

15-112: Fundamentals of Programming and Computer Science, Fall 2019

Homework 5 Programming: Decoding a Qatari License Plate (the old style)

Due: Tuesday, October 8th, 2019 by 22:00

This programming homework is designed to get you more practise with processing images and applying your the skills you have learnt, to solve real world problems.

Your submission will be made through the web interface of Autolab. In this homework, you will be writing several functions. Write all functions in the same file and call that file `YourAndrewIDhw5.py`. You should not have any test code in this file besides the function definitions plus any other helper functions you want to write. You should not have any main code that is executed. Your functions should be named according to the specifications given in the questions below. Again, if you want to write helper functions within the same file to help you organize your code, you are more than welcome to do so and you can name them whatever you want. You should submit this python file under lab5 option at:

<https://autolab.andrew.cmu.edu/courses/15112q-f19>

1 Cops!

As traffic accidents increase due to over speeding and other traffic violations, it becomes important for law enforcement agencies to find technological solutions to detect these violations. In Qatar, the government has placed high resolution cameras on various roads and highways that detect speeding motorists and take a picture of their vehicles. These images are then processed to detect the license plate numbers and issue tickets accordingly.

Your task, in this homework, is to take an image of a license plate and pragmatically (by writing a computer program) determine the license plate number. To assist you in this task, I am providing you with a pseudo research paper that describes an algorithm in detail about the steps needed to decode a license plate. You can assume that the license plate image file exists in the same directory as your program. The paper can be downloaded from the following link:

<http://www.qatar.cmu.edu/~srazak/courses/15112-f19/hw/LicenseDetection.pdf>

This homework needs the ImageWriter Library that can be downloaded from the Resources section of the course website (you should already have this from assignment 4):

<http://www.qatar.cmu.edu/~srazak/courses/15112-f19/resources.php>

You can use the following function in your code to convert a picture to black and white:

```
def convertBlackWhite(pic):
    rows = ImageWriter.getHeight(pic)
    columns = ImageWriter.getWidth(pic)
    for i in range(0,rows):
        for j in range(0,columns):
            c = ImageWriter.getColor(pic,j,i)
            if sum(c)/3 >= 100:
                ImageWriter.setColor(pic,j,i,[255,255,255])
            else:
                ImageWriter.setColor(pic,j,i,[0,0,0])
```

Task 1 (-5 pts) *As in the previous homework, in this assignment, you will be graded on style. Make sure your code meets style guidelines for the course*

Task 2 (10 pts) *Write a function called `removeBorder(pic)` that takes a picture as input and removes the border from the picture. The function should not return anything.*

Task 3 (10 pts) *Write a function called `horizontalSegmentation(pic)`. This function takes an image that does not have any borders as input argument. This function should determine the position of the Arabia numbers on the license plate and send the top and bottom of the area of license plate that holds the numbers. This information should be returned as a list of the format `[top, bottom]`*

Task 4 (10 pts) *Write a function called `verticalSegmentation(pic,startrow, endrow,col)`. This function should take the start and end rows between which the numbers exists as input arguments. The function should also take a column number from which to start looking for the next digit. This function should determine the position of the next number and return the start and end column for the next digit. The return value should be in the format `[startColumn, endColumn]`*

Task 5 (10 pts) *Write a function `decodeCharacter(pic,startrow, endrow, startcol, endcol)` that will take a `pic` as input parameter and decode the number bounded the rectangle represented by `startrow, endrow, startcol, and endcol`.*

Task 6 (10 pts) *Write a function called `decodeLicensePlate(filename)` that will take a filename of a license plate image as input. The function should then load the image represented by `filename` and should return a string that represents the number on the license plate.*