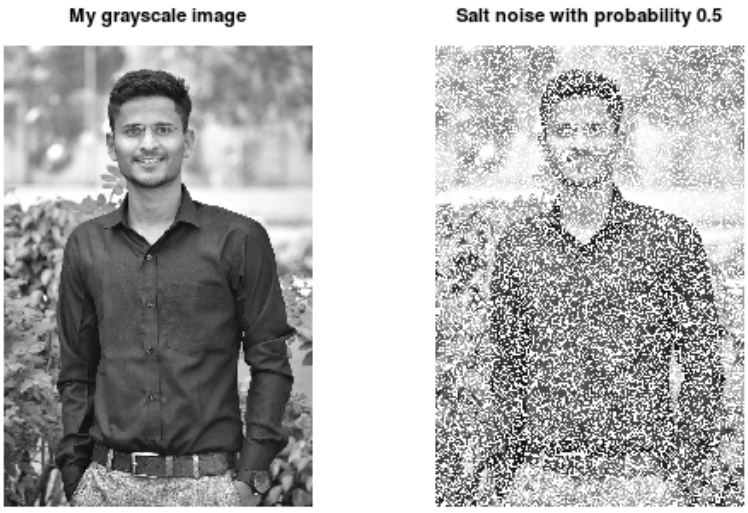
Code:

```
pkg load image
img = imread('images/my_img.jpg');
subplot(1,2,1)
imshow(img);
title('My grayscale image');
prob =  0.5;
noisy = SaltNoise(img,prob);
subplot(1,2,2)
imshow(noisy);
title("Salt noise with probability 0.5");
```

SaltNoise Function:

```
function noisy = SaltNoise(img,prob)
  [M,N]=size(img);
  for i=1:(M*N*prob)
    p = round(1+(M-1)*rand());
    q = round(1+(N-1)*rand());
    img(p,q) = 255;
  endfor
  noisy = img;
endfunction
```

Output:



- **Pepper noise with probability 0.3 using your user defined function.**

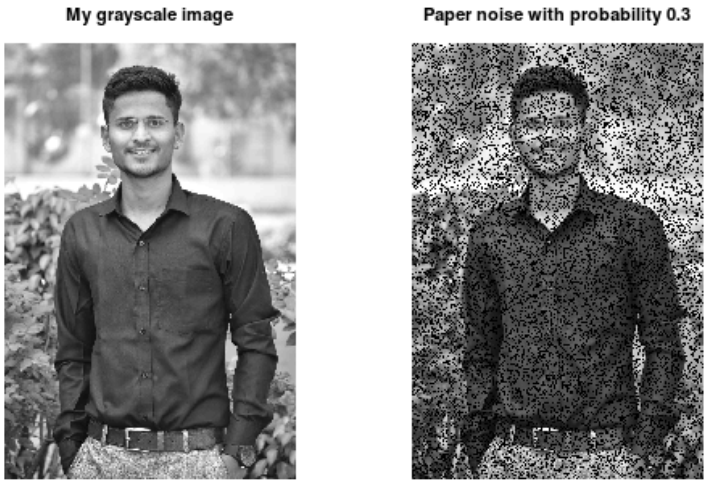
Code:

```
pkg load image
img = imread('images/my_img.jpg');
subplot(1,2,1)
imshow(img);
title('My grayscale image');
prob =  0.3;
noisy = PaperNoise(img,prob);
subplot(1,2,2)
imshow(noisy);
title("Paper noise with probability 0.3");
```

PaperNoise Function:

```
function noisy = PaperNoise(img,prob)
  [M,N]=size(img);
  for i=1:(M*N*prob)
    p = round(1+(M-1)*rand());
    q = round(1+(N-1)*rand());
    img(p,q) = 0;
  endfor
  noisy = img;
endfunction
```

Output:



- **Uniform noise with probability 1 and a=10, b=20.**

Code:

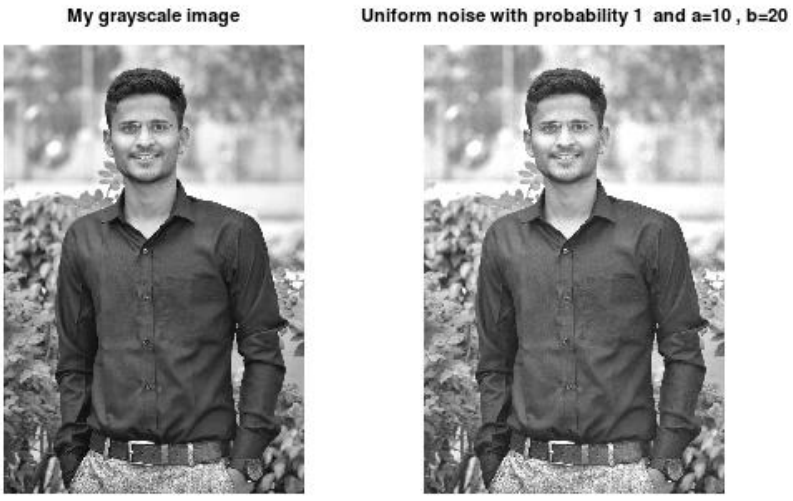
```
pkg load image
img = imread('images/my_img.jpg');
subplot(1,2,1)
imshow(img);
title('My grayscale image');

a=10;
b=20;
noisy = Uniform(img,a,b);
subplot(1,2,2)
imshow(noisy);
title("Uniform noise with probability 1  and a=10 , b=20");
```

Uniform Function:

```
function noisy = Uniform(img,a,b)
  [M,N] = size(img);
  n = uint8(round(a .+ (b-a).*rand(M,N)));
  noisy = img+n;
endfunction
```

Output:



- **Gaussian plus salt and pepper noise.**

Code:

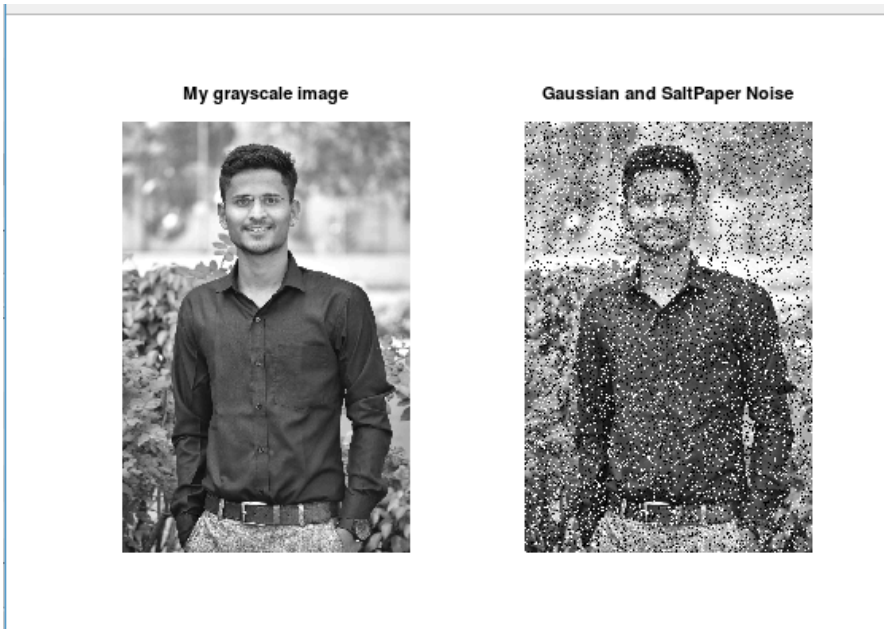
```
pkg load image
img = imread('images/my_img.jpg');
subplot(1,2,1)
imshow(img);
title('My grayscale image');

prob=0.2;
noisy = saltpaper(img,prob);
variance=0.2;
mean=0;
noisy = GaussianNoise(noisy,variance,mean);
subplot(1,2,2)
imshow(noisy);
title("Gaussian and SaltPaper Noise");
```

GaussianNoise Function:

```
function noisy = GaussianNoise(img,sigma,mean)
  [M,N]=size(img);
  n = round(sigma*randn(M,N))+mean;
  noisy = img+n;
endfunction
```

Output:



- **Salt noise with probability 0.3 and pepper noise with probability 0.2**

Cdoe:

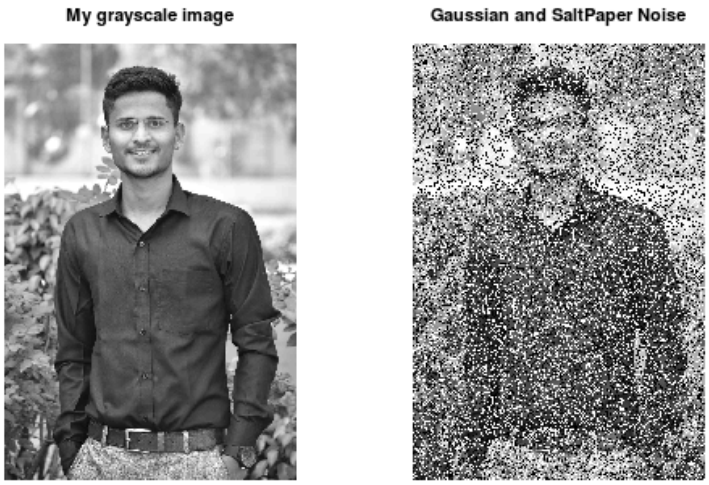
```
pkg load image
img = imread('images/my_img.jpg');
subplot(1,2,1)
imshow(img);
title('My grayscale image');

prob =  0.3;
noisy = SaltNoise(img,prob);

prob =  0.2;
noisy = PaperNoise(noisy,prob);
subplot(1,2,2)
imshow(noisy);
title("Gaussian and SaltPaper Noise");
```

- SaltNoise and PaperNoise Functions are mentioned in above questions.

Output:



- **Salt and pepper noise with random probability of salt and pepper noise.**

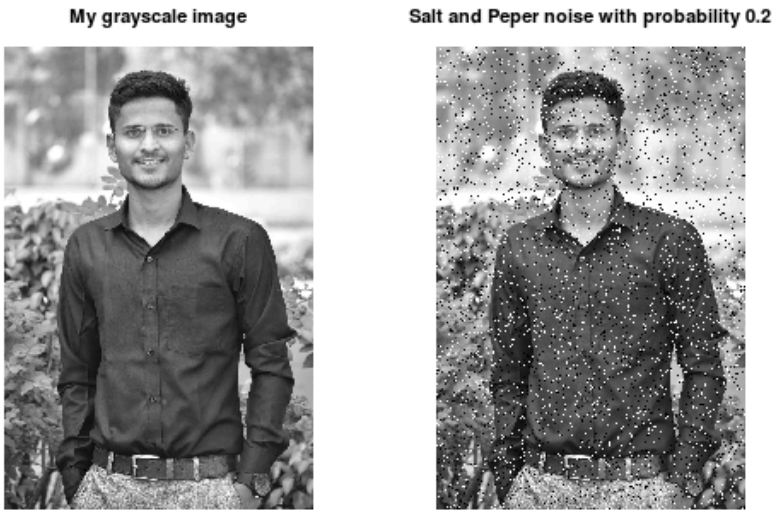
Code:

```
pkg load image
img = imread('images/my_img.jpg');
subplot(1,2,1)
imshow(img);
title('My grayscale image');

prob =  rand();
noisy = saltpaper(img,prob);
subplot(1,2,2)
imshow(noisy);
title("Salt and Peper noise with probability 0.2");
```

O saltpaper function is mentioned in the above questions.

Output:



- **Get information about imnoise and generate various noisy images.**

  Code:

```
pkg load image
image = imread('images/my_img.jpg');
subplot(2,3,1)
imshow(image);
title('My grayscale image');

mean=0;
variance=0.01;
gaussianNoisy = imnoise (image, "gaussian", mean, variance);
subplot(2,3,2)
imshow(gaussianNoisy);
title('Gaussian Noise');

poissionNoisy=imnoise (image, "poisson");
subplot(2,3,3)
imshow(poissionNoisy);
title('Poission Noise');

density=0.05;
saltpaperNoisy = imnoise (image, "salt & pepper", density);
subplot(2,3,4)
imshow(saltpaperNoisy);
title('Salt & Pepper Noise');

speckleNoisy=imnoise (image, "speckle", variance);
subplot(2,3,5)
imshow(speckleNoisy);
title('Speckle Noise');
```

Output: