

الآية

قال تعالى:

(قالوا سبحانك لا علم لنا إلا ما علمنا إنك أنت
العليم الحكيم)

صدق الله العظيم

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DEDICATION

I dedicate this project report to Allah Almighty for his infinite mercy that He has granted to me through my studies and I also dedicate this work to our parents for their motivation and moral support throughout our day in school May Allah Almighty bless them and sustain their help to reap the fruit of their efforts.

Abstract

Fuzzy logic is the most common way to implement machine learning algorithms. It is been used in this research for color detection and comparison in an image file, using an acknowledged dataset to make the decision between colors of an image and the specified color by comparing the colors of the image with the colors in the Look-up Table (LUT) by the color name of the LUT, the implementation also includes a dominant color detection and RGB to HSV, HSI color spaces conversions, and also 3D histogram representation of an image, the whole project is implemented using MATLAB programming environment by creating a (GUI) based application to load the image selected by user and all the previously mentioned function can be applied to get the results immediately and the results was successfully get as expected.

المستخلص

يمثل المنطق الغامض أكثر الطرق شيوعاً لتطبيق خوارزميات تعليم الآلة، كما يتم استخدامه في هذا المشروع لاكتشاف ومقارنة الألوان في ملف صورة، باستخدام مجموعة بيانات معلومة مسبقاً لاتخاذ القرار بين الألوان من الصورة المدخلة واللون المحدد بمقارنة ألوان الصورة مع الألوان في جدول النظر باستخدام اسم اللون من الجدول، يتضمن أيضاً التطبيق دالة لاكتشاف اللون السائد على الصورة والتحويل بين أنظمة الألوان من RGB إلى HSI و HSV ويتضمن أيضاً التمثيل ثلاثي الأبعاد للرسم البياني لدرجات الألوان من الصورة، ويعتمد تطبيق جميع دوال البرنامج باستخدام بيئة برمجة الماتلاب بإنشاء تطبيق ذو واجهة مستخدم رسومية للسماح بتحميل ورفع الصورة إلى التطبيق وإجراء أي من الدوال السابق ذكرها واستخراج النتائج مباشرة ، وقد تم تجربة كل الدوال الخاصة بالتطبيق وتنفيذها بنجاح.

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List of Abbreviations

RGB : Red, Green, Blue

HSV : Hue Saturation Value

HSI : Hue Saturation Intensity

HSB : Hue Saturation Brightness

HSL : Hue Saturation Lightness

GUI : Graphic User Interface

LUT : Look Up Tabl

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Appendix

A. Code of Dominant Color

```
function [output,output2,output3,IM] = dominant(I1)

n_bits = 6; %consider the 6 most significant bits
resolut = 2^n_bits;

%I1 = imread(figs);
I1 = imresize(I1,0.25); %reduce the image dimension in
order to reduce time processing

if size(I1,3) == 3
    IU1 = I1(:,:,1); %R
    IU1 = IU1(:);

    IU2 = I1(:,:,2); %G
    IU2 = IU2(:);

    IU3 = I1(:,:,3); %B
    IU3 = IU3(:);

elseif size(I1,3) == 1 %gray scale image
    IU1 = I1(:,:,1);
    IU1 = IU1(:);
    IU2 = IU1;
    IU3 = IU1;
end

Im_1 = IU1;
Im_2 = IU2;
Im_3 = IU3;

%reduce image resolution in order to reduce time processing
and obtain
%better result
Im_1 = Im_1(:)*(resolut-1)/255;
Im_2 = Im_2(:)*(resolut-1)/255;
Im_3 = Im_3(:)*(resolut-1)/255;

III = double([Im_1 Im_2 Im_3]);
```

```

Im = double(Im_1) + resolut*double(Im_2) +
(resolut*resolut)*double(Im_3);

%compute the image histogram
A = zeros(1,resolut*resolut*resolut);
fori = 1:length(Im)
    A(Im(i)+1) = A(Im(i)+1) + 1;
end

%find the bins different from zero (colors)
Index = find(A ~= 0);
Index = Index - 1;

fori = 1:length(Index)
Cores(i,:) = color_retrieval(Index(i),resolut);
Freq(i) = A(Index(i)+1);
end

%compute Euclidian distance of each color to all colors
B = inf*ones(1,size(Cores,1));
fori = 1:size(Cores,1)
    B(i) = sum(sqrt(sum((ones(size(Cores,1),1)*Cores(i,:)) -
Cores).^2,2)).*Freq';
end

[tmp,IDX] = sort(B);
IDX = IDX(1); %ID of the most predominant color

%identify the colors nearest to the most predominant color
C = inf*ones(1,size(Cores,1));
fori = 1:size(Cores,1)
ifi ~= IDX
    C(i) = sqrt(sum((Cores(IDX,:)) - Cores(i,:)).^2));
end
end

ID = find(C <= 3); %find the colors with distance lesser or
equal 3
ID = [ID IDX];

Im_media = Freq(ID)*Cores(ID,:)/sum(Freq(ID)); %compute
weighted mean of the colors

R = Im_media(1)*255/(resolut-1);
G = Im_media(2)*255/(resolut-1);
B = Im_media(3)*255/(resolut-1);

```

```

myout(1)= double(R/255);
myout(2)= double(G/255);
myout(3)= double(B/255);

output(1) = uint8(R);
output(2) = uint8(G);
output(3) = uint8(B);

%figure
%show the color
IM_1 = R*ones(100,100);
IM_2 = G*ones(100,100);
IM_3 = B*ones(100,100);
IM(:,:,1) = uint8(IM_1);
IM(:,:,2) = uint8(IM_2);
IM(:,:,3) = uint8(IM_3);
%imshow(IM);
output2 = sprintf('"%s %s %s',dec2hex(floor(R*255/(resolut-
1))),dec2hex(floor(G*255/(resolut-
1))),dec2hex(floor(B*255/(resolut-1)))); 
output3 = sprintf('%s %s %s',R/255,G/255,B/255);

function I = color_retrieval(Index,resolut)
B = floor(Index/(resolut*resolut));
G = floor((Index - B*resolut*resolut)/resolut);
R = Index - B*resolut*resolut - G*resolut;
I = [R G B];

```

B. Code of Fuzzy color detection

```
function [iscolor,colornames]=fuzzycolor(RGB,colorquery)

% have we loaded in the fuzzycolordata array yet?
persistentFuzzyColorData
if isempty(FuzzyColorData)
% not yet loaded.
    load FuzzyColorData
end
ncolors = FuzzyColorData.ncolors;

% default for colorquery?
if (nargin<2) || isempty(colorquery)
colorquery = 'all';
colorind = 1:ncolors;
else
% which color name was requested?
colorquery = lower(colorquery);
ifstrcmp(colorquery,'all')
% all was requested, so
colorind = 1:ncolors;
else
% must have been a color name
colornames = FuzzyColorData.colornames;
colorind =
find(strncmp(colorquery,colornames,length(colorquery)));
if isempty(colorind)
    error 'colorquery is not a match for any color name
in the database'
elseif length(colorind)>1
    error 'colorquery is an ambiguous color name'
end
end
end

% verify that RGB is a valid color or set of colors
if mod(numel(RGB),3)~=0
    error 'RGB array must be a 1x3 vector, a nx3 or an nxmxB3
array'
end
ifisa(RGB,'uint8')
    RGB = double(RGB)/255;
else
if (max(RGB(:))<0) || (min(RGB(:))>1)
```

```

    error 'RGB array does not appear to be scaled as [0,1]
intensity'
end
end

RGB = reshape(RGB,[ ],3);
np = size(RGB,1);

% initialize the result array
iscolor = zeros(np,length(colorind));

for i = 1:length(colorind)
iscolor(:,i) =
interp3(FuzzyColorData.rnodes,FuzzyColorData.gnodes,FuzzyCo
lorData.bnodes,FuzzyColorData.colorlut{colorind(i)},RGB(:,1
),RGB(:,2),RGB(:,3),'linear');
end
% return the list of colonames tested for
colornames = FuzzyColorData.colornames(colorind);

```

C. Code of 3D Histogram

```
function [ resultTable ] = get_3D_histogram( image,
X, Y, Z )
%UNTITLED Summary of this function goes here
% Detailed explanation goes here
height = size(image,1);
width = size(image,2);

resultTable = zeros(X,Y,Z);

R_table = [];
G_table = [];
B_table = [];
size_table = [];
color_table = [];
%get the number of pixels for each RGB color
%for example resultTable(0,0,255) = 10 means
%there are 10 pixels in blue
for h = 1:height;
for w = 1:width;
    r = round(int16(image(h,w,1))*X/255);
    g = round(int16(image(h,w,2))*Y/255);
    b = round(int16(image(h,w,3))*Z/255);
if r==0;
    r = 1;
end;
if g==0;
    g = 1;
end;
if b==0;
    b = 1;
end;
resultTable(r,g,b) = resultTable(r,g,b) + 1;
end;
end;

largest = max(resultTable(:,:,:));
offset = largest/5;
```

```

i= 0;
for r = 1:X;
for g = 1:Y;
for b = 1:Z;
if resultTable(r,g,b) > 0
R_table = [R_table,r];
G_table = [G_table,g];
B_table = [B_table,b];

size_table = [size_table, resultTable(r,g,b) ];
color_table = [color_table; r/X,g/Y,b/Z];

i = 1 +i;
p = i / (X*Y*Z);
%disp(p);
end;
end;
end;
end

scatter3(R_table, G_table, B_table, size_table,
color_table);
axis([0 X 0 Y 0 Z]);
xlabel('Red');
ylabel('Green');
zlabel('Blue');
rotate3d on
title('3-D histogram');

```