## 160050030\_160050031\_1600500 33\_assignment2\_Filtering

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```
function matrix = myLinearContrastStretching(imgmatrix)
[a, b, dimension] = size(mat2gray(imgmatrix));
if dimension==1
  max1 = max(max(imgmatrix));
  min1 = min(min(imgmatrix));
  matrix = (255/(max1- min1))*(imgmatrix-min1);
else
       max1 = max(max(imgmatrix(:,:,1)));
     min1 = min(min(imgmatrix(:,:,1)));
     matrix(:,:,1) = (255/(max1-min1))*(imgmatrix(:,:,1)-min1);
       max2 = max(max(imgmatrix(:,:,2)));
     min2 = min(min(imgmatrix(:,:,2)));
     matrix(:,:,2) = (255/(max2-min2))*(imgmatrix(:,:,2)-min2);
```

```
max3 = max(max(imgmatrix(:,:,3)));
     min3 = min(min(imgmatrix(:,:,3)));
     matrix(:,:,3) = (255/(max3-min3))*(imgmatrix(:,:,3)-min3);
end
%% MyMainScript
tic;
%% Your code here
imgPath1 = '../data/lionCrop.mat';
Struct = load(imgPath1);
Image1 = Struct.imageOrig;
InputImage = mat2gray(myLinearContrastStretching(Image1));
radius1=2;
scale1=2;
```

```
OutputImage=myUnsharpMasking(Image1,radius1,scale1);
  figure
subplot(1,2,1);
imshow(InputImage), colorbar;
subplot(1,2,2);
imshow(Outputlmage), colorbar;
imgPath2 = '../data/superMoonCrop.mat';
Struct2 = load(imgPath2);
Image2 = Struct2.imageOrig;
InputImage2 = mat2gray(myLinearContrastStretching(Image2));
radius2=2;
scale2=2;
Output Image 2 = my Unsharp Masking (Image 2, radius 2, scale 2);
```

```
3
figure
```

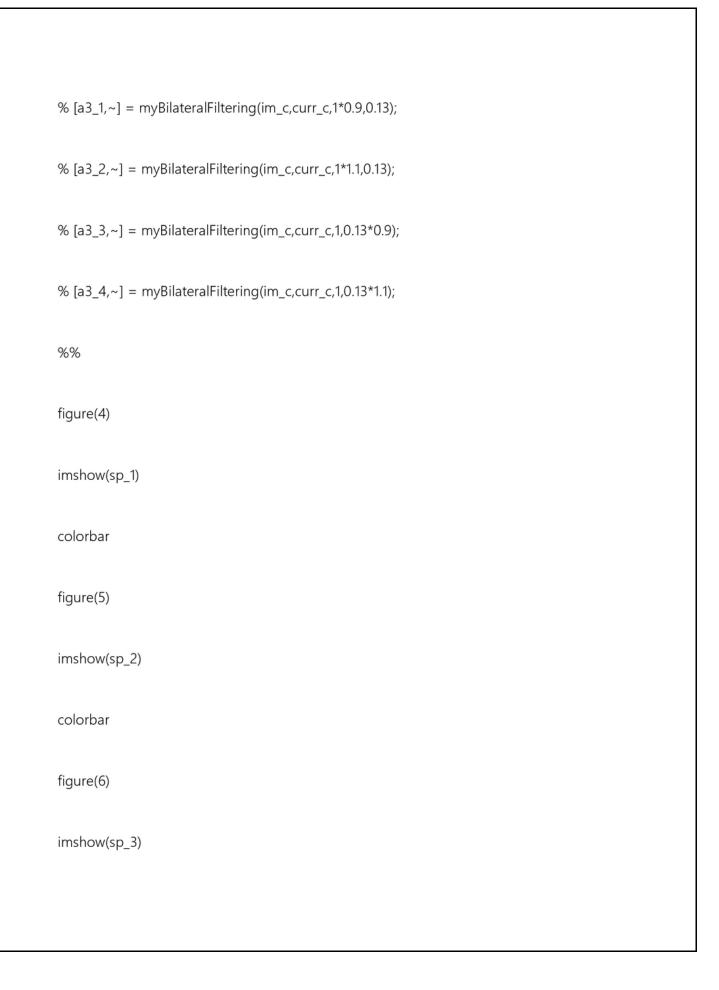
```
subplot(1,2,1);
imshow(InputImage2), colorbar;
subplot(1,2,2);
imshow(Outputlmage2), colorbar;
toc;
function [OutputImage] = myUnsharpMasking(Image,radius,scale)
A = fspecial('gaussian',[5,5], radius);
convolution = imfilter(Image,A,'conv');
matrix = Image + scale*(Image - convolution);
OutputImage = mat2gray(myLinearContrastStretching(matrix));
end
ASSIGNMENT 2 QUESTION 1
```

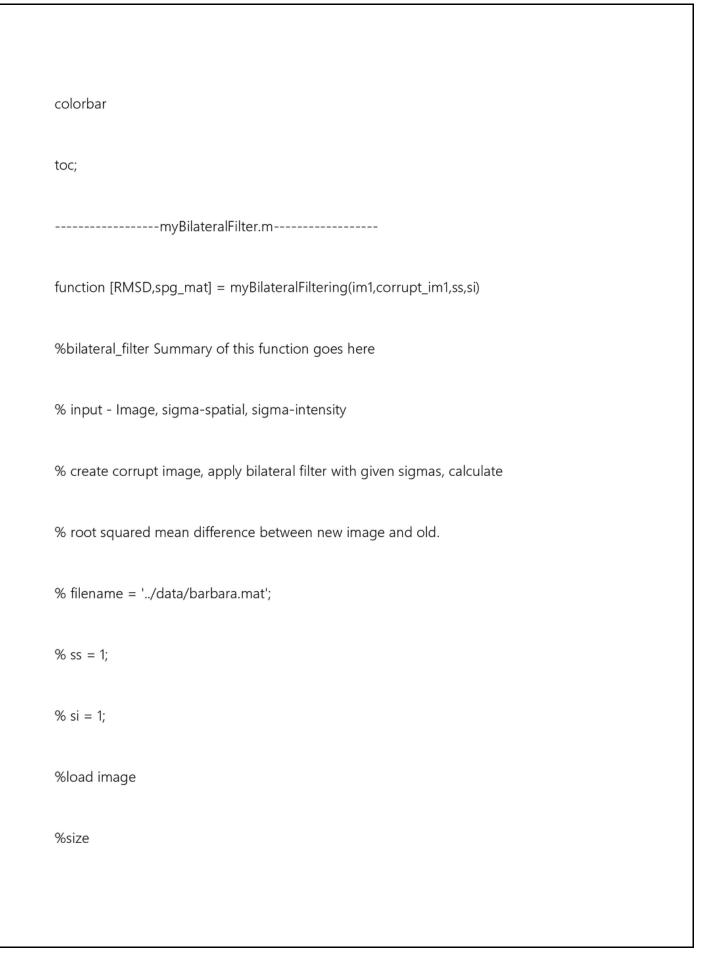
Files included
myLinearContrastStretching.m
myMainScript.m
myUnsharpMasking.m
OUTPUT -
For lionCrop.mat -
Window size of gaussian = 5x5 radius =2 scaling =2
For superMoon.mat
Window size of gaussian = 5x5 radius =2 scaling =2
Ques2
myMainScript.m

```
%% MyMainScript
tic;
%% Your code here
%Loading barbara original and corrupt it
load('../data/barbara.mat')
im_a = imageOrig;
max1 = max(max(im_a));
min1 = min(min(im_a));
range1 = max1 - min1;
curr_a = normrnd(im_a,0.05*range1);
%loading original grass and noisy
im_b = imread('../data/grass.png');
im_b = double(im_b)/256;
```

```
load('../data/grassNoisy.mat')
curr_b = imgCorrupt;
%loading original honeycomb and noisy
im_c = imread('../data/honeyCombReal.png');
im_c = double(im_c)/256;
load('../data/honeyCombReal_Noisy.mat')
curr_c = imgCorrupt;
figure(1)
[a1,sp_1] = myBilateralFiltering(im_a,curr_a,1.5,9.5);
%%
% [a1_1,\sim] = myBilateralFiltering(im_a,curr_a,1.5*0.9,9.5);
% [a1_2,\sim] = myBilateralFiltering(im_a,curr_a,1.5*1.1,9.5);
% [a1_3,\sim] = myBilateralFiltering(im_a,curr_a,1.5,9.5*0.9);
```

```
% [a1_4,\sim] = myBilateralFiltering(im_a,curr_a,1.5,9.5*1.1);
%%
figure(2)
[a2,sp_2] = myBilateralFiltering(im_b,curr_b,0.9,0.14);
%%
% [a2_1,\sim] = myBilateralFiltering(im_b,curr_b,0.9*0.9,0.14);
% [a2_2,\sim] = myBilateralFiltering(im_b,curr_b,0.9*1.1,0.14);
% [a2_3,\sim] = myBilateralFiltering(im_b,curr_b,0.9,0.14*0.9);
% [a2_4,\sim] = myBilateralFiltering(im_b,curr_b,0.9,0.14*1.1);
%%
figure(3)
[a3,sp_3] = myBilateralFiltering(im_c,curr_c,1,0.13);
%%
```





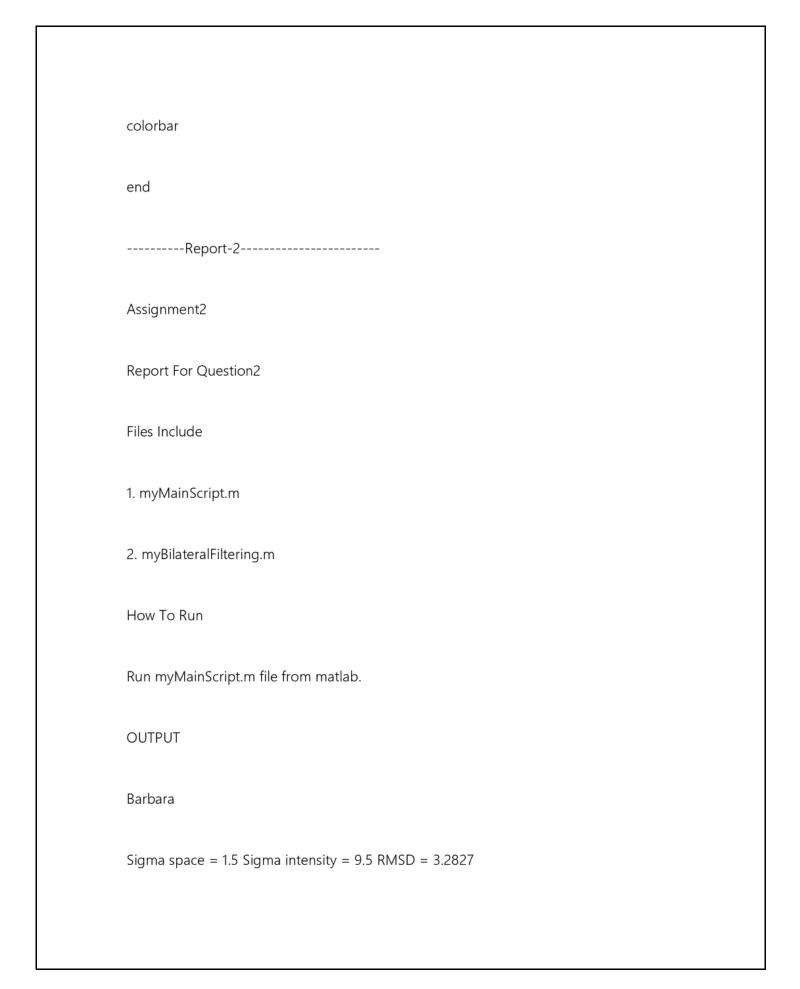
```
[row1,col1] = size(im1);
%initialize new image
new_im1 = zeros(row1,col1);
for i = 1:row1
   for j = 1:col1
     I = floor(j - 3*ss);
     if (1 < 1); 1 = 1; end
     r = floor(j + 3*ss);
     if (r > col1); r = col1; end
     t = floor(i - 3*ss);
     if (t < 1); t = 1; end
     b = floor(i + 3*ss);
```

if (b > row1); b = row1; end

```
in = exp((-0.5/si^2)*(in.*in));
     sp = exp((-0.5/ss^2)*(sp.*sp));
     wts = in.*sp;
     new_im1(i,j) = sum(sum(wts.*X))/sum(sum(wts));
  end
end
%printing gaussian spatial mask
I = 2*floor(3*ss) + 1;
sp_r = 1:1;
sp_r = sp_r';
sp_r = repmat(sp_r,1,l);
sp_c = 1:1;
sp_c = repmat(sp_c, l, 1);
```

```
sp_r = sp_r - (floor(3*ss) + 1);
sp_c = sp_c - (floor(3*ss) + 1);
sp_r = sp_r.*sp_r;
sp_c = sp_c.*sp_c;
sp = sp_r + sp_c;
sp = sqrt(sp);
spg_mat = exp((-0.5/ss^2)*(sp.*sp))/(ss*sqrt(2*pi));
RMSD = sqrt(mean(mean((new_im1 - im1).^2)));
% RMSD = 0;
myNumOfColors=200;
myColorScale = [(0:1/(myNumOfColors-1):1)',(0:1/(myNumOfColors-
1):1)',(0:1/(myNumOfColors-1):1)'];
subplot(1,3,1)
```





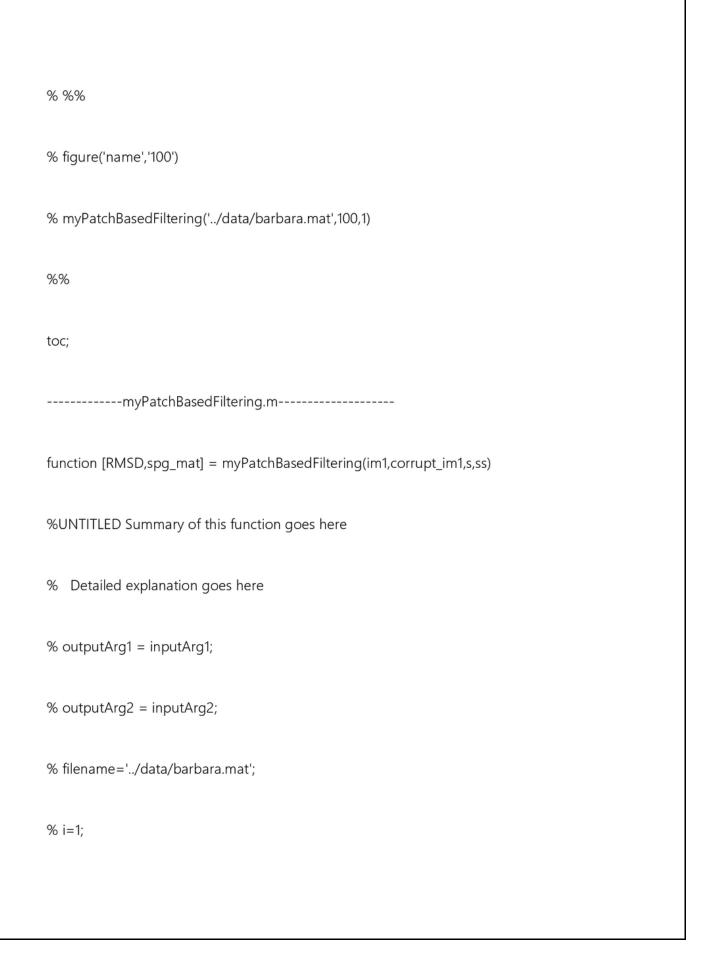
1. 3.289913177490234
2. 3.282960176467896
3. 3.320384263992310
4. 3.283159971237183Grass
Sigma space = 1 Sigma intensity = 0.14 RMSD = 0.078643311009290
1. 0.078693902682144
2. 0.078715169090018
3. 0.078779692223188
4. 0.078607165451484
HoneyComb
Sigma space = 1 Sigma intensity = 0.13 RMSD = 0.070446266752326
1. 0.070539464802749
2. 0.070475655542278

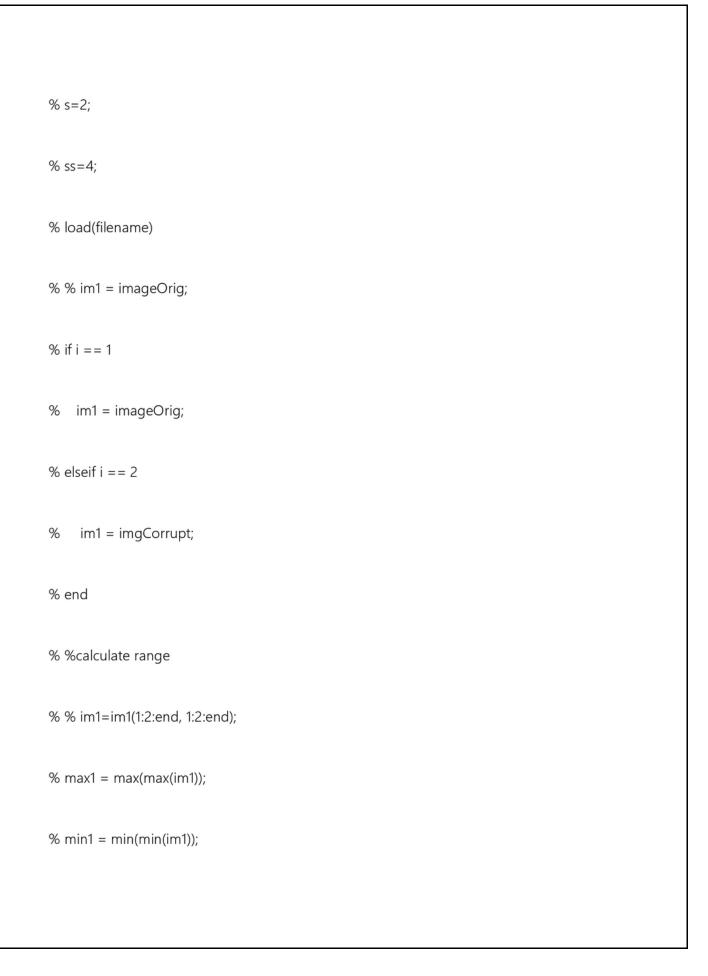
3. 0.070563453428366
4. 0.070447187128614
Ques3
myMainScript.m
%% MyMainScript
tic;
%% Your code here
%Loading barbara original and corrupt it
oad('/data/barbara.mat')
m_a = imageOrig;
m_a = im_a(1:2:end,1:2:end);

```
max1 = max(max(im_a));
min1 = min(min(im_a));
range1 = max1 - min1;
curr_a = normrnd(im_a,0.05*range1);
curr_a = curr_a(1:2:end,1:2:end);
%loading original grass and noisy
im_b = imread('../data/grass.png');
im_b = double(im_b)/256;
load('../data/grassNoisy.mat')
curr_b = imgCorrupt;
%loading original honeycomb and noisy
im_c = imread('../data/honeyCombReal.png');
im_c = double(im_c)/256;
```

```
load('../data/honeyCombReal_Noisy.mat')
curr_c = imgCorrupt;
%%
figure(1)
a1 = myPatchBasedFiltering(im_a,curr_a,2,2);
%%
figure(2)
a2 = myPatchBasedFiltering(im_b,curr_b,1,2);
%%
figure(3)
a3 = myPatchBasedFiltering(im_c,curr_c,0.15,2);
%%
% figure('name','0.001')
```







```
% range1 = max1 - min1;
%size
[row1,col1] = size(im1);
%corrupting image with gaussian noise with std dev = 5% of range
% corrupt_im1 = normrnd(im1,0.05*range1);
%initialize new image
new_im1 = zeros(row1,col1);
windows=25;
patchs=9;
w=(windows-1)/2;
p=(patchs-1)/2;
for i=1:row1
  if((i-w) > = 1)
```

```
iwmin=i-w;
else
  iwmin=1;
end
if((i+w) < = row1)
  iwmax=i+w;
else
  iwmax=row1;
end
if((i-p)>=1)
  ipmin=i-p;
else
  ipmin=1;
```

```
end
if((i+p) < = row1)
  ipmax=i+p;
else
  ipmax=row1;
end
for j=1:col1
  if((j-w) > = 1)
    jwmin=j-w;
  else
    jwmin=1;
  end
  if((j+w) < = col1)
```

```
jwmax=j+w;
else
  jwmax=col1;
end
if((j-p)>=1)
  jpmin=j-p;
else
  jpmin=<mark>1</mark>;
end
if((j+p) < = col1)
  jpmax=j+p;
else
  jpmax=col1;
```

```
end
% patch((ipmin))=im1(ipmin:ipmax, jpmin:jpmax);
% for ip1=ipmin:ipmax
    for jp1=jpmin:jpmax
%
       patch((ip1-ipmin+1),(jp1-jpmin+1))=im1(ip1,jp1);
%
%
     end
% end
wt = zeros(windows,windows);
spacial=zeros(windows,windows);
window_image=zeros(windows,windows);
       sp_r = 1:row1;
       sp_r = sp_r';
       sp_r = repmat(sp_r,1,col1);
```

```
sp_c = 1:col1;
       sp_c = repmat(sp_c,row1,1);
       sp_r = sp_r - i;
       sp_c = sp_c - j;
       sp_r = sp_r.*sp_r;
       sp_c = sp_c.*sp_c;
       sp = sp_r + sp_c;
       % sp = sqrt(sp);
% lambda=jwmax-jwmin+1;
  sum_wt=0;
  numerator=0;
for iw=iwmin:iwmax
  if((iw-p)>=1)
```

%

%

```
ipmin1=iw-p;
else
  ipmin1=1;
end
if((iw+p) < = row1)
  ipmax1=iw+p;
else
  ipmax1=row1;
end
for jw=jwmin:jwmax
  if((jw-p)>=1)
    jpmin1=jw-p;
  else
```

```
jpmin1=1;
end
if((jw+p) < = col1)
  jpmax1=jw+p;
else
  jpmax1=col1;
end
% (1:ipmax-ipmin+1, 1:jpmax-ipmin+1)
% (1:ipmax1-ipmin1+1,1:jpmax1-jpmin1+1)
if ipmax-ipmin==9 && jpmax-jpmin==9
  %display(i);
  %display(iw);
  %display(ipmin1);
```

```
%display(ipmax1);
            %display
            patch1=corrupt_im1(i-(iw-ipmin1):i+(ipmax1-iw), j-(jw-jpmin1):j+(jpmax1-jw));
            patch2=corrupt_im1(ipmin1:ipmax1,jpmin1:jpmax1);
          else
            a=ipmax-ipmin;
            a1=ipmax1-ipmin1;
            b=jpmax-jpmin;
            b1=jpmax1-jpmin1;
            if a>a1
               if b>b1
                  patch1=corrupt_im1(i-(iw-ipmin1):i+(ipmax1-iw), j-(jw-
jpmin1):j+(jpmax1-jw));
```

```
patch2=corrupt_im1(ipmin1:ipmax1, jpmin1:jpmax1);
    c=sp(i-(iw-ipmin1):i+(ipmax1-iw), j-(jw-jpmin1):j+(jpmax1-jw));
  else
     patch1=corrupt_im1(i-(iw-ipmin1):i+(ipmax1-iw), jpmin:jpmax);
     patch2=corrupt_im1(ipmin1:ipmax1, jw-(j-jpmin):jw+(jpmax-j));
    c=sp(i-(iw-ipmin1):i+(ipmax1-iw), jpmin:jpmax);
  end
else
  if b>b1
     patch1=corrupt_im1(ipmin:ipmax, j-(jw-jpmin1):j+(jpmax1-jw));
     patch2=corrupt_im1(iw-(i-ipmin):iw+(ipmax-i),jpmin1:jpmax1);
    c=sp(ipmin:ipmax,j-(jw-jpmin1):j+(jpmax1-jw));
  else
```

```
patch1=corrupt_im1(ipmin:ipmax, jpmin:jpmax);
                 patch2=corrupt_im1(iw-(i-ipmin):iw+(ipmax-i), jw-(j-jpmin):jw+(jpmax-i)
j));
                 c=sp(ipmin:ipmax, jpmin:jpmax);
               end
            end
          end
          % for ip2=ipmin1:ipmax1
              for jp2=jpmin1:jpmax1
                 patch2((ip2-ipmin1+1),(jp2-jpmin2+1))=im1(ip2,jp2);
          %
          %
               end
          % end
          patch3=patch1-patch2;
```

```
c=(1/(sqrt(2*pi)*ss))*exp((-1/(2*ss*ss))*c);
          wt(iw-iwmin+1,jw-jwmin+1)=exp(-(sumsqr(patch3.*c)/s*s));
             % spacial(iw-iwmin+1, jw-jwmin+1) = (i-iw)*(i-iw)+(j-jw)*(j-jw); \\
            window_image(iw-iwmin+1, jw-jwmin+1)=corrupt_im1(iw, jw);
%
             sum_wt=sum_wt+wt;
             numerator()=numerator+wt*corrupt_im1(iw,jw);
%
        end
     end
     % sp = \exp((\text{spacial*}(-0.5))/(\text{ss*ss}));
%
        n_wt = exp((-1/s*s)*wt);
        fprintf()
%
%
        save('special','sp');
%
        save('weights','wt');
```

```
% n_wt = sp.*wt;
       n_wt=wt;
%
     new_im1(i,j)=sum(sum(window_image.*wt))/sum(sum(wt));
  end
     fprintf('%d of %d ₩n', i,row1);
end
%printing gaussian spatial mask
I = 2*floor(3*ss) + 1;
sp_r = 1:1;
sp_r = sp_r';
sp_r = repmat(sp_r, 1, l);
sp_c = 1:1;
sp_c = repmat(sp_c, l, 1);
```

```
sp_r = sp_r - (floor(3*ss) + 1);
sp_c = sp_c - (floor(3*ss) + 1);
sp_r = sp_r.*sp_r;
sp_c = sp_c.*sp_c;
sp = sp_r + sp_c;
sp = sqrt(sp);
spg_mat = exp((-0.5/ss^2)*(sp.*sp))/(ss*sqrt(2*pi));
RMSD = sqrt(mean(mean((new_im1 - im1).^2)));
display(RMSD)
myNumOfColors=200;
myColorScale = [(0:1/(myNumOfColors-1):1)',(0:1/(myNumOfColors-
1):1)',(0:1/(myNumOfColors-1):1)'];
subplot(1,3,1)
```



colorbar
end
Report 3
Assignment 2 Question 3
Files Included
1. myMainScript.m
2. myPatchBasedFiltering.m

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## 160050030\_160050031\_160050033\_assignment2\_Filtering

PAGE 1			
PAGE 2			
PAGE 3			
PAGE 4			
PAGE 5			
PAGE 6			
PAGE 7			
PAGE 8			
PAGE 9			
PAGE 10			
PAGE 11			
PAGE 12			
PAGE 13			
PAGE 14			
PAGE 15			
PAGE 16			
PAGE 17			
PAGE 18			
PAGE 19			
PAGE 20			
PAGE 21			
PAGE 22			
PAGE 23			
PAGE 24			

PAGE 25	
PAGE 26	
PAGE 27	
PAGE 28	
PAGE 29	
PAGE 30	
PAGE 31	
PAGE 32	
PAGE 33	
PAGE 34	
PAGE 35	
PAGE 36	
PAGE 37	
PAGE 38	
PAGE 39	