**PROGRAM CODES**

**For size**

1. Sample Program for comparison of sizes

I = imread('D:\matlab files\img\grade 2.bmp');

gray = rgb2gray(I);

bw = im2bw(gray, 0.09);

%bw = im2bw(gray, graythresh(gray));

%either can be used. In case of first one value has to be changed depending on the image

cont = Contourfn(bw);

%centroid using inbuilt function

c1 = regionprops(cont,'centroid');

c1 = c1.Centroid;

%centroid using formula

c2 = Centroidfn(cont);

%diameter using formula inbuilt

[dmean, dmedian]= Diameterfn(cont,c1);

[dlidar, chord] = Endptfn(cont, c1);

%contour points

[a b]= find(cont ==1);

contpoints = [b a];

%diameter through total area

totarea = 0;

for i = 1:size(bw,1)

for j = 1:size(bw,2)

if(bw(i,j)==1)

totarea = totarea + 1;

end

end

end

darea = totarea\*4 /pi;

darea = nthroot(darea,2);

%diameter through perimeter

perimeter = regionprops(cont, 'perimeter');

dperi = perimeter.Perimeter(1)/pi;

d(2,:) = [dlidar chord dmean dmedian darea dperi];

2. Function to find contour of an image

bw is the black and white image

Note: last two lines might even be enough, the loops are to make it thinner.

function [ a ] = Contourfn ( bw )

% To find the contour of a b/w image

for i = 1:size(bw,1)-1

for j = 1:size(bw,2)-1

if (bw(i,j)==1 && bw(i,j+1)==0)

a1(i,j)=0;

elseif (bw(i,j)==0 && bw(i,j+1)==1)

a1(i,j)=0;

else

a1(i,j)=1;

end

end

end

for i = 1:size(bw,1)-1

for j = 1:size(bw,2)-1

if (bw(i,j)==1 && bw(i+1,j)==0)

a2(i,j)=0;

elseif (bw(i,j)==0 && bw(i+1,j)==1)

a2(i,j)=0;

else

a2(i,j)=1;

end

end

end

for i = 1:size(bw,1)-1

for j = 1:size(bw,2)-1

if (a1(i,j)==0 || a2(i,j)==0)

a(i,j)=0;

else

a(i,j)=1;

end

end

end

a = ~a;

a = bwperim(a);

a = bwmorph(a,'thin',Inf);

end

3. Function to find centroid of a contour image.

cont is the contour image.

function [ centroid ] = Centroidfn( cont )

% to find centroid of a contour image

[a b]= find(cont ==1);

contpoints = [b a];

%input is contour points matrix

x = size(contpoints,1);

for i = 2:x

xk = contpoints(i,1);

xk1 = contpoints(i-1,1);

yk = contpoints(i,2);

yk1 = contpoints(i-1,2);

xc1 = yk\*(xk^2 -xk1^2) - (xk^2)\*(yk - yk1);

xyc2 = yk\*(xk - xk1) - xk\*(yk - yk1);

yc1 = (yk^2)\*(xk - xk1) - xk\*(yk^2 - yk1^2);

end

xc = xc1 / (2\*xyc2);

yc = yc1 / (2\*xyc2);

%centroid

centroid = [xc yc];

end

4. Function to find diameter through formula and using median of Rk.

function [ diameter ] = Diameterfn(cont1,centroid)

% finding diameter given centroid and image contour

[a b]= find(cont1 ==1);

cont = [b a];

for i = 1:size(cont,1)

xk = cont(i,1);

yk = cont(i,2);

Rk(i,1) = hypot((xk - centroid(1)),(yk - centroid(2)));

Rd = median(Rk);

R = mean(Rk);

end

dmean = R\*2;

dmedian = Rd\*2

end

5. Finding endpoints of the diameter on the contour image, and then finding the length of the diameter and chord.

function [ actualdiameter,chordlength ] = Endptfn( a1,centroid )

x = 455 - size(a1,1);

y = 455 - size(a1,2);

[a b]= find(a1 ==1);

contpoints = [b a];

fp = padarray(a1, [x y],'replicate','post');

% size is 455\*455

x = 455:-1:1;

y = ones(1,455)\*455;

z = 1:1:455;

v = 0.0125:0.0125:1;

% figure,imshow(fp);

% hold on;

for i = 1:800

V = y - v(i)\*z;

X1 = [x' round(V)'];

common1 = intersect(X1, contpoints,'rows');

if numel(common1)>1

break

end

end

% h = plot(x,y-v(i)\*z,'Color','r');

% hold on;

x = ones(1,455)\*455;

y = 455:-1:1;

z = 1:455;

v = 0.0125:0.0125:1;

for i = 1:800

V = x - v(i)\*z;

Y1 = [round(V)' y'];

common2 = intersect(Y1, contpoints,'rows');

if numel(common2)>1

break;

end

end

% h = plot(x-v(i)\*z,y,'Color','r');

endpt1 = mean(common1);

endpt2 = mean(common2);

% hold on;

x = [endpt1(1) endpt2(1)];

y = [endpt1(2) endpt2(2)];

% line(x,y);

x = [endpt1(1) centroid(1)];

y = [endpt1(2) centroid(2)];

% line(x,y);

x = [endpt2(1) centroid(1)];

y = [endpt2(2) centroid(2)];

% line(x,y);

chordlength = pdist2(endpt1,endpt2); % chord length

actualdiameter = pdist2(endpt1,centroid) + pdist2(endpt2,centroid);

end

**Fruit filter:**

function [ I ] = fruitfilter( I1 )

% To filter background in the fruit image

I = I1;

for i = 1:350

for j = 1:1024

if I(i,j,3) > 170

I(i,j,1)=255;

I(i,j,2)=255;

I(i,j,3)=255;

end

end

end

end

**Color distance - program:**

%References

%Class A

i1 = imread('d:\matlab files\lda\oranges\2a.bmp');

i1 = fruitfilter(i1);

hsv1 = rgb2hsv(i1);

h1 = hsv1(:,:,1);

s1 = hsv1(:,:,2);

%Class B

i2 = imread('d:\matlab files\lda\oranges\17a.bmp');

i2 = fruitfilter(i2);

hsv2 = rgb2hsv(i2);

h2 = hsv2(:,:,1);

s2 = hsv2(:,:,2);

%Class C

i3 = imread('d:\matlab files\lda\oranges\23b.bmp');

i3 = fruitfilter(i3);

hsv3 = rgb2hsv(i3);

h3= hsv3(:,:,1);

s3 = hsv3(:,:,2);

%Class D

i4 = imread('d:\matlab files\lda\oranges\18a.bmp');

i4 = fruitfilter(i4);

hsv4 = rgb2hsv(i4);

h4= hsv4(:,:,1);

s4 = hsv4(:,:,2);

%--------------------------------#

%Samples from each class

a1 = imread('D:\matlab files\LDA\Oranges\11A.bmp');

a1 = fruitfilter(a1);

hsva1 = rgb2hsv(a1);

ha1 = hsva1(:,:,1);

sa1 = hsva1(:,:,2);

a2 = imread('D:\matlab files\LDA\Oranges\11B.bmp');

a2 = fruitfilter(a2);

hsva2 = rgb2hsv(a2);

ha2 = hsva2(:,:,1);

sa2 = hsva2(:,:,2);

a3 = imread('D:\matlab files\LDA\Oranges\11C.bmp');

a3 = fruitfilter(a3);

hsva3 = rgb2hsv(a3);

ha3 = hsva3(:,:,1);

sa3 = hsva3(:,:,2);

a4 = imread('D:\matlab files\LDA\Oranges\11D.bmp');

a4 = fruitfilter(a4);

hsva4 = rgb2hsv(a4);

ha4 = hsva4(:,:,1);

sa4 = hsva4(:,:,2);

a5 = imread('D:\matlab files\LDA\Oranges\11E.bmp');

a5 = fruitfilter(a5);

hsva5 = rgb2hsv(a5);

ha5 = hsva5(:,:,1);

sa5 = hsva5(:,:,2);

%class b

b1 = imread('D:\matlab files\LDA\Oranges\21A.bmp');

b1 = fruitfilter(b1);

hsvb1 = rgb2hsv(b1);

hb1 = hsvb1(:,:,1);

sb1 = hsvb1(:,:,2);

b2 = imread('D:\matlab files\LDA\Oranges\21B.bmp');

b2 = fruitfilter(b2);

hsvb2 = rgb2hsv(b2);

hb2 = hsvb2(:,:,1);

sb2 = hsvb2(:,:,2);

b3 = imread('D:\matlab files\LDA\Oranges\21C.bmp');

b3 = fruitfilter(b3);

hsvb3 = rgb2hsv(b3);

hb3 = hsvb3(:,:,1);

sb3 = hsvb3(:,:,2);

b4 = imread('D:\matlab files\LDA\Oranges\21D.bmp');

b4 = fruitfilter(b4);

hsvb4 = rgb2hsv(b4);

hb4 = hsvb4(:,:,1);

sb4 = hsvb4(:,:,2);

b5 = imread('D:\matlab files\LDA\Oranges\21E.bmp');

b5 = fruitfilter(b5);

hsvb5 = rgb2hsv(b5);

hb5 = hsvb5(:,:,1);

sb5 = hsvb5(:,:,2);

%class c

c1 = imread('D:\matlab files\LDA\Oranges\14A.bmp');

c1 = fruitfilter(c1);

hsvc1 = rgb2hsv(c1);

hc1 = hsvc1(:,:,1);

sc1 = hsvc1(:,:,2);

c2 = imread('D:\matlab files\LDA\Oranges\14B.bmp');

c2 = fruitfilter(c2);

hsvc2 = rgb2hsv(c2);

hc2 = hsvc2(:,:,1);

sc2 = hsvc2(:,:,2);

c3 = imread('D:\matlab files\LDA\Oranges\14C.bmp');

c3 = fruitfilter(c3);

hsvc3 = rgb2hsv(c3);

hc3 = hsvc3(:,:,1);

sc3 = hsvc3(:,:,2);

c4 = imread('D:\matlab files\LDA\Oranges\14D.bmp');

c4 = fruitfilter(c4);

hsvc4 = rgb2hsv(c4);

hc4 = hsvc4(:,:,1);

sc4 = hsvc4(:,:,2);

c5 = imread('D:\matlab files\LDA\Oranges\14E.bmp');

c5 = fruitfilter(c5);

hsvc5 = rgb2hsv(c5);

hc5 = hsvc5(:,:,1);

sc5 = hsvc5(:,:,2);

d1 = imread('D:\matlab files\LDA\Oranges\15A.bmp');

d1 = fruitfilter(d1);

hsvd1 = rgb2hsv(d1);

hd1 = hsvd1(:,:,1);

sd1 = hsvd1(:,:,2);

d2 = imread('D:\matlab files\LDA\Oranges\15B.bmp');

d2 = fruitfilter(d2);

hsvd2 = rgb2hsv(d2);

hd2 = hsvd2(:,:,1);

sd2 = hsvd2(:,:,2);

d3 = imread('D:\matlab files\LDA\Oranges\15C.bmp');

d3 = fruitfilter(d3);

hsvd3 = rgb2hsv(d3);

hd3 = hsvd3(:,:,1);

sd3 = hsvd3(:,:,2);

d4 = imread('D:\matlab files\LDA\Oranges\15D.bmp');

d4 = fruitfilter(d4);

hsvd4 = rgb2hsv(d4);

hd4 = hsvd4(:,:,1);

sd4 = hsvd4(:,:,2);

d5 = imread('D:\matlab files\LDA\Oranges\15E.bmp');

d5 = fruitfilter(d5);

hsvd5 = rgb2hsv(d5);

hd5 = hsvd5(:,:,1);

sd5 = hsvd5(:,:,2);

%------------------------------------%

d(1,1) = mean2(abs(h1 - ha1) + abs(s1 - sa1));

d(1,2) = mean2(abs(h2 - ha1) + abs(s2 - sa1));

d(1,3) = mean2(abs(h3 - ha1) + abs(s3 - sa1));

d(1,4) = mean2(abs(h4 - ha1) + abs(s4 - sa1));

d(2,1) = mean2(abs(h1 - ha2) + abs(s1 - sa2));

d(2,2) = mean2(abs(h2 - ha2) + abs(s2 - sa2));

d(2,3) = mean2(abs(h3 - ha2) + abs(s3 - sa2));

d(2,4) = mean2(abs(h4 - ha2) + abs(s4 - sa2));

d(3,1) = mean2(abs(h1 - ha3) + abs(s1 - sa3));

d(3,2) = mean2(abs(h2 - ha3) + abs(s2 - sa3));

d(3,3) = mean2(abs(h3 - ha3) + abs(s3 - sa3));

d(3,4) = mean2(abs(h4 - ha3) + abs(s4 - sa3));

d(4,1) = mean2(abs(h1 - ha4) + abs(s1 - sa4));

d(4,2) = mean2(abs(h2 - ha4) + abs(s2 - sa4));

d(4,3) = mean2(abs(h3 - ha4) + abs(s3 - sa4));

d(4,4) = mean2(abs(h4 - ha4) + abs(s4 - sa4));

d(5,1) = mean2(abs(h1 - ha5) + abs(s1 - sa5));

d(5,2) = mean2(abs(h2 - ha5) + abs(s2 - sa5));

d(5,3) = mean2(abs(h3 - ha5) + abs(s3 - sa5));

d(5,4) = mean2(abs(h4 - ha5) + abs(s4 - sa5));

%-----

d(6,1) = mean2(abs(h1 - hb1) + abs(s1 - sb1));

d(6,2) = mean2(abs(h2 - hb1) + abs(s2 - sb1));

d(6,3) = mean2(abs(h3 - hb1) + abs(s3 - sb1));

d(6,4) = mean2(abs(h4 - hb1) + abs(s4 - sb1));

d(7,1) = mean2(abs(h1 - hb2) + abs(s1 - sb2));

d(7,2) = mean2(abs(h2 - hb2) + abs(s2 - sb2));

d(7,3) = mean2(abs(h3 - hb2) + abs(s3 - sb2));

d(7,4) = mean2(abs(h4 - hb2) + abs(s4 - sb2));

d(8,1) = mean2(abs(h1 - hb3) + abs(s1 - sb3));

d(8,2) = mean2(abs(h2 - hb3) + abs(s2 - sb3));

d(8,3) = mean2(abs(h3 - hb3) + abs(s3 - sb3));

d(8,4) = mean2(abs(h4 - hb3) + abs(s4 - sb3));

d(9,1) = mean2(abs(h1 - hb4) + abs(s1 - sb4));

d(9,2) = mean2(abs(h2 - hb4) + abs(s2 - sb4));

d(9,3) = mean2(abs(h3 - hb4) + abs(s3 - sb4));

d(9,4) = mean2(abs(h4 - hb4) + abs(s4 - sb4));

d(10,1) = mean2(abs(h1 - hb5) + abs(s1 - sb5));

d(10,2) = mean2(abs(h2 - hb5) + abs(s2 - sb5));

d(10,3) = mean2(abs(h3 - hb5) + abs(s3 - sb5));

d(10,4) = mean2(abs(h4 - hb5) + abs(s4 - sb5));

%---

d(11,1) = mean2(abs(h1 - hc1) + abs(s1 - sc1));

d(11,2) = mean2(abs(h2 - hc1) + abs(s2 - sc1));

d(11,3) = mean2(abs(h3 - hc1) + abs(s3 - sc1));

d(11,4) = mean2(abs(h4 - hc1) + abs(s4 - sc1));

d(12,1) = mean2(abs(h1 - hc2) + abs(s1 - sc2));

d(12,2) = mean2(abs(h2 - hc2) + abs(s2 - sc2));

d(12,3) = mean2(abs(h3 - hc2) + abs(s3 - sc2));

d(12,4) = mean2(abs(h4 - hc2) + abs(s4 - sc2));

d(13,1) = mean2(abs(h1 - hc3) + abs(s1 - sc3));

d(13,2) = mean2(abs(h2 - hc3) + abs(s2 - sc3));

d(13,3) = mean2(abs(h3 - hc3) + abs(s3 - sc3));

d(13,4) = mean2(abs(h4 - hc3) + abs(s4 - sc3));

d(14,1) = mean2(abs(h1 - hc4) + abs(s1 - sc4));

d(14,2) = mean2(abs(h2 - hc4) + abs(s2 - sc4));

d(14,3) = mean2(abs(h3 - hc4) + abs(s3 - sc4));

d(14,4) = mean2(abs(h4 - hc4) + abs(s4 - sc4));

d(15,1) = mean2(abs(h1 - hc5) + abs(s1 - sc5));

d(15,2) = mean2(abs(h2 - hc5) + abs(s2 - sc5));

d(15,3) = mean2(abs(h3 - hc5) + abs(s3 - sc5));

d(15,4) = mean2(abs(h4 - hc5) + abs(s4 - sc5));

%-----------------

d(16,1) = mean2(abs(h1 - hd1) + abs(s1 - sd1));

d(16,2) = mean2(abs(h2 - hd1) + abs(s2 - sd1));

d(16,3) = mean2(abs(h3 - hd1) + abs(s3 - sd1));

d(16,4) = mean2(abs(h4 - hd1) + abs(s4 - sd1));

d(17,1) = mean2(abs(h1 - hd2) + abs(s1 - sd2));

d(17,2) = mean2(abs(h2 - hd2) + abs(s2 - sd2));

d(17,3) = mean2(abs(h3 - hd2) + abs(s3 - sd2));

d(17,4) = mean2(abs(h4 - hd2) + abs(s4 - sd2));

d(18,1) = mean2(abs(h1 - hd3) + abs(s1 - sd3));

d(18,2) = mean2(abs(h2 - hd3) + abs(s2 - sd3));

d(18,3) = mean2(abs(h3 - hd3) + abs(s3 - sd3));

d(18,4) = mean2(abs(h4 - hd3) + abs(s4 - sd3));

d(19,1) = mean2(abs(h1 - hd4) + abs(s1 - sd4));

d(19,2) = mean2(abs(h2 - hd4) + abs(s2 - sd4));

d(19,3) = mean2(abs(h3 - hd4) + abs(s3 - sd4));

d(19,4) = mean2(abs(h4 - hd4) + abs(s4 - sd4));

d(20,1) = mean2(abs(h1 - hd5) + abs(s1 - sd5));

d(20,2) = mean2(abs(h2 - hd5) + abs(s2 - sd5));

d(20,3) = mean2(abs(h3 - hd5) + abs(s3 - sd5));

d(20,4) = mean2(abs(h4 - hd5) + abs(s4 – sd5));

**Ripefn2 – to find if fruit is ripe or not**

function [ rr, rg ] = Ripefn2( i )

% Function to find if a fruit is ripe or not

r = i(:,:,1);

g = i(:,:,2);

b = i(:,:,3);

tr = sum(sum(r));

tb = sum(sum(b));

tg = sum(sum(g));

rg = tr/tg;

rr = tr\*100/(tr+tg+tb);

gg = tg\*100/(tr+tg+tb);

bb = tb\*100/(tr+tg+tb);

k1 = 0.95;

k2 = 0.85; %differs for other fruits

if(rg>k1)

disp('Ripe');

elseif(k2<rg && rg<k1)

disp('Moderately ripe');

elseif(rg<k2)

disp('Unripe');

end

end

**LDA:**

padcat2 : used to concatenate two matrices with different lengths by padding

function [M, TF] = padcat(varargin)

% PADCAT - concatenate vectors with different lengths by padding with NaN

%

% M = PADCAT(V1, V2, V3, ..., VN) concatenates the vectors V1 through VN

% into one large matrix. All vectors should have the same orientation,

% that is, they are all row or column vectors. The vectors do not need to

% have the same lengths, and shorter vectors are padded with NaNs.

% The size of M is determined by the length of the longest vector. For

% row vectors, M will be a N-by-MaxL matrix and for column vectors, M

% will be a MaxL-by-N matrix, where MaxL is the length of the longest

% vector.

%

% Examples:

% a = 1:5 ; b = 1:3 ; c = [] ; d = 1:4 ;

% padcat(a,b,c,d) % row vectors

% % -> 1 2 3 4 5

% % 1 2 3 NaN NaN

% % NaN NaN NaN NaN NaN

% % 1 2 3 4 NaN

% CC = {d.' a.' c.' b.' d.'} ;

% padcat(CC{:}) % column vectors

% % 1 1 NaN 1 1

% % 2 2 NaN 2 2

% % 3 3 NaN 3 3

% % 4 4 NaN NaN 4

% % NaN 5 NaN NaN NaN

%

% [M, TF] = PADCAT(..) will also return a logical matrix TF with the same

% size as R having true values for those positions that originate from an

% input vector. This may be useful if any of the vectors contain NaNs.

%

% Example:

% a = 1:3 ; b = [] ; c = [1 NaN] ;

% [M,tf] = padcat(a,b,c)

% % find the original NaN

% [Vev,Pos] = find(tf & isnan(M))

% % -> Vec = 3 , Pos = 2

%

% This second output can also be used to change the padding value into

% something else than NaN.

%

% [M, tf] = padcat(1:3,1,1:4)

% M(~tf) = 99 % change the padding value into 99

%

% Scalars will be concatenated into a single column vector.

%

% See also CAT, RESHAPE, STRVCAT, CHAR, HORZCAT, VERTCAT, ISEMPTY

% NONES, GROUP2CELL (Matlab File Exchange)

% for Matlab 2008 and up (tested in R2011a)

% version 1.2 (oct 2011)

% (c) Jos van der Geest

% email: jos@jasen.nl

% History

% 1.0 (feb 2009) created

% 1.1 (feb 2011) improved comments

% 1.2 (oct 2011) added help on changing the padding value into something

% else than NaN

% Acknowledgements:

% Inspired by padadd.m (feb 2000) Fex ID 209 by Dave Johnson

error(nargchk(1,Inf,nargin)) ;

% check the inputs

SZ = cellfun(@size,varargin,'UniformOutput',false) ; % sizes

Ndim = cellfun(@ndims,varargin) ; %

if ~all(Ndim==2)

error([mfilename ':WrongInputDimension'], ...

'Input should be vectors.') ;

end

TF = [] ; % default second output so we do not have to check all the time

% for 2D matrices (including vectors) the size is a 1-by-2 vector

SZ = cat(1,SZ{:}) ;

maxSZ = max(SZ) ; % probable size of the longest vector

% maxSZ equals :

% - [1 1] for all scalars input

% - [X 1] for column vectors

% - [1 X] for all row vectors

% - [X Y] otherwise (so padcat will not work!)

if ~any(maxSZ == 1), % hmm, not all elements are 1-by-N or N-by-1

% 2 options ...

if any(maxSZ==0),

% 1) all inputs are empty

M = [] ;

return

else

% 2) wrong input

% Either not all vectors have the same orientation (row and column

% vectors are being mixed) or an input is a matrix.

error([mfilename ':WrongInputSize'], ...

'Inputs should be all row vectors or all column vectors.') ;

end

end

if nargin == 1,

% single input, nothing to concatenate ..

M = varargin{1} ;

else

% Concatenate row vectors in a row, and column vectors in a column.

dim = (maxSZ(1)==1) + 1 ; % Find out the dimension to work on

X = cat(dim, varargin{:}) ; % make one big list

% we will use linear indexing, which operates along columns. We apply a

% transpose at the end if the input were row vectors.

if maxSZ(dim) == 1,

% if all inputs are scalars, ...

M = X ; % copy the list

elseif all(SZ(:,dim)==SZ(1,dim)),

% all vectors have the same length

M = reshape(X,SZ(1,dim),[]) ;% copy the list and reshape

else

% We do have vectors of different lengths.

% Pre-allocate the final output array as a column oriented array. We

% make it one larger to accommodate the largest vector as well.

M = zeros([maxSZ(dim)+1 nargin]) ;

% where do the fillers begin in each column

M(sub2ind(size(M), SZ(:,dim).'+1, 1:nargin)) = 1 ;

% Fillers should be put in after that position as well, so applying

% cumsum on the columns

% Note that we remove the last row; the largest vector will fill an

% entire column.

M = cumsum(M(1:end-1,:),1) ; % remove last row

% If we need to return position of the non-fillers we will get them

% now. We cannot do it afterwards, since NaNs may be present in the

% inputs.

if nargout>1,

TF = ~M ;

% and make use of this logical array

M(~TF) = 0 ; % put the fillers in

M(TF) = X ; % put the values in

else

M(M==1) = 0 ; % put the fillers in

M(M==0) = X ; % put the values in

end

end

if dim == 2,

% the inputs were row vectors, so transpose

M = M.' ;

TF = TF.' ; % was initialized as empty if not requested

end

end % nargin == 1

if nargout > 1 && isempty(TF),

% in this case, the inputs were all empty, all scalars, or all had the

% same size.

TF = true(size(M)) ;

end

**LDA Saturation Programme:**

%class a

a1 = imread('D:\matlab files\LDA\Oranges\11A.bmp');

a1 = fruitfilter(a1);

hsva1 = rgb2hsv(a1);

ha1 = hsva1(:,:,2);

ha1 = ha1\*255;

ha1 = nonzeros(ha1);

a1mean = mean(ha1);

a2 = imread('D:\matlab files\LDA\Oranges\11B.bmp');

a2 = fruitfilter(a2);

hsva2 = rgb2hsv(a2);

ha2 = hsva2(:,:,2);

ha2 = ha2\*255;

ha2 = nonzeros(ha2);

a2mean = mean(ha2);

a3 = imread('D:\matlab files\LDA\Oranges\11C.bmp');

a3 = fruitfilter(a3);

hsva3 = rgb2hsv(a3);

ha3 = hsva3(:,:,2);

ha3 = ha3\*255;

ha3 = nonzeros(ha3);

a3mean = mean(ha3);

a4 = imread('D:\matlab files\LDA\Oranges\11D.bmp');

a4 = fruitfilter(a4);

hsva4 = rgb2hsv(a4);

ha4 = hsva4(:,:,2);

ha4 = ha4\*255;

ha4 = nonzeros(ha4);

a4mean = mean(ha4);

a5 = imread('D:\matlab files\LDA\Oranges\11E.bmp');

a5 = fruitfilter(a5);

hsva5 = rgb2hsv(a5);

ha5 = hsva5(:,:,2);

ha5 = ha5\*255;

ha5 = nonzeros(ha5);

a5mean = mean(ha5);

a6 = imread('D:\matlab files\LDA\Oranges\2A.bmp');

a6 = fruitfilter(a6);

hsva6 = rgb2hsv(a6);

ha6 = hsva6(:,:,2);

ha6 = ha6\*255;

ha6 = nonzeros(ha6);

a6mean = mean(ha6);

a7 = imread('D:\matlab files\LDA\Oranges\2B.bmp');

a7 = fruitfilter(a7);

hsva7 = rgb2hsv(a7);

ha7 = hsva7(:,:,2);

ha7 = ha7\*255;

ha7 = nonzeros(ha7);

a7mean = mean(ha7);

a8 = imread('D:\matlab files\LDA\Oranges\2C.bmp');

a8 = fruitfilter(a8);

hsva8 = rgb2hsv(a8);

ha8 = hsva8(:,:,2);

ha8 = ha8\*255;

ha8 = nonzeros(ha8);

a8mean = mean(ha8);

a9 = imread('D:\matlab files\LDA\Oranges\2D.bmp');

a9 = fruitfilter(a9);

hsva9 = rgb2hsv(a9);

ha9 = hsva9(:,:,2);

ha9 = ha9\*255;

ha9 = nonzeros(ha9);

a9mean = mean(ha9);

a10 = imread('D:\matlab files\LDA\Oranges\2E.bmp');

a10 = fruitfilter(a10);

hsva10 = rgb2hsv(a10);

ha10 = hsva10(:,:,2);

ha10 = ha10\*255;

ha10 = nonzeros(ha10);

a10mean = mean(ha10);

a\_mean = (a1mean+a2mean+a3mean+a4mean+a5mean+a6mean+a7mean+a8mean+a9mean+a10mean)/10;

[am,am2] = padcat2(ha1,ha2,ha3,ha4,ha5,ha6,ha7,ha8,ha9,ha10);

am2 = mean(am);

%class b

b1 = imread('D:\matlab files\LDA\Oranges\14A.bmp');

b1 = fruitfilter(b1);

hsvb1 = rgb2hsv(b1);

hb1 = hsvb1(:,:,2);

hb1 = hb1\*255;

hb1 = nonzeros(hb1);

b1mean = mean(hb1);

b2 = imread('D:\matlab files\LDA\Oranges\14B.bmp');

b2 = fruitfilter(b2);

hsvb2 = rgb2hsv(b2);

hb2 = hsvb2(:,:,2);

hb2 = hb2\*255;

hb2 = nonzeros(hb2);

b2mean = mean(hb2);

b3 = imread('D:\matlab files\LDA\Oranges\14C.bmp');

b3 = fruitfilter(b3);

hsvb3 = rgb2hsv(b3);

hb3 = hsvb3(:,:,2);

hb3 = hb3\*255;

hb3 = nonzeros(hb3);

b3mean = mean(hb3);

b4 = imread('D:\matlab files\LDA\Oranges\14D.bmp');

b4 = fruitfilter(b4);

hsvb4 = rgb2hsv(b4);

hb4 = hsvb4(:,:,2);

hb4 = hb4\*255;

hb4 = nonzeros(hb4);

b4mean = mean(hb4);

b5 = imread('D:\matlab files\LDA\Oranges\14E.bmp');

b5 = fruitfilter(b5);

hsvb5 = rgb2hsv(b5);

hb5 = hsvb5(:,:,2);

hb5 = hb5\*255;

hb5 = nonzeros(hb5);

b5mean = mean(hb5);

b6 = imread('D:\matlab files\LDA\Oranges\21A.bmp');

b6 = fruitfilter(b6);

hsvb6 = rgb2hsv(b6);

hb6 = hsvb6(:,:,2);

hb6 = hb6\*255;

hb6 = nonzeros(hb6);

b6mean = mean(hb6);

b7 = imread('D:\matlab files\LDA\Oranges\21B.bmp');

b7 = fruitfilter(b7);

hsvb7 = rgb2hsv(b7);

hb7 = hsvb7(:,:,2);

hb7 = hb7\*255;

hb7 = nonzeros(hb7);

b7mean = mean(hb7);

b8 = imread('D:\matlab files\LDA\Oranges\21C.bmp');

b8 = fruitfilter(b8);

hsvb8 = rgb2hsv(b8);

hb8 = hsvb8(:,:,2);

hb8 = hb8\*255;

hb8 = nonzeros(hb8);

b8mean = mean(hb8);

b9 = imread('D:\matlab files\LDA\Oranges\21D.bmp');

b9 = fruitfilter(b9);

hsvb9 = rgb2hsv(b9);

hb9 = hsvb9(:,:,2);

hb9 = hb9\*255;

hb9 = nonzeros(hb9);

b9mean = mean(hb9);

b10 = imread('D:\matlab files\LDA\Oranges\21E.bmp');

b10 = fruitfilter(b10);

hsvb10 = rgb2hsv(b10);

hb10 = hsvb10(:,:,2);

hb10 = hb10\*255;

hb10 = nonzeros(hb10);

b10mean = mean(hb10);

b\_mean = (b1mean+b2mean+b3mean+b4mean+b5mean+b6mean+b7mean+b8mean+b9mean+b10mean)/10;

[bm,bm2] = padcat2(hb1,hb2,hb3,hb4,hb5,hb6,hb7,hb8,hb9,hb10);

bm2 = mean(bm);

%class c

c1 = imread('D:\matlab files\LDA\Oranges\15A.bmp');

c1 = fruitfilter(c1);

hsvc1 = rgb2hsv(c1);

hc1 = hsvc1(:,:,2);

hc1 = hc1\*255;

hc1 = nonzeros(hc1);

c1mean = mean(hc1);

c2 = imread('D:\matlab files\LDA\Oranges\15B.bmp');

c2 = fruitfilter(c2);

hsvc2 = rgb2hsv(c2);

hc2 = hsvc2(:,:,2);

hc2 = hc2\*255;

hc2 = nonzeros(hc2);

c2mean = mean(hc2);

c3 = imread('D:\matlab files\LDA\Oranges\15C.bmp');

c3 = fruitfilter(c3);

hsvc3 = rgb2hsv(c3);

hc3 = hsvc3(:,:,2);

hc3 = hc3\*255;

hc3 = nonzeros(hc3);

c3mean = mean(hc3);

c4 = imread('D:\matlab files\LDA\Oranges\15D.bmp');

c4 = fruitfilter(c4);

hsvc4 = rgb2hsv(c4);

hc4 = hsvc4(:,:,2);

hc4 = hc4\*255;

hc4 = nonzeros(hc4);

c4mean = mean(hc4);

c5 = imread('D:\matlab files\LDA\Oranges\15E.bmp');

c5 = fruitfilter(c5);

hsvc5 = rgb2hsv(c5);

hc5 = hsvc5(:,:,2);

hc5 = hc5\*255;

hc5 = nonzeros(hc5);

c5mean = mean(hc5);

c6 = imread('D:\matlab files\LDA\Oranges\18A.bmp');

c6 = fruitfilter(c6);

hsvc6 = rgb2hsv(c6);

hc6 = hsvc6(:,:,2);

hc6 = hc6\*255;

hc6 = nonzeros(hc6);

c6mean = mean(hc6);

c7 = imread('D:\matlab files\LDA\Oranges\18B.bmp');

c7 = fruitfilter(c7);

hsvc7 = rgb2hsv(c7);

hc7 = hsvc7(:,:,2);

hc7 = hc7\*255;

hc7 = nonzeros(hc7);

c7mean = mean(hc7);

c8 = imread('D:\matlab files\LDA\Oranges\18C.bmp');

c8 = fruitfilter(c8);

hsvc8 = rgb2hsv(c8);

hc8 = hsvc8(:,:,2);

hc8 = hc8\*255;

hc8 = nonzeros(hc8);

c8mean = mean(hc8);

c9 = imread('D:\matlab files\LDA\Oranges\18D.bmp');

c9 = fruitfilter(c9);

hsvc9 = rgb2hsv(c9);

hc9 = hsvc9(:,:,2);

hc9 = hc9\*255;

hc9 = nonzeros(hc9);

c9mean = mean(hc9);

c10 = imread('D:\matlab files\LDA\Oranges\18E.bmp');

c10 = fruitfilter(c10);

hsvc10 = rgb2hsv(c10);

hc10 = hsvc10(:,:,2);

hc10 = hc10\*255;

hc10 = nonzeros(hc10);

c10mean = mean(hc10);

c\_mean = (c1mean+c2mean+c3mean+c4mean+c5mean+c6mean+c7mean+c8mean+c9mean+c10mean)/10;

[cm,cm2] = padcat2(hc1,hc2,hc3,hc4,hc5,hc6,hc7,hc8,hc9,hc10);

cm2 = mean(cm);

%class d

d1 = imread('D:\matlab files\LDA\Sathukudi\1A.bmp');

d1 = fruitfilter(d1);

hsvd1 = rgb2hsv(d1);

hd1 = hsvd1(:,:,2);

hd1 = hd1\*255;

hd1 = nonzeros(hd1);

d1mean = mean(hd1);

d2 = imread('D:\matlab files\LDA\Sathukudi\1B.bmp');

d2 = fruitfilter(d2);

hsvd2 = rgb2hsv(d2);

hd2 = hsvd2(:,:,2);

hd2 = hd2\*255;

hd2 = nonzeros(hd2);

d2mean = mean(hd2);

d3 = imread('D:\matlab files\LDA\Sathukudi\1C.bmp');

d3 = fruitfilter(d3);

hsvd3 = rgb2hsv(d3);

hd3 = hsvd3(:,:,2);

hd3 = hd3\*255;

hd3 = nonzeros(hd3);

d3mean = mean(hd3);

d4 = imread('D:\matlab files\LDA\Sathukudi\1D.bmp');

d4 = fruitfilter(d4);

hsvd4 = rgb2hsv(d4);

hd4 = hsvd4(:,:,2);

hd4 = hd4\*255;

hd4 = nonzeros(hd4);

d4mean = mean(hd4);

d5 = imread('D:\matlab files\LDA\Sathukudi\1E.bmp');

d5 = fruitfilter(d5);

hsvd5 = rgb2hsv(d5);

hd5 = hsvd5(:,:,2);

hd5 = hd5\*255;

hd5 = nonzeros(hd5);

d5mean = mean(hd5);

d6 = imread('D:\matlab files\LDA\Sathukudi\2A.bmp');

d6 = fruitfilter(d6);

hsvd6 = rgb2hsv(d6);

hd6 = hsvd6(:,:,2);

hd6 = hd6\*255;

hd6 = nonzeros(hd6);

d6mean = mean(hd6);

d7 = imread('D:\matlab files\LDA\Sathukudi\2B.bmp');

d7 = fruitfilter(d7);

hsvd7 = rgb2hsv(d7);

hd7 = hsvd7(:,:,2);

hd7 = hd7\*255;

hd7 = nonzeros(hd7);

d7mean = mean(hd7);

d8 = imread('D:\matlab files\LDA\Sathukudi\2C.bmp');

d8 = fruitfilter(d8);

hsvd8 = rgb2hsv(d8);

hd8 = hsvd8(:,:,2);

hd8 = hd8\*255;

hd8 = nonzeros(hd8);

d8mean = mean(hd8);

d9 = imread('D:\matlab files\LDA\Sathukudi\2D.bmp');

d9 = fruitfilter(d9);

hsvd9 = rgb2hsv(d9);

hd9 = hsvd9(:,:,2);

hd9 = hd9\*255;

hd9 = nonzeros(hd9);

d9mean = mean(hd9);

d10 = imread('D:\matlab files\LDA\Sathukudi\2E.bmp');

d10 = fruitfilter(d10);

hsvd10 = rgb2hsv(d10);

hd10 = hsvd10(:,:,2);

hd10 = hd10\*255;

hd10 = nonzeros(hd10);

d10mean = mean(hd10);

d\_mean = (d1mean+d2mean+d3mean+d4mean+d5mean+d6mean+d7mean+d8mean+d9mean+d10mean)/10;

[dm,dm2] = padcat2(hd1,hd2,hd3,hd4,hd5,hd6,hd7,hd8,hd9,hd10);

dm2 = mean(dm);

%class e

e1 = imread('D:\matlab files\LDA\Lemon\1A.bmp');

e1 = fruitfilter(e1);

hsve1 = rgb2hsv(e1);

he1 = hsve1(:,:,2);

he1 = he1\*255;

he1 = nonzeros(he1);

e1mean = mean(he1);

e2 = imread('D:\matlab files\LDA\Lemon\1B.bmp');

e2 = fruitfilter(e2);

hsve2 = rgb2hsv(e2);

he2 = hsve2(:,:,2);

he2 = he2\*255;

he2 = nonzeros(he2);

e2mean = mean(he2);

e3 = imread('D:\matlab files\LDA\Lemon\1C.bmp');

e3 = fruitfilter(e3);

hsve3 = rgb2hsv(e3);

he3 = hsve3(:,:,2);

he3 = he3\*255;

he3 = nonzeros(he3);

e3mean = mean(he3);

e4 = imread('D:\matlab files\LDA\Lemon\1D.bmp');

e4 = fruitfilter(e4);

hsve4 = rgb2hsv(e4);

he4 = hsve4(:,:,2);

he4 = he4\*255;

he4 = nonzeros(he4);

e4mean = mean(he4);

e5 = imread('D:\matlab files\LDA\Lemon\1E.bmp');

e5 = fruitfilter(e5);

hsve5 = rgb2hsv(e5);

he5 = hsve5(:,:,2);

he5 = he5\*255;

he5 = nonzeros(he5);

e5mean = mean(he5);

e6 = imread('D:\matlab files\LDA\Lemon\2A.bmp');

e6 = fruitfilter(e6);

hsve6 = rgb2hsv(e6);

he6 = hsve6(:,:,2);

he6 = he6\*255;

he6 = nonzeros(he6);

e6mean = mean(he6);

e7 = imread('D:\matlab files\LDA\Lemon\2B.bmp');

e7 = fruitfilter(e7);

hsve7 = rgb2hsv(e7);

he7 = hsve7(:,:,2);

he7 = he7\*255;

he7 = nonzeros(he7);

e7mean = mean(he7);

e8 = imread('D:\matlab files\LDA\Lemon\2C.bmp');

e8 = fruitfilter(e8);

hsve8 = rgb2hsv(e8);

he8 = hsve8(:,:,2);

he8 = he8\*255;

he8 = nonzeros(he8);

e8mean = mean(he8);

e9 = imread('D:\matlab files\LDA\Lemon\2D.bmp');

e9 = fruitfilter(e9);

hsve9 = rgb2hsv(e9);

he9 = hsve9(:,:,2);

he9 = he9\*255;

he9 = nonzeros(he9);

e9mean = mean(he9);

e10 = imread('D:\matlab files\LDA\Lemon\2E.bmp');

e10 = fruitfilter(e10);

hsve10 = rgb2hsv(e10);

he10 = hsve10(:,:,2);

he10 = he10\*255;

he10 = nonzeros(he10);

e10mean = mean(he10);

e\_mean = (e1mean+e2mean+e3mean+e4mean+e5mean+e6mean+e7mean+e8mean+e9mean+e10mean)/10;

[em,em2] = padcat2(he1,he2,he3,he4,he5,he6,he7,he8,he9,he10);

em2 = mean(em);

am1 = mean(am);

bm1 = mean(bm);

cm1 = mean(cm);

dm1 = mean(dm);

em1 = mean(em);

I1 = imread('D:\Matlab files\LDA\Samples\39e.bmp');

c(1) = ldasatfn(I1,am1,bm1,cm1,dm1,em1);

I2 = imread('D:\Matlab files\LDA\Samples\10c.bmp');

c(2) = ldasatfn(I2,am1,bm1,cm1,dm1,em1);

I3 = imread('D:\Matlab files\LDA\Samples\23e.bmp');

c(3) = ldasatfn(I3,am1,bm1,cm1,dm1,em1);

I4 = imread('D:\Matlab files\LDA\Samples\19c.bmp');

c(4) = ldasatfn(I4,am1,bm1,cm1,dm1,em1);

I5 = imread('D:\Matlab files\LDA\Samples\14d.bmp');

c(5) = ldasatfn(I5,am1,bm1,cm1,dm1,em1);

I6 = imread('D:\Matlab files\LDA\Samples\9b.bmp');

c(6) = ldasatfn(I6,am1,bm1,cm1,dm1,em1);

I7 = imread('D:\Matlab files\LDA\Samples\12c.bmp');

c(7) = ldasatfn(I7,am1,bm1,cm1,dm1,em1);

I8 = imread('D:\Matlab files\LDA\Samples\4d.bmp');

c(8) = ldasatfn(I8,am1,bm1,cm1,dm1,em1);

I9 = imread('D:\Matlab files\LDA\Samples\20c.bmp');

c(9) = ldasatfn(I9,am1,bm1,cm1,dm1,em1);

I10 = imread('D:\Matlab files\LDA\Samples\42c.bmp');

c(10) = ldasatfn(I10,am1,bm1,cm1,dm1,em1);

I11 = imread('D:\Matlab files\LDA\Samples\1b.bmp');

c(11) = ldasatfn(I11,am1,bm1,cm1,dm1,em1);

I12 = imread('D:\Matlab files\LDA\Samples\22c.bmp');

c(12) = ldasatfn(I12,am1,bm1,cm1,dm1,em1);

I13 = imread('D:\Matlab files\LDA\Samples\23b.bmp');

c(13) = ldasatfn(I13,am1,bm1,cm1,dm1,em1);

I14 = imread('D:\Matlab files\LDA\Samples\7b.bmp');

c(14) = ldasatfn(I14,am1,bm1,cm1,dm1,em1);

I15 = imread('d:\matlab files\lda\samples\25c.bmp');

c(15) = ldasatfn(I15,am1,bm1,cm1,dm1,em1);

Function for LDA classification

%class a

a1 = imread('D:\matlab files\LDA\Oranges\11A.bmp');

a1 = fruitfilter(a1);

hsva1 = rgb2hsv(a1);

ha1 = hsva1(:,:,1);

ha1 = ha1\*255;

ha1 = nonzeros(ha1);

a1mean = mean(ha1);

a2 = imread('D:\matlab files\LDA\Oranges\11B.bmp');

a2 = fruitfilter(a2);

hsva2 = rgb2hsv(a2);

ha2 = hsva2(:,:,1);

ha2 = ha2\*255;

ha2 = nonzeros(ha2);

a2mean = mean(ha2);

a3 = imread('D:\matlab files\LDA\Oranges\11C.bmp');

a3 = fruitfilter(a3);

hsva3 = rgb2hsv(a3);

ha3 = hsva3(:,:,1);

ha3 = ha3\*255;

ha3 = nonzeros(ha3);

a3mean = mean(ha3);

a4 = imread('D:\matlab files\LDA\Oranges\11D.bmp');

a4 = fruitfilter(a4);

hsva4 = rgb2hsv(a4);

ha4 = hsva4(:,:,1);

ha4 = ha4\*255;

ha4 = nonzeros(ha4);

a4mean = mean(ha4);

a5 = imread('D:\matlab files\LDA\Oranges\11E.bmp');

a5 = fruitfilter(a5);

hsva5 = rgb2hsv(a5);

ha5 = hsva5(:,:,1);

ha5 = ha5\*255;

ha5 = nonzeros(ha5);

a5mean = mean(ha5);

a6 = imread('D:\matlab files\LDA\Oranges\2A.bmp');

a6 = fruitfilter(a6);

hsva6 = rgb2hsv(a6);

ha6 = hsva6(:,:,1);

ha6 = ha6\*255;

ha6 = nonzeros(ha6);

a6mean = mean(ha6);

a7 = imread('D:\matlab files\LDA\Oranges\2B.bmp');

a7 = fruitfilter(a7);

hsva7 = rgb2hsv(a7);

ha7 = hsva7(:,:,1);

ha7 = ha7\*255;

ha7 = nonzeros(ha7);

a7mean = mean(ha7);

a8 = imread('D:\matlab files\LDA\Oranges\2C.bmp');

a8 = fruitfilter(a8);

hsva8 = rgb2hsv(a8);

ha8 = hsva8(:,:,1);

ha8 = ha8\*255;

ha8 = nonzeros(ha8);

a8mean = mean(ha8);

a9 = imread('D:\matlab files\LDA\Oranges\2D.bmp');

a9 = fruitfilter(a9);

hsva9 = rgb2hsv(a9);

ha9 = hsva9(:,:,1);

ha9 = ha9\*255;

ha9 = nonzeros(ha9);

a9mean = mean(ha9);

a10 = imread('D:\matlab files\LDA\Oranges\2E.bmp');

a10 = fruitfilter(a10);

hsva10 = rgb2hsv(a10);

ha10 = hsva10(:,:,1);

ha10 = ha10\*255;

ha10 = nonzeros(ha10);

a10mean = mean(ha10);

a\_mean = (a1mean+a2mean+a3mean+a4mean+a5mean+a6mean+a7mean+a8mean+a9mean+a10mean)/10;

[am,am2] = padcat2(ha1,ha2,ha3,ha4,ha5,ha6,ha7,ha8,ha9,ha10);

am2 = mean(am);

%class b

b1 = imread('D:\matlab files\LDA\Oranges\14A.bmp');

b1 = fruitfilter(b1);

hsvb1 = rgb2hsv(b1);

hb1 = hsvb1(:,:,1);

hb1 = hb1\*255;

hb1 = nonzeros(hb1);

b1mean = mean(hb1);

b2 = imread('D:\matlab files\LDA\Oranges\14B.bmp');

b2 = fruitfilter(b2);

hsvb2 = rgb2hsv(b2);

hb2 = hsvb2(:,:,1);

hb2 = hb2\*255;

hb2 = nonzeros(hb2);

b2mean = mean(hb2);

b3 = imread('D:\matlab files\LDA\Oranges\14C.bmp');

b3 = fruitfilter(b3);

hsvb3 = rgb2hsv(b3);

hb3 = hsvb3(:,:,1);

hb3 = hb3\*255;

hb3 = nonzeros(hb3);

b3mean = mean(hb3);

b4 = imread('D:\matlab files\LDA\Oranges\14D.bmp');

b4 = fruitfilter(b4);

hsvb4 = rgb2hsv(b4);

hb4 = hsvb4(:,:,1);

hb4 = hb4\*255;

hb4 = nonzeros(hb4);

b4mean = mean(hb4);

b5 = imread('D:\matlab files\LDA\Oranges\14E.bmp');

b5 = fruitfilter(b5);

hsvb5 = rgb2hsv(b5);

hb5 = hsvb5(:,:,1);

hb5 = hb5\*255;

hb5 = nonzeros(hb5);

b5mean = mean(hb5);

b6 = imread('D:\matlab files\LDA\Oranges\21A.bmp');

b6 = fruitfilter(b6);

hsvb6 = rgb2hsv(b6);

hb6 = hsvb6(:,:,1);

hb6 = hb6\*255;

hb6 = nonzeros(hb6);

b6mean = mean(hb6);

b7 = imread('D:\matlab files\LDA\Oranges\21B.bmp');

b7 = fruitfilter(b7);

hsvb7 = rgb2hsv(b7);

hb7 = hsvb7(:,:,1);

hb7 = hb7\*255;

hb7 = nonzeros(hb7);

b7mean = mean(hb7);

b8 = imread('D:\matlab files\LDA\Oranges\21C.bmp');

b8 = fruitfilter(b8);

hsvb8 = rgb2hsv(b8);

hb8 = hsvb8(:,:,1);

hb8 = hb8\*255;

hb8 = nonzeros(hb8);

b8mean = mean(hb8);

b9 = imread('D:\matlab files\LDA\Oranges\21D.bmp');

b9 = fruitfilter(b9);

hsvb9 = rgb2hsv(b9);

hb9 = hsvb9(:,:,1);

hb9 = hb9\*255;

hb9 = nonzeros(hb9);

b9mean = mean(hb9);

b10 = imread('D:\matlab files\LDA\Oranges\21E.bmp');

b10 = fruitfilter(b10);

hsvb10 = rgb2hsv(b10);

hb10 = hsvb10(:,:,1);

hb10 = hb10\*255;

hb10 = nonzeros(hb10);

b10mean = mean(hb10);

b\_mean = (b1mean+b2mean+b3mean+b4mean+b5mean+b6mean+b7mean+b8mean+b9mean+b10mean)/10;

[bm,bm2] = padcat2(hb1,hb2,hb3,hb4,hb5,hb6,hb7,hb8,hb9,hb10);

bm2 = mean(bm);

%class c

c1 = imread('D:\matlab files\LDA\Oranges\15A.bmp');

c1 = fruitfilter(c1);

hsvc1 = rgb2hsv(c1);

hc1 = hsvc1(:,:,1);

hc1 = hc1\*255;

hc1 = nonzeros(hc1);

c1mean = mean(hc1);

c2 = imread('D:\matlab files\LDA\Oranges\15B.bmp');

c2 = fruitfilter(c2);

hsvc2 = rgb2hsv(c2);

hc2 = hsvc2(:,:,1);

hc2 = hc2\*255;

hc2 = nonzeros(hc2);

c2mean = mean(hc2);

c3 = imread('D:\matlab files\LDA\Oranges\15C.bmp');

c3 = fruitfilter(c3);

hsvc3 = rgb2hsv(c3);

hc3 = hsvc3(:,:,1);

hc3 = hc3\*255;

hc3 = nonzeros(hc3);

c3mean = mean(hc3);

c4 = imread('D:\matlab files\LDA\Oranges\15D.bmp');

c4 = fruitfilter(c4);

hsvc4 = rgb2hsv(c4);

hc4 = hsvc4(:,:,1);

hc4 = hc4\*255;

hc4 = nonzeros(hc4);

c4mean = mean(hc4);

c5 = imread('D:\matlab files\LDA\Oranges\15E.bmp');

c5 = fruitfilter(c5);

hsvc5 = rgb2hsv(c5);

hc5 = hsvc5(:,:,1);

hc5 = hc5\*255;

hc5 = nonzeros(hc5);

c5mean = mean(hc5);

c6 = imread('D:\matlab files\LDA\Oranges\18A.bmp');

c6 = fruitfilter(c6);

hsvc6 = rgb2hsv(c6);

hc6 = hsvc6(:,:,1);

hc6 = hc6\*255;

hc6 = nonzeros(hc6);

c6mean = mean(hc6);

c7 = imread('D:\matlab files\LDA\Oranges\18B.bmp');

c7 = fruitfilter(c7);

hsvc7 = rgb2hsv(c7);

hc7 = hsvc7(:,:,1);

hc7 = hc7\*255;

hc7 = nonzeros(hc7);

c7mean = mean(hc7);

c8 = imread('D:\matlab files\LDA\Oranges\18C.bmp');

c8 = fruitfilter(c8);

hsvc8 = rgb2hsv(c8);

hc8 = hsvc8(:,:,1);

hc8 = hc8\*255;

hc8 = nonzeros(hc8);

c8mean = mean(hc8);

c9 = imread('D:\matlab files\LDA\Oranges\18D.bmp');

c9 = fruitfilter(c9);

hsvc9 = rgb2hsv(c9);

hc9 = hsvc9(:,:,1);

hc9 = hc9\*255;

hc9 = nonzeros(hc9);

c9mean = mean(hc9);

c10 = imread('D:\matlab files\LDA\Oranges\18E.bmp');

c10 = fruitfilter(c10);

hsvc10 = rgb2hsv(c10);

hc10 = hsvc10(:,:,1);

hc10 = hc10\*255;

hc10 = nonzeros(hc10);

c10mean = mean(hc10);

c\_mean = (c1mean+c2mean+c3mean+c4mean+c5mean+c6mean+c7mean+c8mean+c9mean+c10mean)/10;

[cm,cm2] = padcat2(hc1,hc2,hc3,hc4,hc5,hc6,hc7,hc8,hc9,hc10);

cm2 = mean(cm);

%class d

d1 = imread('D:\matlab files\LDA\Sathukudi\1A.bmp');

d1 = fruitfilter(d1);

hsvd1 = rgb2hsv(d1);

hd1 = hsvd1(:,:,1);

hd1 = hd1\*255;

hd1 = nonzeros(hd1);

d1mean = mean(hd1);

d2 = imread('D:\matlab files\LDA\Sathukudi\1B.bmp');

d2 = fruitfilter(d2);

hsvd2 = rgb2hsv(d2);

hd2 = hsvd2(:,:,1);

hd2 = hd2\*255;

hd2 = nonzeros(hd2);

d2mean = mean(hd2);

d3 = imread('D:\matlab files\LDA\Sathukudi\1C.bmp');

d3 = fruitfilter(d3);

hsvd3 = rgb2hsv(d3);

hd3 = hsvd3(:,:,1);

hd3 = hd3\*255;

hd3 = nonzeros(hd3);

d3mean = mean(hd3);

d4 = imread('D:\matlab files\LDA\Sathukudi\1D.bmp');

d4 = fruitfilter(d4);

hsvd4 = rgb2hsv(d4);

hd4 = hsvd4(:,:,1);

hd4 = hd4\*255;

hd4 = nonzeros(hd4);

d4mean = mean(hd4);

d5 = imread('D:\matlab files\LDA\Sathukudi\1E.bmp');

d5 = fruitfilter(d5);

hsvd5 = rgb2hsv(d5);

hd5 = hsvd5(:,:,1);

hd5 = hd5\*255;

hd5 = nonzeros(hd5);

d5mean = mean(hd5);

d6 = imread('D:\matlab files\LDA\Sathukudi\2A.bmp');

d6 = fruitfilter(d6);

hsvd6 = rgb2hsv(d6);

hd6 = hsvd6(:,:,1);

hd6 = hd6\*255;

hd6 = nonzeros(hd6);

d6mean = mean(hd6);

d7 = imread('D:\matlab files\LDA\Sathukudi\2B.bmp');

d7 = fruitfilter(d7);

hsvd7 = rgb2hsv(d7);

hd7 = hsvd7(:,:,1);

hd7 = hd7\*255;

hd7 = nonzeros(hd7);

d7mean = mean(hd7);

d8 = imread('D:\matlab files\LDA\Sathukudi\2C.bmp');

d8 = fruitfilter(d8);

hsvd8 = rgb2hsv(d8);

hd8 = hsvd8(:,:,1);

hd8 = hd8\*255;

hd8 = nonzeros(hd8);

d8mean = mean(hd8);

d9 = imread('D:\matlab files\LDA\Sathukudi\2D.bmp');

d9 = fruitfilter(d9);

hsvd9 = rgb2hsv(d9);

hd9 = hsvd9(:,:,1);

hd9 = hd9\*255;

hd9 = nonzeros(hd9);

d9mean = mean(hd9);

d10 = imread('D:\matlab files\LDA\Sathukudi\2E.bmp');

d10 = fruitfilter(d10);

hsvd10 = rgb2hsv(d10);

hd10 = hsvd10(:,:,1);

hd10 = hd10\*255;

hd10 = nonzeros(hd10);

d10mean = mean(hd10);

d\_mean = (d1mean+d2mean+d3mean+d4mean+d5mean+d6mean+d7mean+d8mean+d9mean+d10mean)/10;

[dm,dm2] = padcat2(hd1,hd2,hd3,hd4,hd5,hd6,hd7,hd8,hd9,hd10);

dm2 = mean(dm);

%class e

e1 = imread('D:\matlab files\LDA\Lemon\1A.bmp');

e1 = fruitfilter(e1);

hsve1 = rgb2hsv(e1);

he1 = hsve1(:,:,1);

he1 = he1\*255;

he1 = nonzeros(he1);

e1mean = mean(he1);

e2 = imread('D:\matlab files\LDA\Lemon\1B.bmp');

e2 = fruitfilter(e2);

hsve2 = rgb2hsv(e2);

he2 = hsve2(:,:,1);

he2 = he2\*255;

he2 = nonzeros(he2);

e2mean = mean(he2);

e3 = imread('D:\matlab files\LDA\Lemon\1C.bmp');

e3 = fruitfilter(e3);

hsve3 = rgb2hsv(e3);

he3 = hsve3(:,:,1);

he3 = he3\*255;

he3 = nonzeros(he3);

e3mean = mean(he3);

e4 = imread('D:\matlab files\LDA\Lemon\1D.bmp');

e4 = fruitfilter(e4);

hsve4 = rgb2hsv(e4);

he4 = hsve4(:,:,1);

he4 = he4\*255;

he4 = nonzeros(he4);

e4mean = mean(he4);

e5 = imread('D:\matlab files\LDA\Lemon\1E.bmp');

e5 = fruitfilter(e5);

hsve5 = rgb2hsv(e5);

he5 = hsve5(:,:,1);

he5 = he5\*255;

he5 = nonzeros(he5);

e5mean = mean(he5);

e6 = imread('D:\matlab files\LDA\Lemon\2A.bmp');

e6 = fruitfilter(e6);

hsve6 = rgb2hsv(e6);

he6 = hsve6(:,:,1);

he6 = he6\*255;

he6 = nonzeros(he6);

e6mean = mean(he6);

e7 = imread('D:\matlab files\LDA\Lemon\2B.bmp');

e7 = fruitfilter(e7);

hsve7 = rgb2hsv(e7);

he7 = hsve7(:,:,1);

he7 = he7\*255;

he7 = nonzeros(he7);

e7mean = mean(he7);

e8 = imread('D:\matlab files\LDA\Lemon\2C.bmp');

e8 = fruitfilter(e8);

hsve8 = rgb2hsv(e8);

he8 = hsve8(:,:,1);

he8 = he8\*255;

he8 = nonzeros(he8);

e8mean = mean(he8);

e9 = imread('D:\matlab files\LDA\Lemon\2D.bmp');

e9 = fruitfilter(e9);

hsve9 = rgb2hsv(e9);

he9 = hsve9(:,:,1);

he9 = he9\*255;

he9 = nonzeros(he9);

e9mean = mean(he9);

e10 = imread('D:\matlab files\LDA\Lemon\2E.bmp');

e10 = fruitfilter(e10);

hsve10 = rgb2hsv(e10);

he10 = hsve10(:,:,1);

he10 = he10\*255;

he10 = nonzeros(he10);

e10mean = mean(he10);

e\_mean = (e1mean+e2mean+e3mean+e4mean+e5mean+e6mean+e7mean+e8mean+e9mean+e10mean)/10;

[em,em2] = padcat2(he1,he2,he3,he4,he5,he6,he7,he8,he9,he10);

em2 = mean(em);

am1 = mean(am);

bm1 = mean(bm);

cm1 = mean(cm);

dm1 = mean(dm);

em1 = mean(em);

I1 = imread('D:\Matlab files\LDA\Samples\39e.bmp');

c(1) = classifyfn2(I1,am1,bm1,cm1,dm1,em1);

I2 = imread('D:\Matlab files\LDA\Samples\10c.bmp');

c(2) = classifyfn2(I2,am1,bm1,cm1,dm1,em1);

I3 = imread('D:\Matlab files\LDA\Samples\23e.bmp');

c(3) = classifyfn2(I3,am1,bm1,cm1,dm1,em1);

I4 = imread('D:\Matlab files\LDA\Samples\19c.bmp');

c(4) = classifyfn2(I4,am1,bm1,cm1,dm1,em1);

I5 = imread('D:\Matlab files\LDA\Samples\14d.bmp');

c(5) = classifyfn2(I5,am1,bm1,cm1,dm1,em1);

I6 = imread('D:\Matlab files\LDA\Samples\9b.bmp');

c(6) = classifyfn2(I6,am1,bm1,cm1,dm1,em1);

I7 = imread('D:\Matlab files\LDA\Samples\12c.bmp');

c(7) = classifyfn2(I7,am1,bm1,cm1,dm1,em1);

I8 = imread('D:\Matlab files\LDA\Samples\4d.bmp');

c(8) = classifyfn2(I8,am1,bm1,cm1,dm1,em1);

I9 = imread('D:\Matlab files\LDA\Samples\20c.bmp');

c(9) = classifyfn2(I9,am1,bm1,cm1,dm1,em1);

I10 = imread('D:\Matlab files\LDA\Samples\42c.bmp');

c(10) = classifyfn2(I10,am1,bm1,cm1,dm1,em1);

I11 = imread('D:\Matlab files\LDA\Samples\1b.bmp');

c(11) = classifyfn2(I11,am1,bm1,cm1,dm1,em1);

I12 = imread('D:\Matlab files\LDA\Samples\22c.bmp');

c(12) = classifyfn2(I12,am1,bm1,cm1,dm1,em1);

I13 = imread('D:\Matlab files\LDA\Samples\23b.bmp');

c(13) = classifyfn2(I13,am1,bm1,cm1,dm1,em1);

I14 = imread('D:\Matlab files\LDA\Samples\7b.bmp');

c(14) = classifyfn2(I14,am1,bm1,cm1,dm1,em1);

I15 = imread('d:\matlab files\lda\samples\25c.bmp');

c(15) = classifyfn2(I15,am1,bm1,cm1,dm1,em1);

**Function for classifying**

function [ index ] = ldasatfn(I, am1,bm1,cm1,dm1,em1 )

% Function to classify into one of the classes using LDA

%test sample

i = fruitfilter(I);

hsvt = rgb2hsv(i);

ht = hsvt(:,:,2);

ht = ht\*255;

ht = nonzeros(ht);

%tmean1

t = mean2(ht);

group = [ones(length(am1),1); (ones(length(bm1),1)\*2); (ones(length(cm1),1)\*3);(ones(length(dm1),1)\*4);(ones(length(em1),1)\*5)];

index = classify(t ,[am1'; bm1'; cm1'; dm1'; em1'],group);

% index = mode(class);

if index == 1

disp('Sample belongs to class A of oranges');

elseif index == 2

disp('Sample belongs to class B of oranges');

elseif index == 3

disp('Sample belongs to class C of oranges');

elseif index == 4

disp('Sample belongs to class of Sweet Lime');

elseif index == 5

disp('Sample belongs to class of Lemon');

end

end

% I = imread('D:\Matlab files\LDA\Samples\39e.bmp');

% classifyfn(I,am1,bm1,cm1,dm1,em1);

function [ index ] = classifyfn2(I, am1,bm1,cm1,dm1,em1 )

% Function to classify into one of the classes using LDA

%test sample

i = fruitfilter(I);

hsvt = rgb2hsv(i);

ht = hsvt(:,:,1);

ht = ht\*255;

ht = nonzeros(ht);

%tmean1

t = mean2(ht);

group = [ones(length(am1),1); (ones(length(bm1),1)\*2); (ones(length(cm1),1)\*3);(ones(length(dm1),1)\*4);(ones(length(em1),1)\*5)];

index = classify(t ,[am1'; bm1'; cm1'; dm1'; em1'],group);

% index = mode(class);

if index == 1

disp('Sample belongs to class A of oranges');

elseif index == 2

disp('Sample belongs to class B of oranges');

elseif index == 3

disp('Sample belongs to class C of oranges');

elseif index == 4

disp('Sample belongs to class of Sweet Lime');

elseif index == 5

disp('Sample belongs to class of Lemon');

end

end

% I = imread('D:\Matlab files\LDA\Samples\39e.bmp');

% classifyfn(I,am1,bm1,cm1,dm1,em1);

**PDF Programs:**

%class a

a1 = imread('D:\matlab files\LDA\Oranges\11A.bmp');

a1 = fruitfilter(a1);

hsva1 = rgb2hsv(a1);

ha1 = hsva1(:,:,1);

ha1 = ha1\*255;

ha1 = nonzeros(ha1);

[fa1 ba1] = hist(ha1,100);

fa1 = fa1./sum(fa1);

a2 = imread('D:\matlab files\LDA\Oranges\11B.bmp');

a2 = fruitfilter(a2);

hsva2 = rgb2hsv(a2);

ha2 = hsva2(:,:,1);

ha2 = ha2\*255;

ha2 = nonzeros(ha2);

[fa2 ba2] = hist(ha2,100);

fa2 = fa2./sum(fa2);

a3 = imread('D:\matlab files\LDA\Oranges\11C.bmp');

a3 = fruitfilter(a3);

hsva3 = rgb2hsv(a3);

ha3 = hsva3(:,:,1);

ha3 = ha3\*255;

ha3 = nonzeros(ha3);

[fa3 ba3] = hist(ha3,100);

fa3 = fa3./sum(fa3);

a4 = imread('D:\matlab files\LDA\Oranges\11D.bmp');

a4 = fruitfilter(a4);

hsva4 = rgb2hsv(a4);

ha4 = hsva4(:,:,1);

ha4 = ha4\*255;

ha4 = nonzeros(ha4);

[fa4 ba4] = hist(ha4,100);

fa4 = fa4./sum(fa4);

a5 = imread('D:\matlab files\LDA\Oranges\11E.bmp');

a5 = fruitfilter(a5);

hsva5 = rgb2hsv(a5);

ha5 = hsva5(:,:,1);

ha5 = ha5\*255;

ha5 = nonzeros(ha5);

[fa5 ba5] = hist(ha5,100);

fa5 = fa5./sum(fa5);

a6 = imread('D:\matlab files\LDA\Oranges\2A.bmp');

a6 = fruitfilter(a6);

hsva6 = rgb2hsv(a6);

ha6 = hsva6(:,:,1);

ha6 = ha6\*255;

ha6 = nonzeros(ha6);

[fa6 ba6] = hist(ha6,100);

fa6 = fa6./sum(fa6);

a7 = imread('D:\matlab files\LDA\Oranges\2B.bmp');

a7 = fruitfilter(a7);

hsva7 = rgb2hsv(a7);

ha7 = hsva7(:,:,1);

ha7 = ha7\*255;

ha7 = nonzeros(ha7);

[fa7 ba7] = hist(ha7,100);

fa7 = fa7./sum(fa7);

a8 = imread('D:\matlab files\LDA\Oranges\2C.bmp');

a8 = fruitfilter(a8);

hsva8 = rgb2hsv(a8);

ha8 = hsva8(:,:,1);

ha8 = ha8\*255;

ha8 = nonzeros(ha8);

[fa8 ba8] = hist(ha8,100);

fa8 = fa8./sum(fa8);

a9 = imread('D:\matlab files\LDA\Oranges\2D.bmp');

a9 = fruitfilter(a9);

hsva9 = rgb2hsv(a9);

ha9 = hsva9(:,:,1);

ha9 = ha9\*255;

ha9 = nonzeros(ha9);

[fa9 ba9] = hist(ha9,100);

fa9 = fa9./sum(fa9);

a10 = imread('D:\matlab files\LDA\Oranges\2E.bmp');

a10 = fruitfilter(a10);

hsva10 = rgb2hsv(a10);

ha10 = hsva10(:,:,1);

ha10 = ha10\*255;

ha10 = nonzeros(ha10);

[fa10 ba10] = hist(ha10,100);

fa10 = fa10./sum(fa10);

fa = (fa1+fa2+fa3+fa4+fa5+fa6+fa7+fa8+fa9+fa10)/10;

ba = (ba1+ba2+ba3+ba4+ba5+ba6+ba7+ba8+ba9+ba10)/10;

%class b

b1 = imread('D:\matlab files\LDA\Oranges\14A.bmp');

b1 = fruitfilter(b1);

hsvb1 = rgb2hsv(b1);

hb1 = hsvb1(:,:,1);

hb1 = hb1\*255;

hb1 = nonzeros(hb1);

[fb1 bb1] = hist(hb1,100);

fb1 = fb1./sum(fb1);

b2 = imread('D:\matlab files\LDA\Oranges\14B.bmp');

b2 = fruitfilter(b2);

hsvb2 = rgb2hsv(b2);

hb2 = hsvb2(:,:,1);

hb2 = hb2\*255;

hb2 = nonzeros(hb2);

[fb2 bb2] = hist(hb2,100);

fb2 = fb2./sum(fb2);

b3 = imread('D:\matlab files\LDA\Oranges\14C.bmp');

b3 = fruitfilter(b3);

hsvb3 = rgb2hsv(b3);

hb3 = hsvb3(:,:,1);

hb3 = hb3\*255;

hb3 = nonzeros(hb3);

[fb3 bb3] = hist(hb3,100);

fb3 = fb3./sum(fb3);

b4 = imread('D:\matlab files\LDA\Oranges\14D.bmp');

b4 = fruitfilter(b4);

hsvb4 = rgb2hsv(b4);

hb4 = hsvb4(:,:,1);

hb4 = hb4\*255;

hb4 = nonzeros(hb4);

[fb4 bb4] = hist(hb4,100);

fb4 = fb4./sum(fb4);

b5 = imread('D:\matlab files\LDA\Oranges\14E.bmp');

b5 = fruitfilter(b5);

hsvb5 = rgb2hsv(b5);

hb5 = hsvb5(:,:,1);

hb5 = hb5\*255;

hb5 = nonzeros(hb5);

[fb5 bb5] = hist(hb5,100);

fb5 = fb5./sum(fb5);

b6 = imread('D:\matlab files\LDA\Oranges\21A.bmp');

b6 = fruitfilter(b6);

hsvb6 = rgb2hsv(b6);

hb6 = hsvb6(:,:,1);

hb6 = hb6\*255;

hb6 = nonzeros(hb6);

[fb6 bb6] = hist(hb6,100);

fb6 = fb6./sum(fb6);

b7 = imread('D:\matlab files\LDA\Oranges\21B.bmp');

b7 = fruitfilter(b7);

hsvb7 = rgb2hsv(b7);

hb7 = hsvb7(:,:,1);

hb7 = hb7\*255;

hb7 = nonzeros(hb7);

[fb7 bb7] = hist(hb7,100);

fb7 = fb7./sum(fb7);

b8 = imread('D:\matlab files\LDA\Oranges\21C.bmp');

b8 = fruitfilter(b8);

hsvb8 = rgb2hsv(b8);

hb8 = hsvb8(:,:,1);

hb8 = hb8\*255;

hb8 = nonzeros(hb8);

[fb8 bb8] = hist(hb8,100);

fb8 = fb8./sum(fb8);

b9 = imread('D:\matlab files\LDA\Oranges\21D.bmp');

b9 = fruitfilter(b9);

hsvb9 = rgb2hsv(b9);

hb9 = hsvb9(:,:,1);

hb9 = hb9\*255;

hb9 = nonzeros(hb9);

[fb9 bb9] = hist(hb9,100);

fb9 = fb9./sum(fb9);

b10 = imread('D:\matlab files\LDA\Oranges\21E.bmp');

b10 = fruitfilter(b10);

hsvb10 = rgb2hsv(b10);

hb10 = hsvb10(:,:,1);

hb10 = hb10\*255;

hb10 = nonzeros(hb10);

[fb10 bb10] = hist(hb10,100);

fb10 = fb10./sum(fb10);

fb = (fb1+fb2+fb3+fb4+fb5+fb6+fb7+fb8+fb9+fb10)/10;

bb = (bb1+bb2+bb3+bb4+bb5+bb6+bb7+bb8+bb9+bb10)/10;

%class c

c1 = imread('D:\matlab files\LDA\Oranges\15A.bmp');

c1 = fruitfilter(c1);

hsvc1 = rgb2hsv(c1);

hc1 = hsvc1(:,:,1);

hc1 = hc1\*255;

hc1 = nonzeros(hc1);

[fc1 bc1] = hist(hc1,100);

fc1 = fc1./sum(fc1);

c2 = imread('D:\matlab files\LDA\Oranges\15B.bmp');

c2 = fruitfilter(c2);

hsvc2 = rgb2hsv(c2);

hc2 = hsvc2(:,:,1);

hc2 = hc2\*255;

hc2 = nonzeros(hc2);

[fc2 bc2] = hist(hc2,100);

fc2 = fc2./sum(fc2);

c3 = imread('D:\matlab files\LDA\Oranges\15C.bmp');

c3 = fruitfilter(c3);

hsvc3 = rgb2hsv(c3);

hc3 = hsvc3(:,:,1);

hc3 = hc3\*255;

hc3 = nonzeros(hc3);

[fc3 bc3] = hist(hc3,100);

fc3 = fc3./sum(fc3);

c4 = imread('D:\matlab files\LDA\Oranges\15D.bmp');

c4 = fruitfilter(c4);

hsvc4 = rgb2hsv(c4);

hc4 = hsvc4(:,:,1);

hc4 = hc4\*255;

hc4 = nonzeros(hc4);

[fc4 bc4] = hist(hc4,100);

fc4 = fc4./sum(fc4);

c5 = imread('D:\matlab files\LDA\Oranges\15E.bmp');

c5 = fruitfilter(c5);

hsvc5 = rgb2hsv(c5);

hc5 = hsvc5(:,:,1);

hc5 = hc5\*255;

hc5 = nonzeros(hc5);

[fc5 bc5] = hist(hc5,100);

fc5 = fc5./sum(fc5);

c6 = imread('D:\matlab files\LDA\Oranges\18A.bmp');

c6 = fruitfilter(c6);

hsvc6 = rgb2hsv(c6);

hc6 = hsvc6(:,:,1);

hc6 = hc6\*255;

hc6 = nonzeros(hc6);

[fc6 bc6] = hist(hc6,100);

fc6 = fc6./sum(fc6);

c7 = imread('D:\matlab files\LDA\Oranges\18B.bmp');

c7 = fruitfilter(c7);

hsvc7 = rgb2hsv(c7);

hc7 = hsvc7(:,:,1);

hc7 = hc7\*255;

hc7 = nonzeros(hc7);

[fc7 bc7] = hist(hc7,100);

fc7 = fc7./sum(fc7);

c8 = imread('D:\matlab files\LDA\Oranges\18C.bmp');

c8 = fruitfilter(c8);

hsvc8 = rgb2hsv(c8);

hc8 = hsvc8(:,:,1);

hc8 = hc8\*255;

hc8 = nonzeros(hc8);

[fc8 bc8] = hist(hc8,100);

fc8 = fc8./sum(fc8);

c9 = imread('D:\matlab files\LDA\Oranges\18D.bmp');

c9 = fruitfilter(c9);

hsvc9 = rgb2hsv(c9);

hc9 = hsvc9(:,:,1);

hc9 = hc9\*255;

hc9 = nonzeros(hc9);

[fc9 bc9] = hist(hc9,100);

fc9 = fc9./sum(fc9);

c10 = imread('D:\matlab files\LDA\Oranges\18E.bmp');

c10 = fruitfilter(c10);

hsvc10 = rgb2hsv(c10);

hc10 = hsvc10(:,:,1);

hc10 = hc10\*255;

hc10 = nonzeros(hc10);

[fc10 bc10] = hist(hc10,100);

fc10 = fc10./sum(fc10);

fc = (fc1+fc2+fc3+fc4+fc5+fc6+fc7+fc8+fc9+fc10)/10;

bc = (bc1+bc2+bc3+bc4+bc5+bc6+bc7+bc8+bc9+bc10)/10;

%class d

d1 = imread('D:\matlab files\LDA\Sathukudi\1A.bmp');

d1 = fruitfilter(d1);

hsvd1 = rgb2hsv(d1);

hd1 = hsvd1(:,:,1);

hd1 = hd1\*255;

hd1 = nonzeros(hd1);

[fd1 bd1] = hist(hd1,100);

fd1 = fd1./sum(fd1);

d2 = imread('D:\matlab files\LDA\Sathukudi\1B.bmp');

d2 = fruitfilter(d2);

hsvd2 = rgb2hsv(d2);

hd2 = hsvd2(:,:,1);

hd2 = hd2\*255;

hd2 = nonzeros(hd2);

[fd2 bd2] = hist(hd2,100);

fd2 = fd2./sum(fd2);

d3 = imread('D:\matlab files\LDA\Sathukudi\1C.bmp');

d3 = fruitfilter(d3);

hsvd3 = rgb2hsv(d3);

hd3 = hsvd3(:,:,1);

hd3 = hd3\*255;

hd3 = nonzeros(hd3);

[fd3 bd3] = hist(hd3,100);

fd3 = fd3./sum(fd3);

d4 = imread('D:\matlab files\LDA\Sathukudi\1D.bmp');

d4 = fruitfilter(d4);

hsvd4 = rgb2hsv(d4);

hd4 = hsvd4(:,:,1);

hd4 = hd4\*255;

hd4 = nonzeros(hd4);

[fd4 bd4] = hist(hd4,100);

fd4 = fd4./sum(fd4);

d5 = imread('D:\matlab files\LDA\Sathukudi\1E.bmp');

d5 = fruitfilter(d5);

hsvd5 = rgb2hsv(d5);

hd5 = hsvd5(:,:,1);

hd5 = hd5\*255;

hd5 = nonzeros(hd5);

[fd5 bd5] = hist(hd5,100);

fd5 = fd5./sum(fd5);

d6 = imread('D:\matlab files\LDA\Sathukudi\2A.bmp');

d6 = fruitfilter(d6);

hsvd6 = rgb2hsv(d6);

hd6 = hsvd6(:,:,1);

hd6 = hd6\*255;

hd6 = nonzeros(hd6);

[fd6 bd6] = hist(hd6,100);

fd6 = fd6./sum(fd6);

d7 = imread('D:\matlab files\LDA\Sathukudi\2B.bmp');

d7 = fruitfilter(d7);

hsvd7 = rgb2hsv(d7);

hd7 = hsvd7(:,:,1);

hd7 = hd7\*255;

hd7 = nonzeros(hd7);

[fd7 bd7] = hist(hd7,100);

fd7 = fd7./sum(fd7);

d8 = imread('D:\matlab files\LDA\Sathukudi\2C.bmp');

d8 = fruitfilter(d8);

hsvd8 = rgb2hsv(d8);

hd8 = hsvd8(:,:,1);

hd8 = hd8\*255;

hd8 = nonzeros(hd8);

[fd8 bd8] = hist(hd8,100);

fd8 = fd8./sum(fd8);

d9 = imread('D:\matlab files\LDA\Sathukudi\2D.bmp');

d9 = fruitfilter(d9);

hsvd9 = rgb2hsv(d9);

hd9 = hsvd9(:,:,1);

hd9 = hd9\*255;

hd9 = nonzeros(hd9);

[fd9 bd9] = hist(hd9,100);

fd9 = fd9./sum(fd9);

d10 = imread('D:\matlab files\LDA\Sathukudi\2E.bmp');

d10 = fruitfilter(d10);

hsvd10 = rgb2hsv(d10);

hd10 = hsvd10(:,:,1);

hd10 = hd10\*255;

hd10 = nonzeros(hd10);

[fd10 bd10] = hist(hd10,100);

fd10 = fd10./sum(fd10);

fd = (fd1+fd2+fd3+fd4+fd5+fd6+fd7+fd8+fd9+fd10)/10;

bd = (bd1+bd2+bd3+bd4+bd5+bd6+bd7+bd8+bd9+bd10)/10;

%class e

e1 = imread('D:\matlab files\LDA\Lemon\1A.bmp');

e1 = fruitfilter(e1);

hsve1 = rgb2hsv(e1);

he1 = hsve1(:,:,1);

he1 = he1\*255;

he1 = nonzeros(he1);

[fe1 be1] = hist(he1,100);

fe1 = fe1./sum(fe1);

e2 = imread('D:\matlab files\LDA\Lemon\1B.bmp');

e2 = fruitfilter(e2);

hsve2 = rgb2hsv(e2);

he2 = hsve2(:,:,1);

he2 = he2\*255;

he2 = nonzeros(he2);

[fe2 be2] = hist(he2,100);

fe2 = fe2./sum(fe2);

e3 = imread('D:\matlab files\LDA\Lemon\1C.bmp');

e3 = fruitfilter(e3);

hsve3 = rgb2hsv(e3);

he3 = hsve3(:,:,1);

he3 = he3\*255;

he3 = nonzeros(he3);

[fe3 be3] = hist(he3,100);

fe3 = fe3./sum(fe3);

e4 = imread('D:\matlab files\LDA\Lemon\1D.bmp');

e4 = fruitfilter(e4);

hsve4 = rgb2hsv(e4);

he4 = hsve4(:,:,1);

he4 = he4\*255;

he4 = nonzeros(he4);

[fe4 be4] = hist(he4,100);

fe4 = fe4./sum(fe4);

e5 = imread('D:\matlab files\LDA\Lemon\1E.bmp');

e5 = fruitfilter(e5);

hsve5 = rgb2hsv(e5);

he5 = hsve5(:,:,1);

he5 = he5\*255;

he5 = nonzeros(he5);

[fe5 be5] = hist(he5,100);

fe5 = fe5./sum(fe5);

e6 = imread('D:\matlab files\LDA\Lemon\2A.bmp');

e6 = fruitfilter(e6);

hsve6 = rgb2hsv(e6);

he6 = hsve6(:,:,1);

he6 = he6\*255;

he6 = nonzeros(he6);

[fe6 be6] = hist(he6,100);

fe6 = fe6./sum(fe6);

e7 = imread('D:\matlab files\LDA\Lemon\2B.bmp');

e7 = fruitfilter(e7);

hsve7 = rgb2hsv(e7);

he7 = hsve7(:,:,1);

he7 = he7\*255;

he7 = nonzeros(he7);

[fe7 be7] = hist(he7,100);

fe7 = fe7./sum(fe7);

e8 = imread('D:\matlab files\LDA\Lemon\2C.bmp');

e8 = fruitfilter(e8);

hsve8 = rgb2hsv(e8);

he8 = hsve8(:,:,1);

he8 = he8\*255;

he8 = nonzeros(he8);

[fe8 be8] = hist(he8,100);

fe8 = fe8./sum(fe8);

e9 = imread('D:\matlab files\LDA\Lemon\2D.bmp');

e9 = fruitfilter(e9);

hsve9 = rgb2hsv(e9);

he9 = hsve9(:,:,1);

he9 = he9\*255;

he9 = nonzeros(he9);

[fe9 be9] = hist(he9,100);

fe9 = fe9./sum(fe9);

e10 = imread('D:\matlab files\LDA\Lemon\2E.bmp');

e10 = fruitfilter(e10);

hsve10 = rgb2hsv(e10);

he10 = hsve10(:,:,1);

he10 = he10\*255;

he10 = nonzeros(he10);

[fe10 be10] = hist(he10,100);

fe10 = fe10./sum(fe10);

fe = (fe1+fe2+fe3+fe4+fe5+fe6+fe7+fe8+fe9+fe10)/10;

be = (be1+be2+be3+be4+be5+be6+be7+be8+be9+be10)/10;

%fruit sample

I1 = imread('D:\Matlab files\LDA\Samples\39e.bmp');

c(1) = pdfclassifyfn(I1,fa,fb,fc,fd,fe);

I2 = imread('D:\Matlab files\LDA\Samples\10c.bmp');

c(2) = pdfclassifyfn(I2,fa,fb,fc,fd,fe);

I3 = imread('D:\Matlab files\LDA\Samples\23e.bmp');

c(3) = pdfclassifyfn(I3,fa,fb,fc,fd,fe);

I4 = imread('D:\Matlab files\LDA\Samples\19c.bmp');

c(4) = pdfclassifyfn(I4,fa,fb,fc,fd,fe);

I5 = imread('D:\Matlab files\LDA\Samples\14d.bmp');

c(5) = pdfclassifyfn(I5,fa,fb,fc,fd,fe);

I6 = imread('D:\Matlab files\LDA\Samples\9b.bmp');

c(6) = pdfclassifyfn(I6,fa,fb,fc,fd,fe);

I7 = imread('D:\Matlab files\LDA\Samples\12c.bmp');

c(7) = pdfclassifyfn(I7,fa,fb,fc,fd,fe);

I8 = imread('D:\Matlab files\LDA\Samples\4d.bmp');

c(8) = pdfclassifyfn(I8,fa,fb,fc,fd,fe);

I9 = imread('D:\Matlab files\LDA\Samples\20c.bmp');

c(9) = pdfclassifyfn(I9,fa,fb,fc,fd,fe);

I10 = imread('D:\Matlab files\LDA\Samples\42c.bmp');

c(10) = pdfclassifyfn(I10,fa,fb,fc,fd,fe);

I11 = imread('D:\Matlab files\LDA\Samples\1b.bmp');

c(11) = pdfclassifyfn(I11,fa,fb,fc,fd,fe);

I12 = imread('D:\Matlab files\LDA\Samples\22c.bmp');

c(12) = pdfclassifyfn(I12,fa,fb,fc,fd,fe);

I13 = imread('D:\Matlab files\LDA\Samples\23b.bmp');

c(13) = pdfclassifyfn(I13,fa,fb,fc,fd,fe);

I14 = imread('D:\Matlab files\LDA\Samples\7b.bmp');

c(14) = pdfclassifyfn(I14,fa,fb,fc,fd,fe);

I15 = imread('d:\matlab files\lda\samples\25c.bmp');

c(15) = pdfclassifyfn(I15,fa,fb,fc,fd,fe);

% %sample plot

% plot(ba,fa,'linewidth',1.3);

% hold on;

% plot(bb,fb,'color','m','linewidth',1.3);

% plot(bc,fc,'color','g','linewidth',1.3);

% plot(bd,fd,'color','c','linewidth',1.3);

% plot(be,fe,'color','k','linewidth',1.3);

% plot(bt,ft,'color','r','linewidth',2);

**Function to classify based of pdf**

function [ c ] = pdfclassifyfn( t1,fa,fb,fc,fd,fe )

%Classifies using PDA a sample image into one of the 5 classes

t1 = fruitfilter(t1);

hsvt1 = rgb2hsv(t1);

ht1 = hsvt1(:,:,1);

ht1= ht1\*255;

ht1 = nonzeros(ht1);

[ft bt] = hist(ht1,100);

ft = ft./sum(ft);

x(1) = corr(fa',ft');

x(2) = corr(fb',ft');

x(3) = corr(fc',ft');

x(4) = corr(fd',ft');

x(5) = corr(fe',ft');

l = max(x);

if l == x(1)

disp('sample belongs to class A of oranges');

cls = 1;

elseif l == x(2)

disp('sample belongs to class B of oranges');

cls = 2;

elseif l == x(3)

cls = 3;

disp('sample belongs to class C of oranges');

elseif l == x(4)

cls = 4;

disp('sample belongs to class of Sathukudi');

elseif l == x(5)

disp('sample belongs to class of Lemon');

cls = 5;

end

end

**Shapes:**

**Fourier Harmonics Program:**

I = imread('D:\matlab files\img\Shape\2.bmp');

gray = rgb2gray(I);

bw = im2bw(gray, 0.77);

cont = Contourfn(bw);

imshow(cont);

[a b]= find(cont==1);

cont2 = [b a];

N = 256;

x = length(cont2);

n = linspace(1,x,256);

n = floor(n);

conn1 = zeros(N,2);

for i = 1:N

conn1(i,:) = cont2(n(i),:);

end

centroid = regionprops(cont,'centroid');

centroid = centroid.Centroid;

r1 = zeros(size(conn1,1),1);

for i = 1:size(conn1,1)

xk = conn1(i,1);

yk = conn1(i,2);

r1(i,1) = hypot((xk - centroid(1)),(yk - centroid(2)));

end

f = zeros(11,1);

%heuristic shape separator

for u = 1:11,

xy = 0;

for k = 1:N

xy = xy + r1(k)\*exp(-2\*pi\*(u-1)\*k/N);

end

f(u) = 1/N \*xy;

end

S1 = 0; S2=0; S3=0;

m = 1;

for l = 1:10

S1 = S1 + f(l)\*l^m;

end

m = 2;

for l = 1:10

S2 = S2 + f(l)\*l^m;

end

m = 3;

for l = 1:10

S3 = S3 + f(l)\*l^m;

end

S=[S1;S2;S3];

**Correlation coefficient:**

a = corrcoef(con1 ,conc);

d(1,3) = a(1,2);

a = corrcoef(con2 ,conc);

d(2,3) = a(1,2);

a = corrcoef(con3 ,conc);

d(3,3) = a(1,2);

a = corrcoef(con4 ,conc);

d(4,3) = a(1,2);

a = corrcoef(con5 ,conc);

d(5,3) = a(1,2);

a = corrcoef(con6 ,conc);

d(6,3) = a(1,2);

a = corrcoef(con7 ,conc);

d(7,3) = a(1,2);

a = corrcoef(con8 ,conc);

d(8,3) = a(1,2);

a = corrcoef(con9 ,conc);

d(9,3) = a(1,2);

a = corrcoef(con10 ,conc);

d(10,3) = a(1,2);

a = corrcoef(con11 ,conc);

d(11,3) = a(1,2);

a = corrcoef(con12 ,conc);

d(12,3) = a(1,2);

a = corrcoef(con13 ,conc);

d(13,3) = a(1,2);

a = corrcoef(con14 ,conc);

d(14,3) = a(1,2);

a = corrcoef(con15 ,conc);

d(15,3) = a(1,2);