ECE-271A

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HW1 Report

a) The prior probabilities are calculated by:

$$P_Y(cheetah) = \frac{the\ number\ of\ samples\ in\ the\ foreground\ set}{the\ number\ of\ total\ samples\ in\ the\ tranining\ set} = 0.1919$$

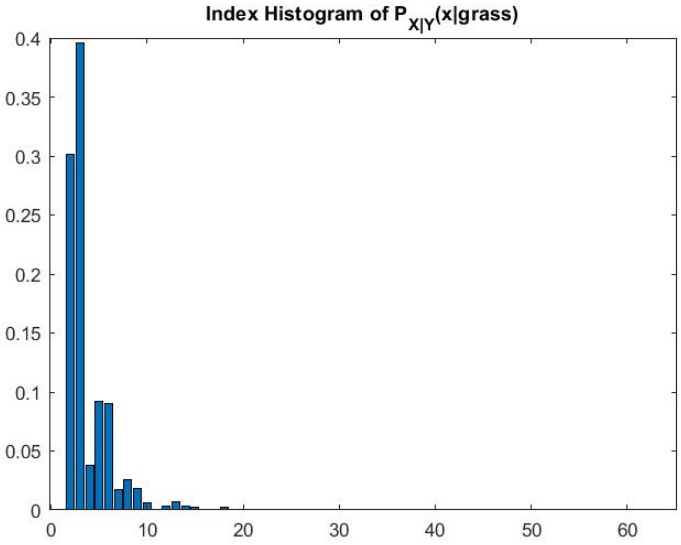
$$P_Y(grass) = \frac{the\ number\ of\ samples\ in\ the\ background\ set}{the\ number\ of\ total\ samples\ in\ the\ tranining\ set} = 0.8081$$

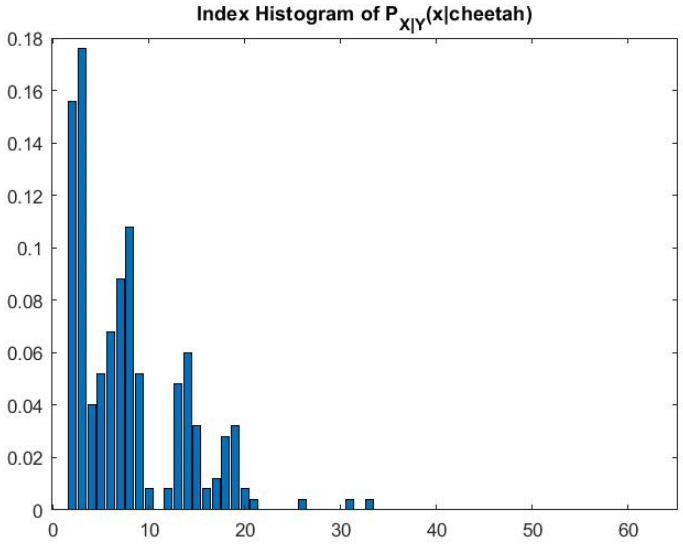
b) The computed data of the $P_{X|Y}(x|cheetah)$ is (from 1 to 64):

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

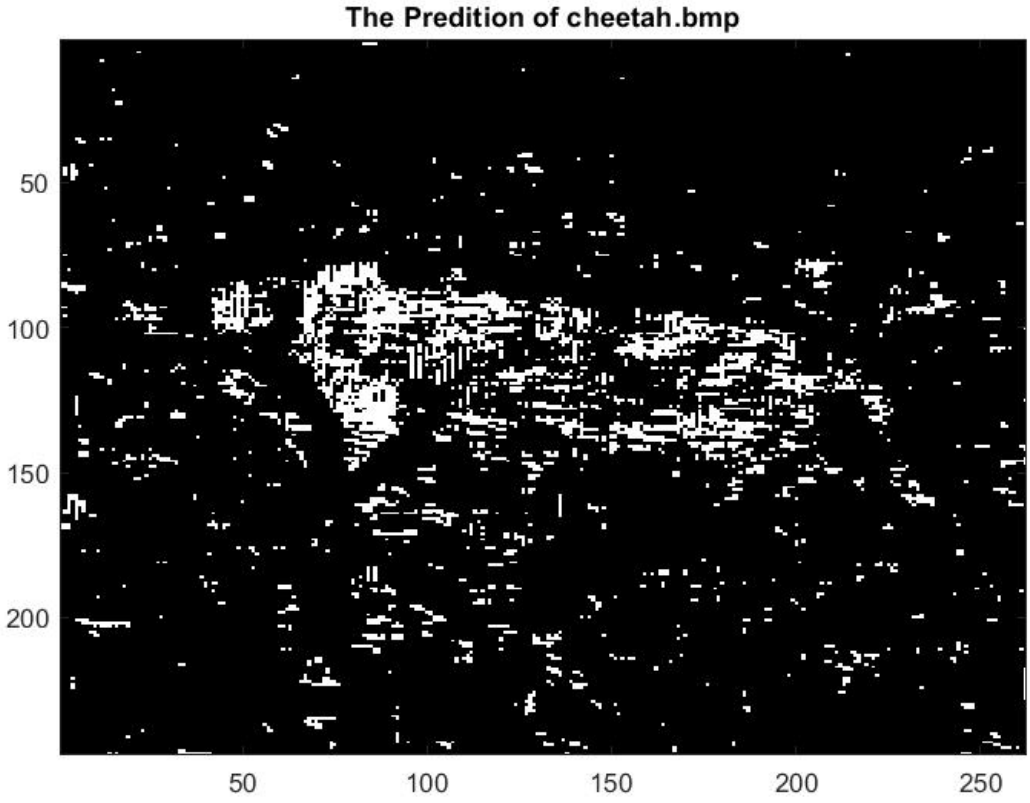
The computed data of the $P_{X|Y}(x|grass)$ is (from 1 to 64):

0	0.30104463 4377968	0.3960113 96011396	0.03798670 46533713	0.09211775 87844255	0.09021842 35517569	0.01709401 70940171	0.0256410 256410256
0.0180436 847103514	0.00569800 569800570	0	0.00284900 284900285	0.00664767 331433998	0.00284900 284900285	0.00189933 523266857	0
0	0.00189933 523266857	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





c)



d) $error(foreground) = 0.1478$

$error(background) = 0.0225$

$error = error(foreground) + error(background) = 0.1703$

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;
```