ECE-271A

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HW1 Report

1. The prior probabilities are calculated by:

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| 0 | 0.15600 | 0.17600 | 0.0400 | 0.05200 | 0.06800 | 0.08800 | 0.10800 |
| 0.05200 | 0.00800 | 0 | 0.00800 | 0.04800 | 0.0600 | 0.03200 | 0.00800 |
| 0.01200 | 0.02800 | 0.03200 | 0.00800 | 0.00400 | 0 | 0 | 0 |
| 0 | 0.00400 | 0 | 0 | 0 | 0 | 0.00400 | 0 |
| 0.00400 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

1. The computed data of the is (from 1 to 64):

Chart, histogram

Description automatically generatedThe computed data of the is (from 1 to 64):

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| 0 | 0.301044634377968 | 0.396011396011396 | 0.0379867046533713 | 0.0921177587844255 | 0.0902184235517569 | 0.0170940170940171 | 0.0256410256410256 |
| 0.0180436847103514 | 0.00569800569800570 | 0 | 0.00284900284900285 | 0.00664767331433998 | 0.00284900284900285 | 0.00189933523266857 | 0 |
| 0 | 0.00189933523266857 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

1. A picture containing diagram

   Description automatically generated

Matlab Code:

%% a)

samples= load('TrainingSamplesDCT\_8.mat');

BG = samples.TrainsampleDCT\_BG;

FG = samples.TrainsampleDCT\_FG;

BGsize = size(BG,1) \* size(BG,2); % number of samples in the set of background

FGsize = size(FG,1) \* size(FG,2); % number of samples in the set of foreground

Ysize = BGsize+ FGsize; % number of samples in the total training set

Pyc = FGsize / Ysize; % P\_Y(Cheetah)

Pyg = BGsize / Ysize; % P\_Y(Grass)

%% b)

Xbg = zeros([1 64]);

Xfg = zeros([1 64]);

for i = 1:size(BG,1)

temp = sort(BG(i,:),'descend');

Xbg(BG(i,:)==temp(2)) = Xbg(BG(i,:)==temp(2)) + 1;

end

for i = 1:size(FG,1)

temp = sort(FG(i,:),'descend');

Xfg(FG(i,:)==temp(2)) = Xfg(FG(i,:)==temp(2)) + 1;

end

Pxyg = Xbg/size(BG,1); % P\_X|Y(x|grass)

Pxyc = Xfg/size(FG,1); % P\_X|Y(x|cheetah)

figure

subplot(1,2,1);

bar(Pxyg);

title('Index Histogram of P\_{X|Y}(x|grass)');

subplot(1,2,2);

bar(Pxyc);

title('Index Histogram of P\_{X|Y}(x|cheetah)');

%% c)

img= im2double(imread('cheetah.bmp'));

[row, colm] = size(img);

blocks = zeros(row-8,colm-8);

A = zeros(row-8,colm-8);

%read Zig-Zag Pattern.txt file

ZigZag = fopen('Zig-Zag Pattern.txt','r');

zzPat = fscanf(ZigZag,'%d',[8,8]);

fclose(ZigZag);

for i = 1:row-8

for j = 1:colm-8

dctImg = dct2(img(i:i+7,j:j+7));

zzScan= zeros([1, 64]);

for x = 1:8

for y = 1:8

zzScan(zzPat(x,y)+1) = abs(dctImg(x,y));

end

end

tempZZ = sort(zzScan,'descend');

blocks(i,j) = find(zzScan==tempZZ(2));

end

end

for i = 1:row-8

for j = 1:colm-8

if Pxyc(blocks(i,j))\*Pyc >= Pxyg(blocks(i,j))\*Pyg

A(i,j) = 1;

end

end

end

figure

imagesc(A);

colormap(gray(255));

title(['The Predition of ','cheetah.bmp']);

%% d)

ground\_truth = im2double(imread('cheetah\_mask.bmp'));

% Padding to make the predition image the same size as the mask image

% The size of predition image is 247 x 262

PredImg = padarray(A, [4,4], 0);

missFG = 0;

missBG = 0;

gtFG = 0;

gtBG = 0;

for i = 1:size(ground\_truth,1)

for j = 1:size(ground\_truth,2)

if ground\_truth(i,j) == 1

gtFG = gtFG + 1;

if PredImg(i,j) ~= ground\_truth(i,j)

missFG = missFG + 1;

end

else

gtBG = gtBG + 1;

if PredImg(i,j) ~= ground\_truth(i,j)

missBG = missBG + 1;

end

end

end

end

% Calculate error

errFG = missFG / gtFG \* Pyc;

errBG = missBG / gtBG \* Pyg;

err = errFG + errBG;