UE19CS333 - IPCV Assignment 4

OMR Sheet Evaluation

Team No: 5
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1. **Given an input image, identify the image as belonging to one of the following types:**

a. Instruction sheet

b. Answer sheet with nothing written on it

c. Answer sheet with something written on it (question may be marked or not)

d. Graph sheet

e. Rough sheet (blank)

Code

```
imagefiles = dir('./52scripts/*.jpg');

baseline_hist = zeros(14,256);

baseline_hist(1,:) =
imhist(rgb2gray(imcomplement(imread("./52scripts/PES1UG20BT005#UE20CS151#66_15.
jpg"))));

baseline_hist(2,:) =
imhist(rgb2gray(imcomplement(imread("./52scripts/PES1UG20BT005#UE20CS151#66_16.
jpg"))));%blank
```

```
baseline_hist(3,:) =
imhist(rgb2gray(imcomplement(imread("./52scripts/PES1UG20BT005#UE20CS151#66_52.
jpg"))));%emp

baseline_hist(4,:) =
imhist(rgb2gray(imcomplement(imread("./52scripts/PES1UG20BT005#UE20CS151#66_3.j
pg"))));

baseline_hist(5,:) =
imhist(rgb2gray(imcomplement(imread("./52scripts/PES1UG20BT005#UE20CS151#66_4.j
pg"))));%graph

baseline_hist(6,:) =
imhist(rgb2gray(imcomplement(imread("./52scripts/PES1UG20BT005#UE20CS151#66_5.j
pg"))));

baseline_hist(7,:) =
imhist(rgb2gray(imcomplement(imread("./52scripts/PES1UG20BT005#UE20CS151#66_6.j
pg"))));%log

baseline_hist(8,:) =
imhist(rgb2gray(imcomplement(imread("./52scripts/PES1UG20BT005#UE20CS151#66_2.j
pg"))));%ins

baseline_hist(9,:) =
imhist(rgb2gray(imcomplement(imread("./52scripts/PES1UG20BT005#UE20CS151#66_7.j
pg"))));

baseline_hist(10,:) =
imhist(rgb2gray(imcomplement(imread("./52scripts/PES1UG20BT005#UE20CS151#66_8.j
pg"))));%filled

baseline_hist(11,:) =
imhist(rgb2gray(imcomplement(imread("./52scripts/PES1UG20BT005#UE20CS151#66_13.
jpg"))));

baseline_hist(12,:) =
imhist(rgb2gray(imcomplement(imread("./52scripts/PES1UG20BT005#UE20CS151#66_11.
jpg"))));% half filled

baseline_hist(13,:) =
imhist(rgb2gray(imcomplement(imread("./48scripts/PES1PG20MB354#UM20MB636#72_12.
jpg"))));

baseline_hist(14,:) =
imhist(rgb2gray(imcomplement(imread("./48scripts/PES1PG20MB354#UM20MB636#72_13.
jpg"))));

nfiles = length(imagefiles);

for ii=1:nfiles

  currentfilename = imagefiles(ii).name;

  currentimage = imhist(rgb2gray(imcomplement(imread(['./52scripts/'
currentfilename]))));
```

```
min = 1;
min_val = inf;
for jj = 1:14
    diff = sum(abs(currentimage - baseline_hist(jj,:).'));
    if min_val > diff
        min_val = diff;
        min = jj;
    end
end
disp(currentfilename);
cat = 0;
if min <= 2
    cat = 1;
    disp("Blank Answer Sheet");
elseif min == 3
    cat = 5;
    disp("Worksheet")
elseif min <= 7
    cat = 2;
    disp("Graph Sheet");
elseif min == 8
    cat = 3;
    disp("Instructions Sheet");
elseif min >=13
    cat = 1;
    disp("Blank Answer Sheet");
else
     cat = 4;
     disp("Filled Answer Sheet");
```

```
        imwrite(imread(['./52scripts/' currentfilename]), ['./valid_scripts/'
currentfilename]);

  end

end
```

Output

PES1UG20BT005#UE20CS151#66_10.jpg

Filled Answer Sheet

PES1UG20BT005#UE20CS151#66_11.jpg

Filled Answer Sheet

PES1UG20BT005#UE20CS151#66_12.jpg

Filled Answer Sheet

PES1UG20BT005#UE20CS151#66_13.jpg

Filled Answer Sheet

PES1UG20BT005#UE20CS151#66_14.jpg

Filled Answer Sheet

PES1UG20BT005#UE20CS151#66_15.jpg

Blank Answer Sheet

PES1UG20BT005#UE20CS151#66_16.jpg

Blank Answer Sheet

PES1UG20BT005#UE20CS151#66_2.jpg

Instructions Sheet

PES1UG20BT005#UE20CS151#66_3.jpg

Graph Sheet

PES1UG20BT005#UE20CS151#66_4.jpg

Graph Sheet

PES1UG20BT005#UE20CS151#66_5.jpg

Graph Sheet

PES1UG20BT005#UE20CS151#66_52.jpg

Worksheet

PES1UG20BT005#UE20CS151#66_6.jpg

Graph Sheet

PES1UG20BT005#UE20CS151#66_7.jpg

Filled Answer Sheet

PES1UG20BT005#UE20CS151#66_8.jpg

Filled Answer Sheet

PES1UG20BT005#UE20CS151#66_9.jpg

Filled Answer Sheet

2. For an image identified as type 1(c) – something written on the answer sheet – determine the question number (1, 2, 3, 4 or 5) and section number (a, b, c or d)

evaluateOMR.m

This function reads in an image passed from the client. The image is then cropped to select the region of interest (ROI) based on the location of question and section bubbles.

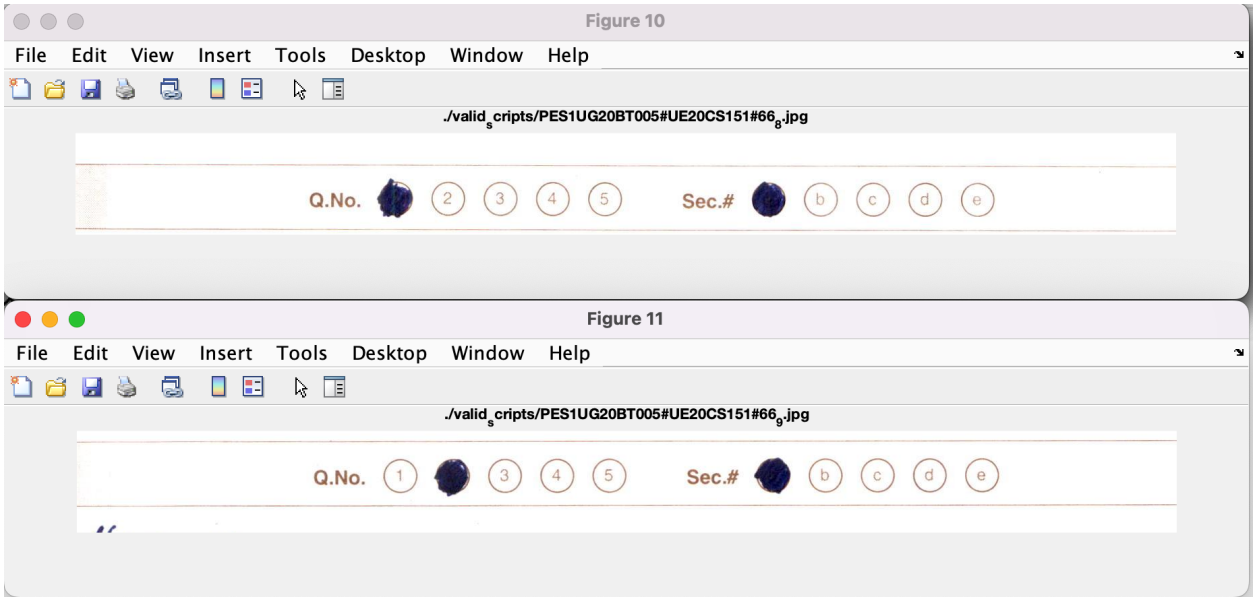

Figure : Sample ROI

The ROI is then converted to grayscale and binarized. The binarized image is then inverted. We then apply a median filter to remove salt and pepper noise (if any). We then find region props in the processed ROI image and store properties like Area, BoundingBox, Centroid and so on.

We then obtain the coordinates of Centroids and then evaluate the question bubble and section bubble based on these centroid positions. Deciding the question number boils down to finding the location of centroid on the first bubble and the location of centroid on the second bubble. The difference between these locations is used to estimate the distance between each bubble.

Location of subsequent bubbles can be estimated by adding this difference (multiplied by bubble_index - 1) to the location of the first bubble. Additionally, a margin of 10 pixels were kept to account for small variations in scanning the scripts.

```
function [q, s] = evaluateOMR(image_path)

img = imread(image_path);

roi = img(300:450,300:end-450,:);

figure; imshow(roi); hold on; title(image_path); hold off;

gray = rgb2gray(roi);

binary = ~(im2bw(gray, graythresh(roi)));

binary = medfilt2(binary);

BW2 = bwareaopen(binary,1000);

cc2 = bwconncomp(BW2);

regionprop = regionprops(BW2,'Area', 'BoundingBox', 'Eccentricity',
'MajorAxisLength', 'MinorAxisLength', 'Orientation', 'Perimeter', 'Centroid');

coords = vertcat(regionprop.Centroid);

if size(coords,1) < 2

   q = "-1";

   s = "-1";

   return;

end

[~, ~, coords(:, 2)] = histcounts(coords(:, 2), 3);

[~, sortIndex] = sortrows(coords, [1 2]);

s_struct = regionprop(sortIndex);

if size(s_struct,1) == 2

   q_centroid = s_struct(1).Centroid;

   s_centroid = s_struct(2).Centroid;

   q_centroid = q_centroid(1);

   s_centroid = s_centroid(1);

else
```

```
    q = "-1";
    s = "-1";
    return;
end
folder = strcat(image_path, ".xlsx");
t = struct2table(s_struct);
writetable(t, folder);
if (q_centroid > 474-10 ) && (q_centroid < 474+10)
    q = "1";
elseif (q_centroid > 474-10+77*1) && (q_centroid < 474+10+77*1)
    q = "2";
elseif (q_centroid > 474-10+77*2) && (q_centroid < 474+10+77*2)
    q = "3";
elseif (q_centroid > 474-10+77*3) && (q_centroid < 474+10+77*3)
    q = "4";
elseif (q_centroid > 474-10+77*4) && (q_centroid < 474+10+77*4)
    q = "5";
else
    q = "-1";
end
if (s_centroid > 1028-10 ) && (s_centroid < 1028+10)
    s = "a";
elseif (s_centroid > 1028-10+77*1) && (s_centroid < 1028+10+77*1)
    s = "b";
elseif (s_centroid > 1028-10+77*2) && (s_centroid < 1028+10+77*2)
    s = "c";
elseif (s_centroid > 1028-10+77*3) && (s_centroid < 1028+10+77*3)
    s = "d";
elseif (s_centroid > 1028-10+77*4) && (s_centroid < 1028+10+77*4)
```

```
    s = "e";
else
    s = "-1";
end
```

Client Code

The images in ./valid_scripts directory will be populated from the first task of this assignment.

```
imagefiles = dir("./valid_scripts/*.jpg");
nfiles = length(imagefiles);
for ii = 1:nfiles
image_path = imagefiles(ii).name;
path_to_dir = "./valid_scripts/";
full_path = strcat(path_to_dir, image_path);
[q,s] = evaluateOMR(full_path);
if q ~= "-1"
fprintf("Question : %s\n",q);
else
fprintf("Question was not marked or was incorrectly marked.\n");
end
if s ~= "-1"
fprintf("Section : %s\n", s);
else
fprintf("Section was not marked or was incorrectly marked.\n");
end
fprintf("Image : %s\n\n", image_path);
end
```

Output

Question : 2

Section : b

Image : PES1UG20BT005#UE20CS151#66_10.jpg

Question : 3

Section : b

Image : PES1UG20BT005#UE20CS151#66_11.jpg

Question : 4

Section : b

Image : PES1UG20BT005#UE20CS151#66_12.jpg

Question : 5

Section : a

Image : PES1UG20BT005#UE20CS151#66_13.jpg

Question was not marked or was incorrectly marked.

Section was not marked or was incorrectly marked.

Image : PES1UG20BT005#UE20CS151#66_14.jpg

Question : 1

Section : a

Image : PES1UG20BT005#UE20CS151#66_7.jpg

Question : 1

Section : a

Image : PES1UG20BT005#UE20CS151#66_8.jpg

Question : 2

Section : a

Image : PES1UG20BT005#UE20CS151#66_9.jpg