Project 4

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1. Source codes

```
clc;
clear;
close all;
%% read original image
Im = imread('Bird 3 blurred.tif');
[w,h,nChannels] = size(Im);
Im = im2double(Im);

%% Figures of R, G, B, H , S and I component images
HSI = rgb2hsi(Im);
Im_pr = hsi2rgb(HSI);
Im_pr = im2uint8(Im_pr);
%inverse rgb hsi test
% figure;
% subplot(1,2,1);
% imshow(Im_pr);
% subplot(1,2,2);
% imshow(Im);
R_component = Im(:,:,1);
G_component = Im(:,:,2);
B_component = Im(:,:,3);
H_component = HSI(:,:,1);
S_component = HSI(:,:,2);
I_component = HSI(:,:,3);
figure('Name','Figures of R, G, B, H , S and I component
images','NumberTitle','off');
subplot(2,3,1);
imshow(R_component);
title('R component image')
subplot(2,3,2);
imshow(G_component);
title('G component image')
```

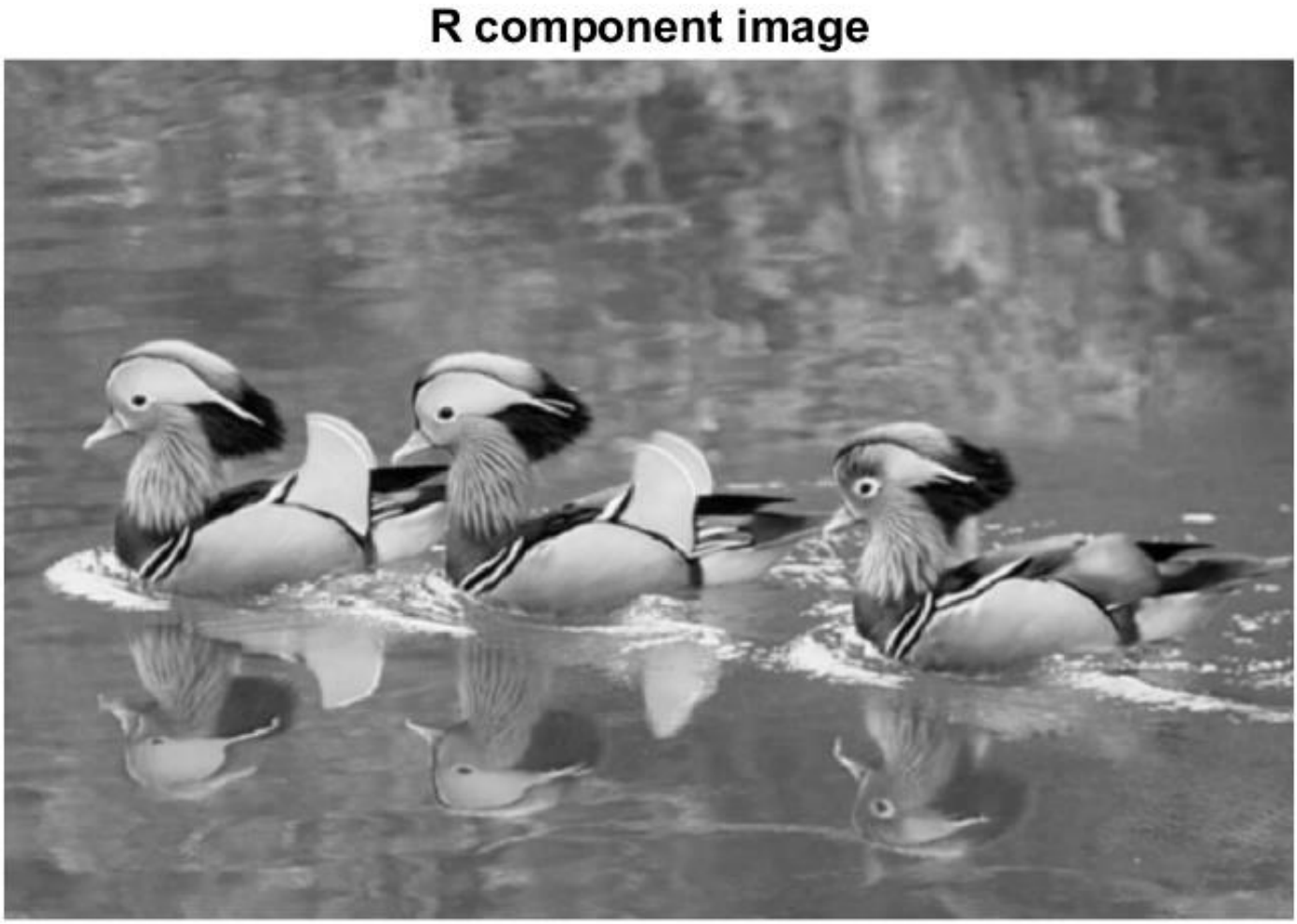
```
subplot(2,3,3);
imshow(B_component);
title('B component image')
subplot(2,3,4);
imshow(H_component);
title('H component image')
subplot(2,3,5);
imshow(S_component);
title('S component image')
subplot(2,3,6);
imshow(I_component);
title('I component image')

%% Figures of RGB based (15%) and HSI based (15%) sharpened
images and their  difference image (10%)
lap_kernal = [  -1 -1 -1;
               -1 8 -1;
               -1 -1 -1];
% RGB filter filter each channel
Im_RGB_filter_process = Im +
cat(3,filter2(lap_kernal,R_component),...

filter2(lap_kernal,G_component),...

filter2(lap_kernal,B_component));
figure('Name','Figures of RGB based and HSI based sharpened
images and their difference image','NumberTitle','off');
subplot(1,3,1);
imshow(Im_RGB_filter_process);
title('RGB based sharpened image')
% HSI filter filter Intensity component
Im_HSI_filter_process = cat(3,H_component, S_component,
filter2(lap_kernal,I_component)+I_component);
Im_HSI_filter_process = hsi2rgb(Im_HSI_filter_process);
subplot(1,3,2);
imshow(Im_HSI_filter_process);
title('HSI based sharpened image')
% difference
```

```
subplot(1,3,3);
Im_diff = Im_HSI_filter_process - Im_RGB_filter_process;
Im_diff = rgb2gray(Im_diff);
Im_diff = mat2gray(Im_diff);
imshow(Im_diff);
title('Difference image')
%% function of hsi2rgb and rgb2hsi
function HSI = rgb2hsi(rgb)
    R_component = rgb(:,:,1);
    G_component = rgb(:,:,2);
    B_component = rgb(:,:,3);

    %Hue
    child = 1/2*((R_component-G_component)+(R_component-
B_component));
    parent = ((R_component-G_component).^2+((R_component-
B_component).*(G_component-B_component))).^0.5;
    theta = acosd(child./(parent+0.0000000001));
    % if B>G ,H = 360 - theta
    theta(B_component>G_component) = 360 -
theta(B_component>G_component);
    H_component = theta/360;
    %Saturation
    S_component=1-
(3./(sum(rgb,3)+0.0000000001)).*min(rgb,[],3);
    %Intensity
    I_component=sum(rgb,3)./3;
    HSI = cat(3,H_component,S_component,I_component);
end
function rgb = hsi2rgb(hsi)
    H_component = hsi(:,:,1);
    S_component = hsi(:,:,2);
    I_component = hsi(:,:,3);
    H_component = H_component * 360;
    R=zeros(size(H_component));
    G=zeros(size(H_component));
    B=zeros(size(H_component));
```

```
    %RG Sector(0<=H<120)
    B(H_component<120)=I_component(H_component<120).*(1-
S_component(H_component<120));

R(H_component<120)=I_component(H_component<120).*(1+((S_compon
ent(H_component<120).*cosd(H_component(H_component<120))./cos
d(60-H_component(H_component<120))));
    G(H_component<120)=3.*I_component(H_component<120)-
(R(H_component<120)+B(H_component<120));

    %GB Sector(120<=H<240)
    H_2 = H_component-120;

R(H_component>=120&H_component<240)=I_component(H_component>=1
20&H_component<240).*(1-
S_component(H_component>=120&H_component<240));

G(H_component>=120&H_component<240)=I_component(H_component>=1
20&H_component<240).*(1+((S_component(H_component>=120&H_compo
nent<240).*cosd(H_2(H_component>=120&H_component<240))./cosd(
60-H_2(H_component>=120&H_component<240))));

B(H_component>=120&H_component<240)=3.*I_component(H_component
>=120&H_component<240)-
(R(H_component>=120&H_component<240)+G(H_component>=120&H_comp
onent<240));

    % BR Sector(240<=H<=360)
    H_2 = H_component-240;

G(H_component>=240&H_component<=360)=I_component(H_component>=
240&H_component<=360).*(1-
S_component(H_component>=240&H_component<=360));

B(H_component>=240&H_component<=360)=I_component(H_component>=
240&H_component<=360).*(1+((S_component(H_component>=240&H_com
ponent<=360).*cosd(H_2(H_component>=240&H_component<=360))./c
osd(60-H_2(H_component>=240&H_component<=360))));
```

```
R(H_component>=240&H_component<=360)=3.*I_component(H_componen
t>=240&H_component<=360)-
(G(H_component>=240&H_component<=360)+B(H_component>=240&H_com
ponent<=360));
    rgb = cat(3,R,G,B);


end
```

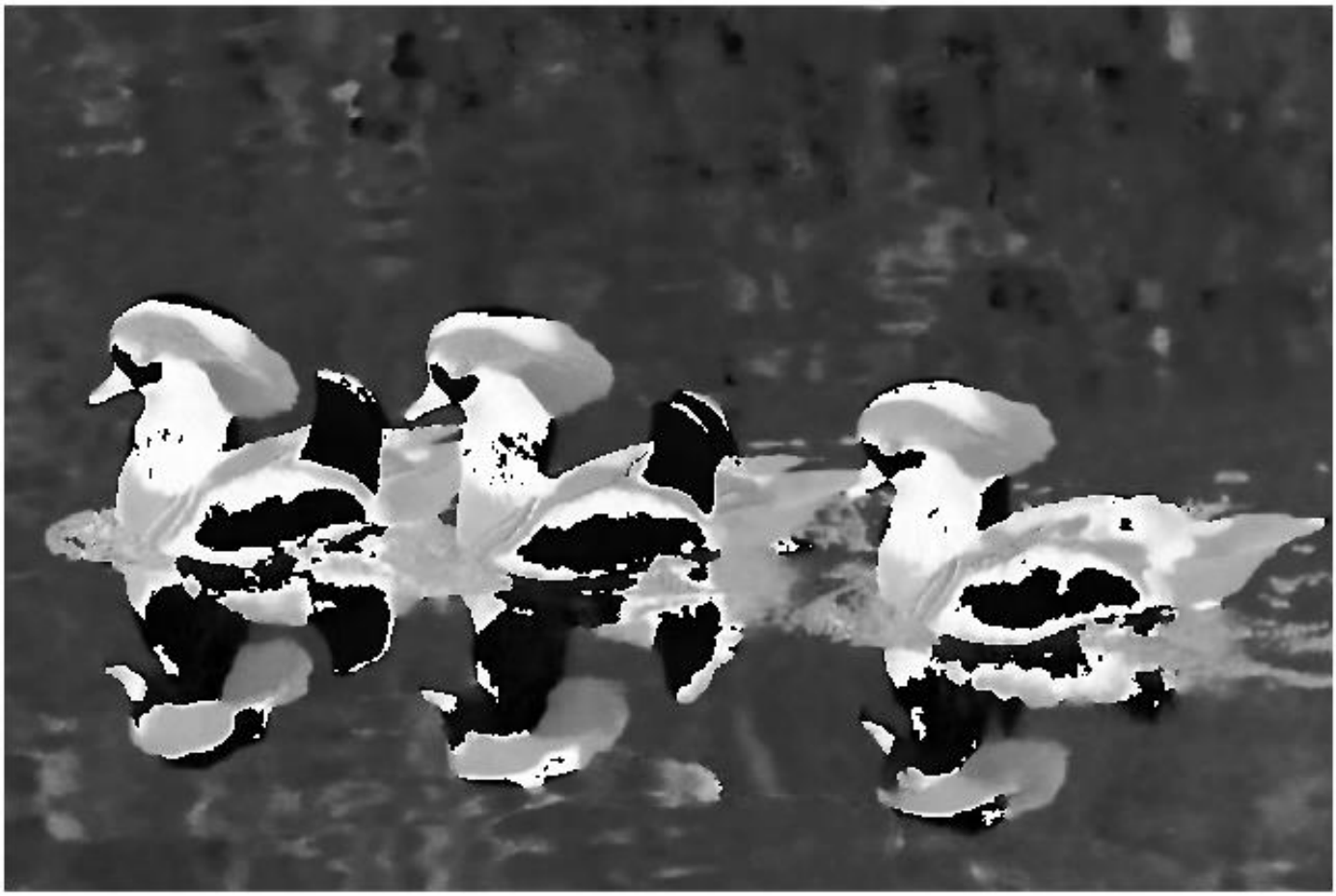
2. Figures of R, G, B, H, S and I component images



G component image

B component image

H component image



S component image

I component image

3. Figures of RGB based and HSI based sharpened images and their difference image

RGB based sharpened image

HSI based sharpened image

Difference image