THE UNIVERSITY OF TEXAS AT ARLINGTON, TEXAS
DEPARTMENT OF ELECTRICAL ENGINEERING

EE 5356

DIGITAL IMAGE PROCESSING

PROJECT # 5

by

SOUTRIK MAITI

1001569883

Presented to

Dr. K.R.RAO

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Color Transformation 3b

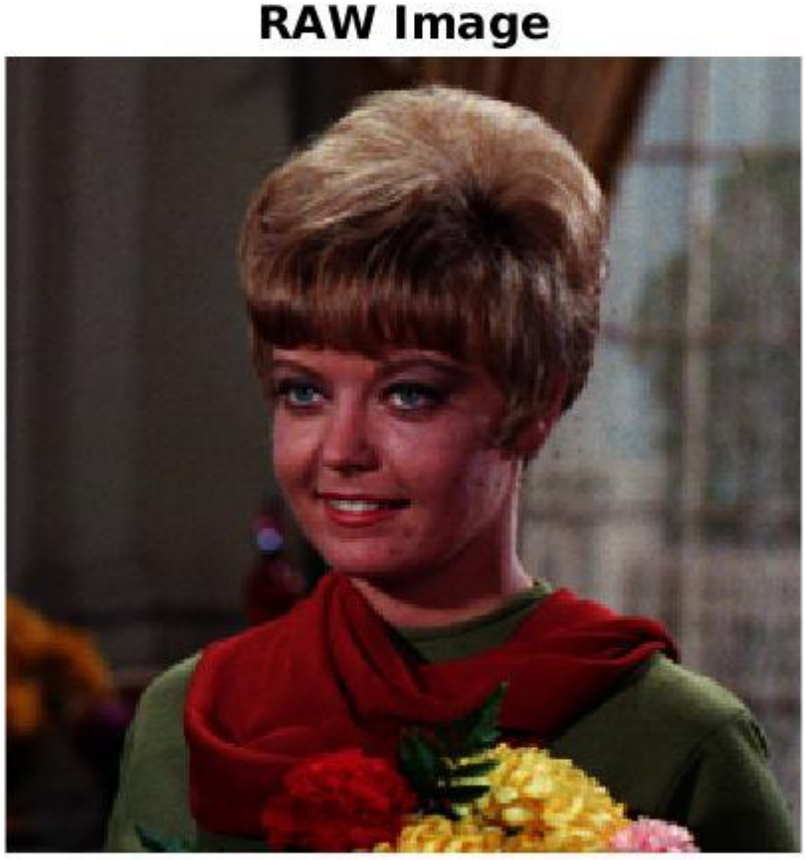
Problem 1 &2 (MATLAB Code):

```
clc;
close all;
clear all;

%% Open the RAW image

img_raw = fopen('girl256color.raw','r');

%% Read the RAW image

img_raw = fread(img_raw);

%% Extract the RGB components of the image

R_img_raw = reshape(img_raw(1:3:length(img_raw)),256,256)';
G_img_raw = reshape(img_raw(2:3:length(img_raw)),256,256)';
B_img_raw = reshape(img_raw(3:3:length(img_raw)),256,256)';

%% Make the complete image

I(:,:,1) = R_img_raw;
I(:,:,2) = G_img_raw;
I(:,:,3) = B_img_raw;

%% Display the RAW image

figure
imshow(uint8(I))
title('RAW Image')
saveas(gca,'RAW_image','jpg');

%% For the first problem, we deploy the following algorithm

%% Initialize a matrix of zeros of the same size as that of the
image

YIQ_img = uint8(zeros(size(I)));

%% Color space conversions

for i = 1:size(I,1)
for j = 1:size(I,2)
```

```
YIQ_img(i,j,1) = 0.299*I(i,j,1)+0.587*I(i,j,2)+0.144*I(i,j,3); %
Y component

YIQ_img(i,j,2) = 0.596*I(i,j,1)-0.274*I(i,j,2)-0.322*I(i,j,3); %
I component

YIQ_img(i,j,3) = 0.211*I(i,j,1)-0.523*I(i,j,2)+0.312*I(i,j,3); %
Q component

end
end

%% Displaying the YIQ color components

figure
subplot(1,3,1)
imshow(YIQ_img(:,:,1))
title('Y Component')
subplot(1,3,2)
imshow(YIQ_img(:,:,2))
title('I Component')
subplot(1,3,3)
imshow(YIQ_img(:,:,3))
title('Q Component')
figure
imshow(YIQ_img)
title('YIQ color space image')
saveas(gca,'YIQ_components','jpg');

%% Reconstructing RGB from the YIQ components

recon_img = uint8(zeros(size(YIQ_img)));

%% Inverse color space conversion

for i = 1:size(YIQ_img,1)
for j = 1:size(YIQ_img,2)

recon_img(i,j,1) =
1.0*YIQ_img(i,j,1)+0.956*YIQ_img(i,j,2)+0.621*YIQ_img(i,j,3); %
R Component

recon_img(i,j,2) = 1.0*YIQ_img(i,j,1)-0.272*YIQ_img(i,j,2)-
0.647*YIQ_img(i,j,3); % G Component

recon_img(i,j,3) = 1.0*YIQ_img(i,j,1)-
1.106*YIQ_img(i,j,2)+1.703*YIQ_img(i,j,3); % B component
```

```
end
end
%% Displaying Reconstructed RGB color components

figure
subplot(1,3,1)
imshow(uint8(recon_img(:,:,1)))
title('R Component(Recon)')
subplot(1,3,2)
imshow(uint8(recon_img(:,:,2)))
title('G Component(Recon)')
subplot(1,3,3)
imshow(uint8(recon_img(:,:,3)))
title('B Component(Recon)')
saveas(gca,'Recon_RGB_YIQ','jpg');
%% Displaying Reconstructed Image

figure
imshow(uint8(recon_img))
title('Reconstructed Image')
saveas(gca,'Recon_1','jpg');
```

RESULTS:

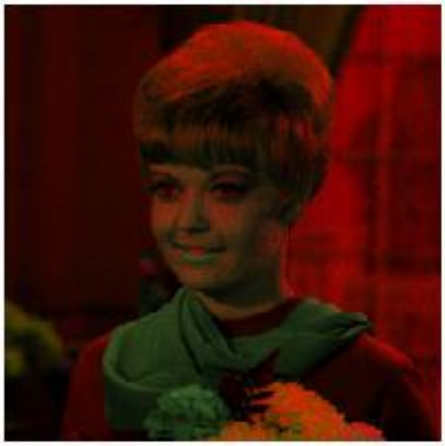


Y Component

I Component

Q Component

YIQ color space image



R Component(Recon)

G Component(Recon)

B Component(Recon)

Reconstructed Image

Problem 3 & 4 (MATLAB Code):

```
clear all; clc; close all;
%% For problem 3 we convert RGB to YCgCo

%% Read the image

img = imread('flowers.bmp');

%% Color space conversion algorithm

Y = double(0.25*img(:,:,1)+0.5*img(:,:,2)+0.25*img(:,:,3)); % Y
Component
Cg = double(-0.25*img(:,:,1)+0.5*img(:,:,2)-0.25*img(:,:,3)); %
Cg component
Co = double(0.5*img(:,:,1)-0.5*img(:,:,3));                   %
Co component

%% Displaying original image

figure,imshow(img)
title('Orignal Image')
saveas(gca,'original_image','jpg');
%% Displaying the YCgCo components

figure,subplot(1,3,1)
imshow(uint8(Y))
title('Y Component')
subplot(1,3,2)
imshow(uint8(Cg))
title('C_g Component')
subplot(1,3,3)
imshow(uint8(Co))
title('C_o Component')
saveas(gca,'YCgCo components','jpg');

%% For problem 4 we do the inverse conversion from YCgCo to RGB

%% Reconstructing to RGB using the following

R = Y - Cg + Co;
G = Y + Cg;
B = Y - Cg - Co;

%% Display reconstructed RGB components

figure
```

```
subplot(1,3,1)
imshow(uint8(R))
title('Recon_R')
subplot(1,3,2)
imshow(uint8(G))
title('Recon_G')
subplot(1,3,3)
imshow(uint8(B))
title('Recon_B')
saveas(gca,'Recon_RGB_YCgCo','jpg');
%% Reconstructing the image

I = zeros(size(img));
I(:,:,1) = R;
I(:,:,2) = G;
I(:,:,3) = B;

%% Displaying reconstrcuted image

figure
imshow(uint8(I))
title('Reconstructed Image')
saveas(gca,'Recon_2','jpg');
```

RESULTS:

Orignal Image

Y Component

C_g Component

C_o Component

Recon$_R$

Recon$_G$

Recon$_B$

Reconstructed Image

Conclusion:

- We first read the RAW image, decompose it into its components – RGB
- We convert the RAW image to the YIQ color space using the matrix given in the problem
- We reconstruct the image from the YIQ color space to the RGB color space using the matrix transform given in the problem.
- For the bmp image, we convert RGB to the YCgCo color space using the matrix given in the problem
- After the YCgCo conversion, we reconstruct the RGB color space Image using the matrix given in the problem
- We reconstruct the image using the inverse color space conversion
- The reconstructed image has a green hue which shows that the reconstruction is not perfect.