Image Processing Lab Report

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Experiment 5 : Filtering based image enhancement in Spatial Domain

a. **WAP to apply 3*3 mean filter, 3*3 weighted mean filter, 5*5 mean filter, and 5*5 Bartlett filter on a grayscale image. Discuss your result.**

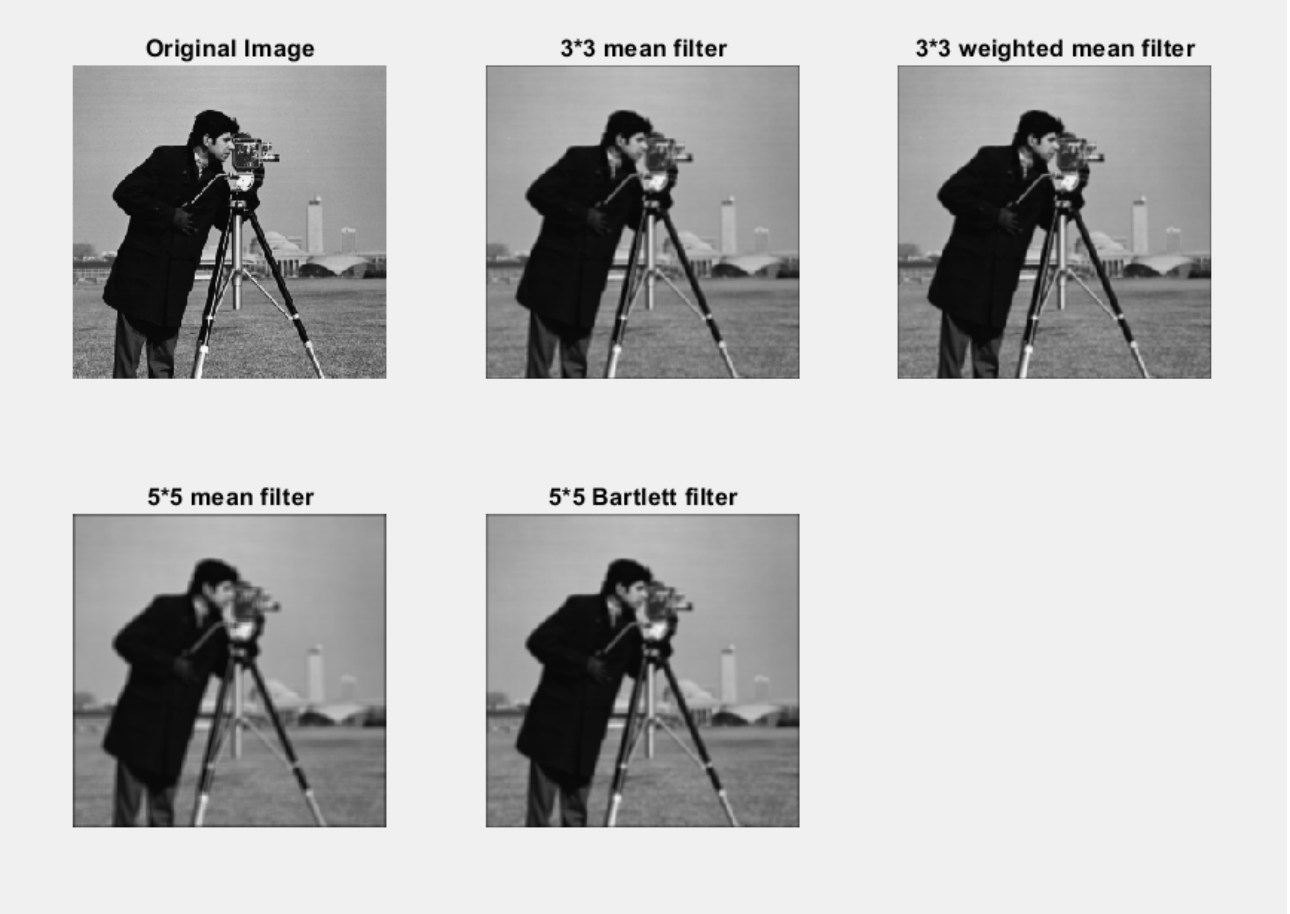
Code

e5a.m

```
I = imread('cameraman.tif');
subplot(2,3,1);
imshow(I);
title('Original Image');

%% 3*3 mean filter
m33 = (1/9)*ones(3,3);
J = imfilter(I, m33);
subplot(2,3,2);
imshow(J);
title('3*3 mean filter');

%% 3*3 weighted mean filter
mw33=(1/16)*[1,2,1; 2,4,2; 1,2,1];
L=imfilter(I,mw33);
subplot(2,3,3);
imshow(L);
title('3*3 weighted mean filter');
%% 5*5 mean filter
m55 = (1/25)*ones(5,5);
K = imfilter(I, m55);
subplot(2,3,4);
imshow(K);
title('5*5 mean filter');

%% 5*5 Bartlett filter
bart=(1/81)*[1,2,3,2,1; 2,4,6,4,2; 3,6,9,6,3; 2,4,6,4,2; 1,2,3,2,1];
M=imfilter (I,bart);
subplot(2,3,5);
imshow(M);
```

title("5*5 Bartlett filter");

Result



b. WAP to filter an image using Gaussian filter (use "imgaussfilt()").Also write a user defined function for 3*3 mask and 5*5 mask Gaussian filter. Compare your result.

Code

e5b.m

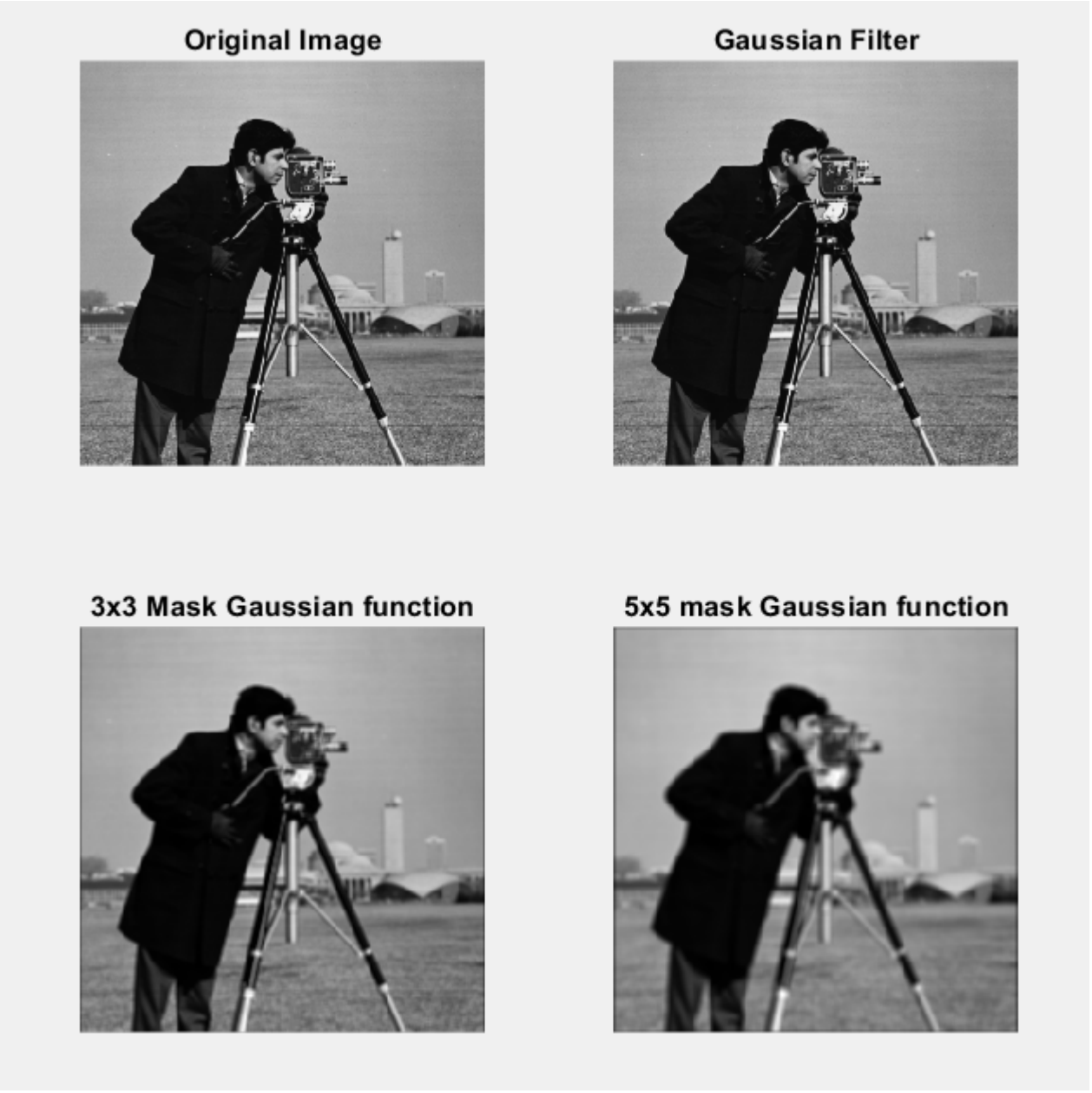
```
%% Original Image
I = imread('cameraman.tif');
subplot(2,2,1);
imshow(I);
title('Original Image');
%% Gaussian Filter
B=imgaussfilt(I,2);
subplot(2,2,2);
imshow(I);
title('Gaussian Filter');
%% 3*3 mask gaussian filter
H=getMaskGaussianFilter(3,2);
```

```
c = filter2(H, I);
subplot(2, 2, 3)
imshow(c,[])
title('3x3 Mask Gaussian function')
%% 5*5 mask gaussian filter
H = getMaskGaussianFilter(5,2);
d = filter2(H, I);
subplot(2, 2, 4)
imshow(d,[])
title('5x5 mask Gaussian function')
```

getMaskGaussianFilter.m

```
function mat = getMaskGaussianFilter(dimen,var)
   mat = zeros(dimen,dimen);
   a=1/((2*pi)^(0.5)*var);
   subVal=round(dimen/2);
   for row=1:dimen
      for col=1:dimen
         mat(row,col)=a*exp((-1/2)*(((row-subVal)^2+(col-subVal)^2)/(var^2)));
      end
   end
   mat
end
```

Result



c. **WAP to add salt and pepper noise to an image. WAP to filter the salt and pepper noisy image using mean and median filter. Vary the size of the filter. Discuss your result. (Use "imnoise" to add noise to the image.)**

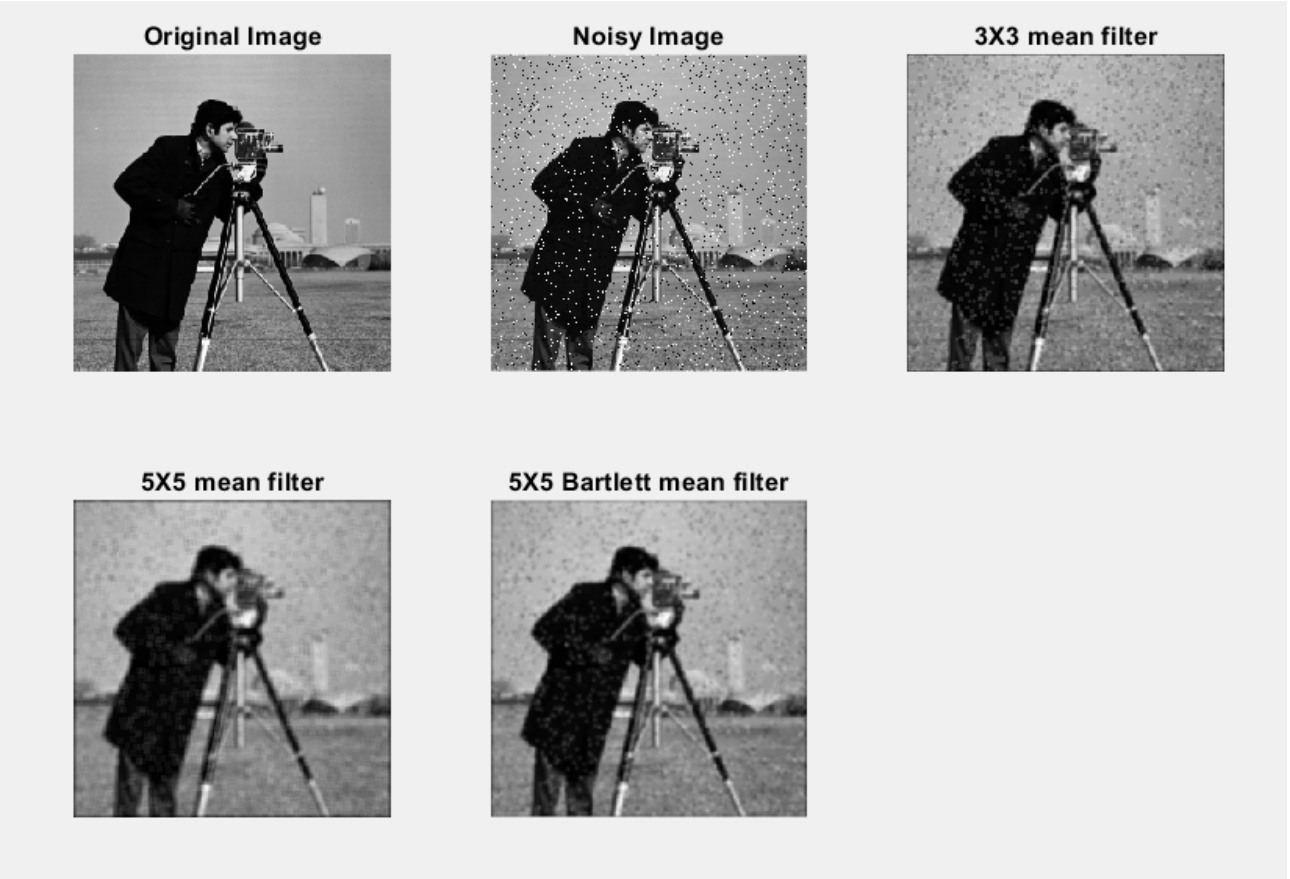
Code

e5c.m

```
close all
clear
clc
I = imread('cameraman.tif');
subplot(2,3,1);
imshow(I, []);
title('Original Image');
```

```
%%
NI = imnoise(I,'salt & pepper');
subplot(2,3,2);
imshow(NI, []);
title('Noisy Image');

%%
f = 1/3*ones(3,1);
F = f*f';
O = filter2(F, NI);
subplot(2,3,3);
imshow(O, []);
title('3X3 mean filter');

f = 1/5*ones(5,1);
F = f*f';
O = filter2(F, NI);
subplot(2,3,4);
imshow(O, []);
title('5X5 mean filter');

f = 1/9*ones(3,3);
F = conv2(f,f);
O = filter2(F, NI);
subplot(2,3,5);
imshow(O, []);
title('5X5 Bartlett mean filter');
```

Result



d. WAP to apply median filter on an image (use in-built function "medfilt2"). Also write a user defined function for median filter. Compare your result.

Code

e5d.m

```
close all
clear
clc
I = imread('cameraman.tif');
subplot(1,3,1);
imshow(I, []);
title('Original Image');
%% In-built
B = medfilt2(I);
subplot(1,3,2);
imshow(B, []);
title('Median Inbuilt Image');
%% Userdefined
C = I;
for row=2:size(I,1)-1
    for col=2:size(I,2)-1
```

```
S=[I(row-1,col-1),I(row-1,col),I(row-1,col+1),I(row,col-1),I(row,col),I(row,col+1),I(r
ow+1,col-1),I(row+1,col),I(row+1,col+1)];
        S=sort(S);
        C(row,col)=median(S);
    end
end
subplot(1,3,3);
imshow(C, []);
title('Median User-defined Image');
```

Result

e. **Take the noisy image created in (c), WAP to apply min filter, max filter and midpoint filter on the noisy image. Analyse your result.**

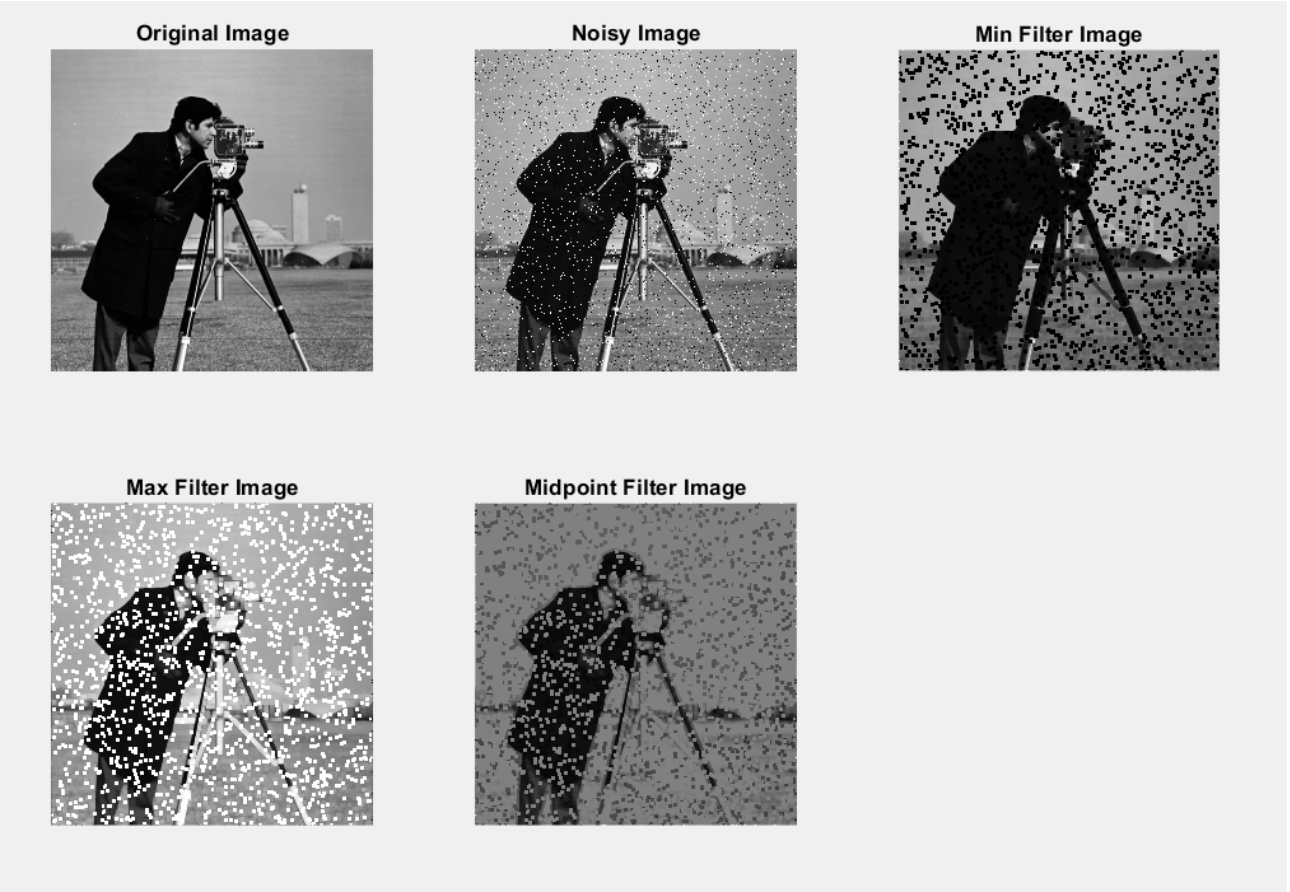
Code

e5e.m

```
close all
clear
clc
I = imread('cameraman.tif');
subplot(2,3,1);
imshow(I, []);
title('Original Image');

NI = imnoise(I,'salt & pepper');
subplot(2,3,2);
imshow(NI, []);
title('Noisy Image');
%% Min, Max and Midpoint Filter
```

```
B = NI;
C = NI;
D = NI;
for row=2:size(NI,1)-1
   for col=2:size(NI,2)-1

S=[NI(row-1,col-1),NI(row-1,col),NI(row-1,col+1),NI(row,col-1),NI(row,col),NI(ro
w,col+1),NI(row+1,col-1),NI(row+1,col),NI(row+1,col+1)];
       S=sort(S);
       B(row,col)=S(1);
       C(row,col)=S(end);
       D(row,col)=(S(1)+S(end))/2;
   end
end
subplot(2,3,3);
imshow(B, []);
title('Min Filter Image');
subplot(2,3,4);
imshow(C, []);
title('Max Filter Image');
subplot(2,3,5);
imshow(D, []);
title('Midpoint Filter Image');
```

Result



f. WAP to perform unsharp masking (i.e high pass filtering) on an image (use" fspecial ('unsharp)" followed by imfilter). Also write a user defined function to perform the same.

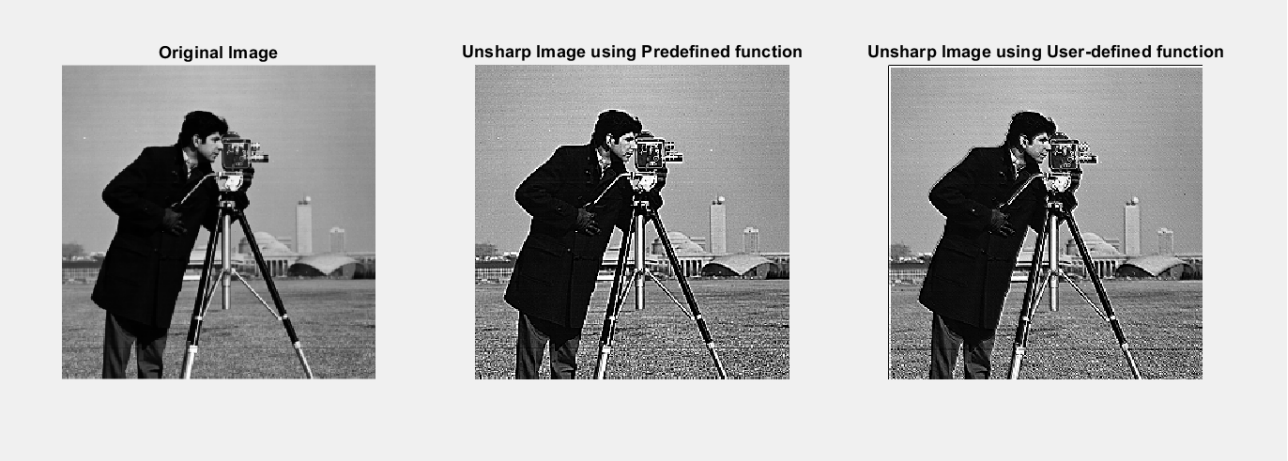
Code

e5f.m

```
close all
clear
clc
I = imread('cameraman.tif');
subplot(1,3,1);
imshow(I, []);
title('Original Image');
%% Predefined
U = fspecial('unsharp');
unsharp = imfilter(I,U,'replicate');
subplot(1,3,2);
imshow(unsharp, []);
title('Unsharp Image using Predefined function');
%% User-defined
G = I;
HPF=[0,1,0;1,-4,1;0,1,0];
```

```
G2=conv2(I,HPF);
for row=1:size(I,1)
   for col=1:size(I,2)
      G(row,col)=I(row,col)-G2(row,col);
   end
end
subplot(1,3,3);
imshow(G,[]);
title('Unsharp Image using User-defined function');
```

Result



g. Write a ‘user defined function()’ to replace 'in-built function histeq()’ for image enhancement using histogram equalization (Use ‘pout.tif’).

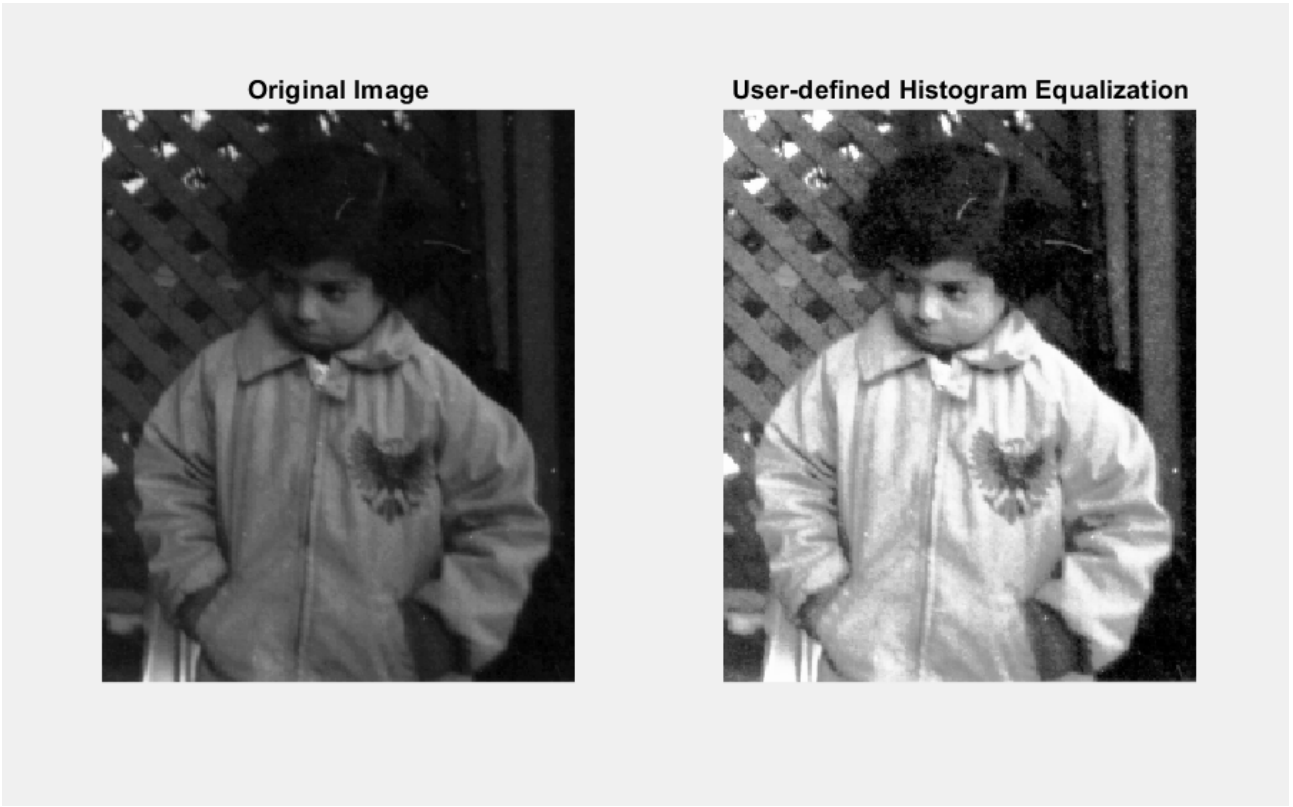
Code

e5g.m

```
close all
clear
clc
I = imread('pout.tif');
subplot(1,2,1);
imshow(I, []);
title('Original Image');
%% User-defined histeq
M=size(I,1);
N=size(I,2);
L=255;

% Generating Histogram Array
c1=zeros(1,256);
```

```
for r=1:size(I,1)
   for c=1:size(I,2)
      c1(I(r,c)+1)=c1(I(r,c)+1)+1;
   end
end

% Histogram Equalization : Where Index represent Original Intensity and
% Value Represents Normalized Intensity
S=c1;
for r=1:size(c1,2)
   c2=c1(1:r);
   nj=sum(c2);
   S(1,r)=((L-1)*nj)/(M*N);
end

% Replacing Original Intensity with Normalized Intensity
HistEquiImg = I;
for r=1:size(I,1)
   for c=1:size(I,2)
      HistEquiImg(r,c)=S(I(r,c));
   end
end
subplot(1,2,2);
imshow(HistEquiImg);
title("User-defined Histogram Equalization");
```

Result



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