

# DIP Assignment 1

-201501146

1)

```
I=rgb2gray(imread('./Assign1_imgs/hist_equal2.jpg'));
I1 = rgb2gray(imread('./Assign1_imgs/hist_equal.jpg'));
sz = size(I);
N = sz(1);
M = sz(2);

normalize = 1 / M / N;

h1 = zeros(1,256);
for i=1:N
    for j= 1:M
        val = I(i,j) + 1;
        h1(val) = h1(val) + normalize;
    end
end

h2 = zeros(1,256);
for i= 1:size(I1,1)
    for j= 1:size(I1,2)
        val = I1(i,j) + 1;
        h2(val) = h2(val) + normalize;
    end
end

cdf1 = cumsum(h1) / numel(I);
cdf2 = cumsum(h2) / numel(I1);

sum = 0.0;

lookup = zeros(1,256);

for i = 1:256
%    sum = sum + h(i);
%    lookup(i) = sum * 255 + 0.5;
    [~,ind] = min(abs(cdf1(i) - cdf2));
    lookup(i) = ind -1;
end

sz = size(I);
N = sz(1);
M = sz(2);

for i = 1:N
    for j = 1:M
        I(i,j) = lookup((I(i,j) + 1));
    end
end

imshow(uint8(I));
```





[1,2,3] matched with 4  
4 matched with 3

1b)

```
xc=[500,250,750,100,250];
yc=[250,750,500,200,500];
% rmax=[200,300,400,500,600];
rmax = [200,250,300,350,400];
rho=[0.5,3,4,5,6];

I = imread('Assign1_imgs/portraits2.jpg');
for l = 1:5
    im = zeros(size(l,1), size(l,2),3);
    N = size(im,1);
    M = size(im,2);
    for i = 1:N
        for j=1:M

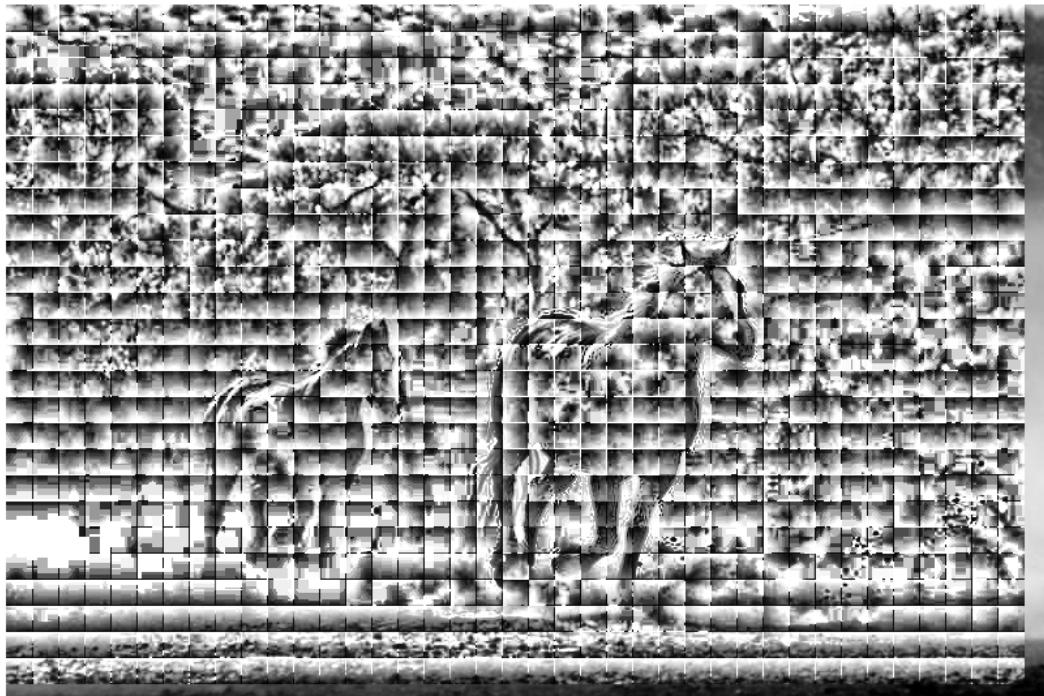
            dx = i - xc(l);
            dy = j - yc(l);
            r = sqrt(dx^2 + dy^2);
            z = sqrt(rmax(l)^2 - r^2);
            betaX = (1 - 1/rho(l)) * asin(dx/sqrt(dx^2 + z^2));
            betaY = (1 - 1/rho(l)) * asin(dy/sqrt(dy^2 + z^2));

            delX = z*tan(betaX);
            delY= z*tan(betaY);

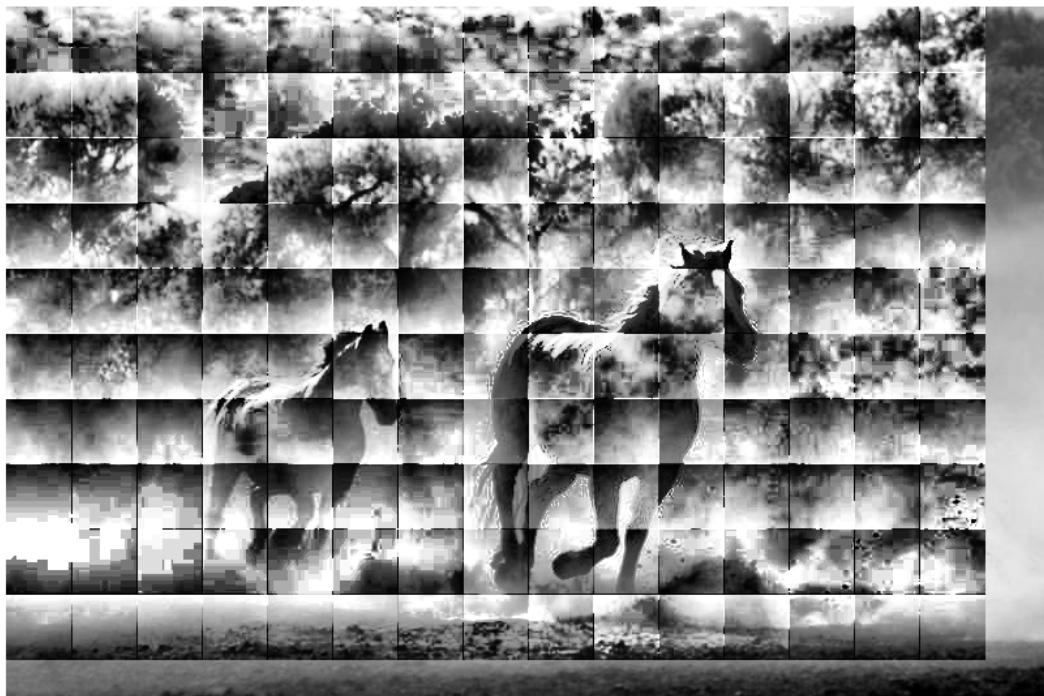
            if r > rmax(l);
                delX = 0;
                delY = 0;
            end
            x = i - int16(round(delX));
            y = j - int16(round(delY));

            x = min(N,x);
            x = max(1,x);
            y = min(M,y);
            y = max(1,y);
            im(i,j,:)= I(x,y,:);
        end
    end
```

```
%  imshow(uint8(im));
  imwrite(uint8(im),['threeb3',num2str(l),'.png']);
end
```



$N = 20, M = 20$



$N = 50, M = 50$



N =100, M = 100

2 a and c)

```
I = imread('Assignment1_imgs/bell.jpg');

% Gauss-----
fsz = [3,5,8];
sigma = [1,2,3];

for q=1:3
    gf = zeros(fsz(q),fsz(q));
    for i = 1:fsz(q)
        for j = 1:fsz(q)
            gf(i,j) = exp(-(abs(fsz(q) - i)^2 + abs(fsz(q) - j)^2) / (2*sigma(q)*sigma(q)));
        end
    end

    total = 0;
    for i = 1:size(gf,1)
        for j = 1:size(gf,2)
            total = total + gf(i,j);
        end
    end

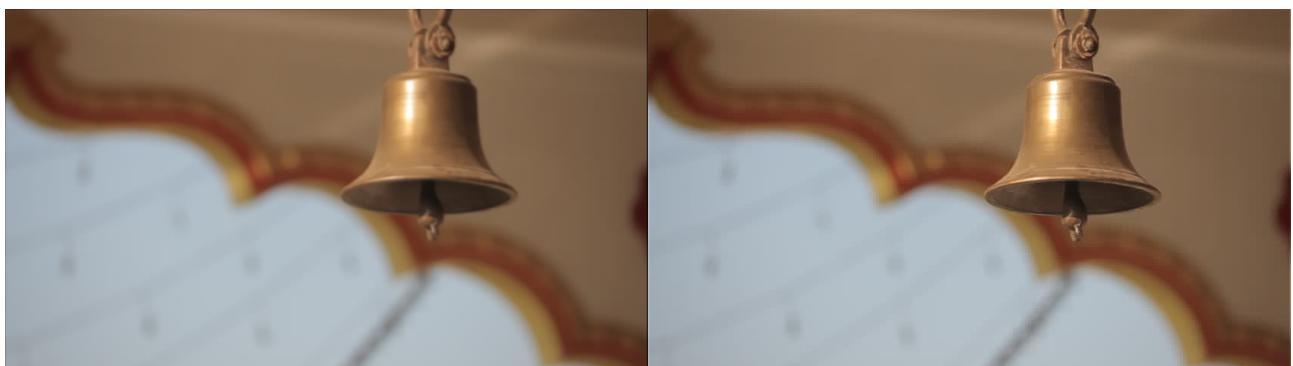
    gf = gf / total;
    gFiltered = imfilter(I, gf);

    % imshow(uint8(gFiltered));

    %High-----
    mask = 0.8;
    sharp = I - gFiltered;
    hbFiltered = I + mask .* sharp;
    % imshow(hbFiltered);
```

```
imwrite([gFiltered,hbFiltered], ['gaussHigh',num2str(q),'.png']);  
end
```

Following are images with filter size [3,5,8] and sigma [1,2,3]



2 b)

```
I = imread('./Assign1_imgs/bell.jpg');
```

% Median-----

```
fsz = 3;  
disp = floor(fsz / 2);  
I = rgb2gray(I);  
mFiltered = I;  
I = padarray(I, [floor(fsz/2) floor(fsz/2)]);  
h = size(I,1);
```

```
w = size(I,2);
for i=1+disp:h-disp
    for j=1+disp:w-disp
        box = I(i-disp:i+disp, j-disp:j+disp);
        box = reshape(box, [1,fsz*fsz]);
        medval = median(box);
        mFiltered(i, j) = medval;
    end
end
imshow(mFiltered);
```

Following are images with filter size[3,5,8]





2 d)

```
I = imread('Assign1_imgs/portraits.jpg');

sigma = 10;
fsz = 8;

I = im2double(I);
least = floor(fsz/2);
I2 = padarray(I, [least least]);
bIFiltered = I;
for i = 1 + least: size(I2,1) - least
    for j = 1 + least: size(I2,2) - least
        box = I2(i - least: i + least, j - least: j + least, :);

        gf = zeros(fsz,fsz);

        for k = 1:fsz
            for l = 1:fsz
                gf = exp(-(abs(fsz - k)^2 + abs(fsz - l)^2) / (2*sigma*sigma));
            end
        end

        diff = [];
        for c = 1:3
            diff =[diff; box(:,:,c) - I2(i,j,c)];
        end

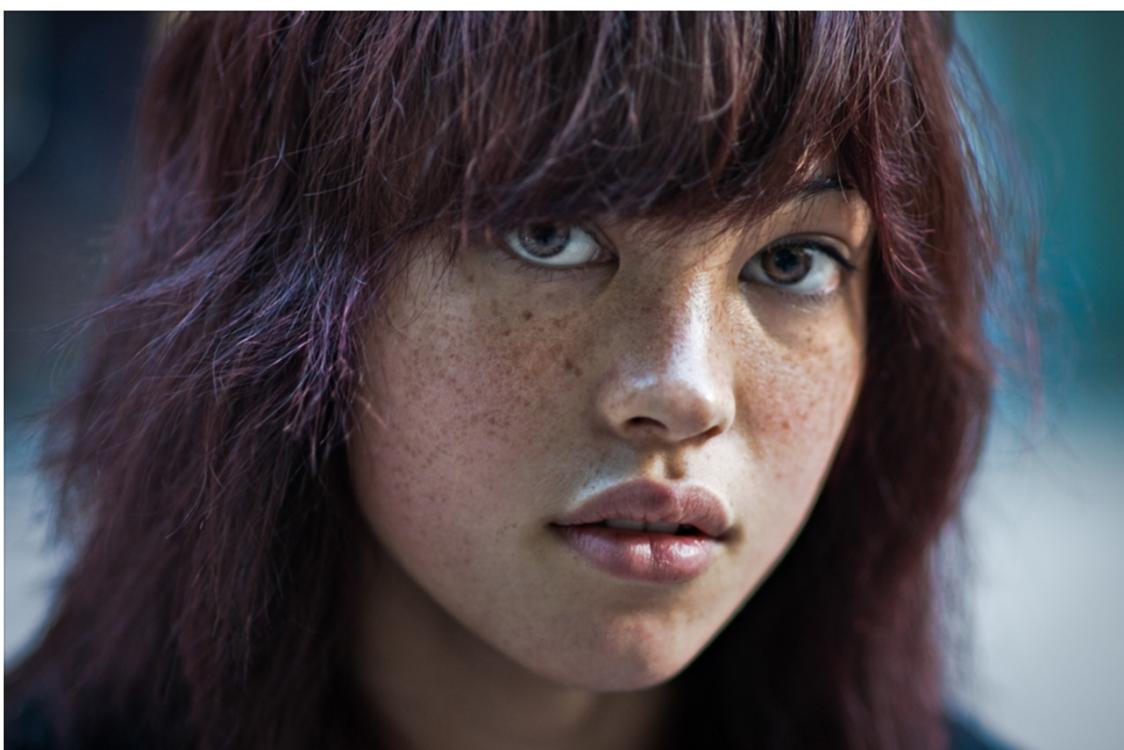
        H = exp(-(diff(1).^2+diff(2).^2+diff(3).^2)/(2*(sigma^2)));

        N = gf .* H;
        N = sum(sum(N(:)));
        for c = 1:3
            temp(:,:,c) = box(:,:,c) .* H;
            temp(:,:,c) = temp(:,:,c) .* gf;
            temp(c) = sum(sum(temp(:,:,c)));
        end
        final(c) = temp(c) / N;
    end
```

```
blFiltered(i, j, :) = final(:);  
end  
end
```

```
imshow(uint8(blFiltered));
```

Following are images with filter sizes [3,5,8] and sigma [3,5,10]





3 a)

```
ax = [5,5,10,20,20];
ay = [5,5,20,10,10];
tx = [10,100,200,100,500];
ty = [10,200,100,100,500];
```

```
I = imread('./Assign1_imgs/bell.jpg');
```

```

for l = 1:5
    im = zeros(size(l,1), size(l,2),3);
    N = size(im,1);
    M = size(im,2);
    for i = 1:N
        for j=1:M
            x = i + int16(round(ax(l)*sin(2*pi*j/tx(l)))); 
            y = j + int16(round(ay(l)*sin(2*pi*i/ty(l)))); 
        % [i,j,x,y]
            x = min(N,x);
            x = max(1,x);
            y = min(M,y);
            y = max(1,y);
            im(i,j,:)= l(x,y,:);
        end
    end
    imwrite(uint8(im),['three3',num2str(l),'.png']);
end

```

Attached are tests on 3 images with

```

ax = [5,5,10,20,20];
ay = [5,5,20,10,10];
tx = [10,100,200,100,500];
ty = [10,200,100,100,500];

```

3 b)

```

xc=[500,250,750,100,250];
yc=[250,750,500,200,500];
% rmax=[200,300,400,500,600];
rmax = [200,250,300,350,400];
rho=[0.5,3,4,5,6];

I = imread('./Assign1_imgs/portraits2.jpg');
for l = 1:5
    im = zeros(size(l,1), size(l,2),3);
    N = size(im,1);
    M = size(im,2);
    for i = 1:N
        for j=1:M
            dx = i - xc(l);
            dy = j - yc(l);
            r = sqrt(dx^2 + dy^2);
            z = sqrt(rmax(l)^2 - r^2);
            betaX = (1 - 1/rho(l)) * asin(dx/sqrt(dx^2 + z^2));
            betaY = (1 - 1/rho(l)) * asin(dy/sqrt(dy^2 + z^2));

            delX = z*tan(betaX);
            delY= z*tan(betaY);

            if r > rmax(l);
                delX = 0;
                delY = 0;
            end
            x = i - int16(round(delX));
            y = j - int16(round(delY));

            x = min(N,x);
            x = max(1,x);

```

```

y = min(M,y);
y = max(1,y);
im(i,:,:)=l(x,y,:);
end
end
% imshow(uint8(im));
imwrite(uint8(im),['threeb3',num2str(l),'.png']);
end

```

Attached are tests on images with

```

xc=[500,250,750,100,250];
yc=[250,750,500,200,500];
rmax = [200,250,300,350,400];
rho=[0.5,3,4,5,6];

```

For the first two images  
but

**rmax=[200,300,400,500,600]** for the third

4)

```

I = imread('./Assign1_imgs/stereo_pair.jpg');
split = size(I,2)/2;

```

I1 = I(:, 1:split -9 , :);

I2 = I(:,split + 10: size(I,2), :);

% imshow(I1);

% [x,y] = getpts;

% pts1 = [x,y];

%

% imshow(I2);

% [x,y] = getpts;

% pts2 = [x,y];

PH = [];

B = [];

for i = 1:4

p1 = [-pts1(i,1),-pts1(i,2), -1, 0,0,0, pts1(i,1)\*pts2(i,1), pts1(i,2)\*pts2(i,1)];

p2 = [0,0,0,-pts1(i,1),-pts1(i,2), -1, pts1(i,1)\*pts2(i,2) , pts1(i,2)\*pts2(i,2)];

p = [p1;p2];

PH = [PH ; p];

B = [B ; pts2(i,1); pts2(i,2)];

end

% B = zeros(8,1);

h = inv(PH) \* B;

h = [h;1];

H = reshape(h, [3,3]);

F = zeros(size(I1,1), size(I1,2));

t = maketform('projective',H);

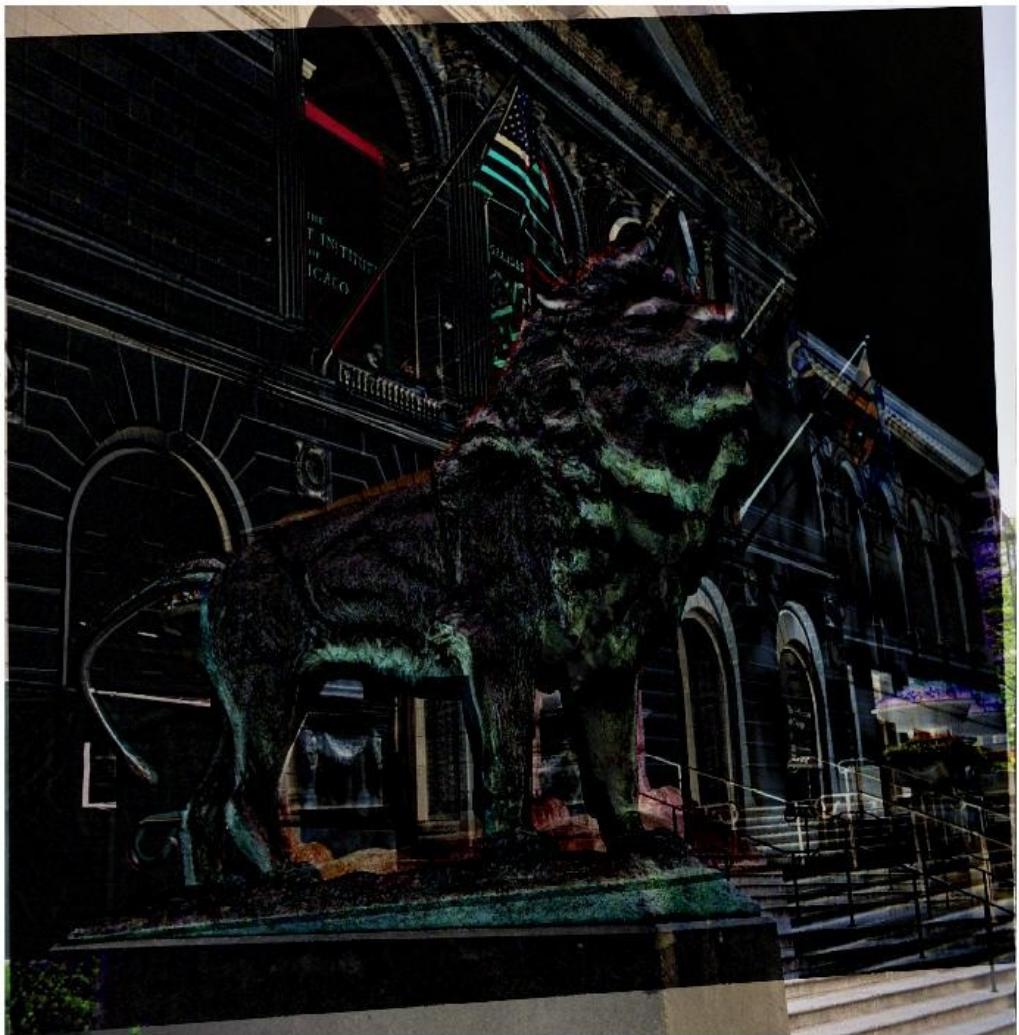
F = imtransform(I1,t);

F = flipud(F);

F = fliplr(F);

F = I1 - imresize(F,[size(I2,1),size(I2,2)]);

imshow(F);



Difference image after transformation