



**Faculty of Engineering  
Computer & Systems Eng. Dept.**

**Digital image processing**

## **License Plate Recognition**

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Our code is based on a paper where we tried as hard as we can to apply it on the code

First we get the **pixel intensity** where the intensity =  $0.3 * \text{red layer} + 0.59 * \text{green layer} + 0.11 * \text{blue layer}$ , as we did this through the function which called (pixel\_intensity(x, y))

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```

- the other condition to tell whether this is a character or not is to determine the connectivity of this contour using `cv2.isContourConvex` method

Here is the function mentioned above :

```
def possible_char(contour):
    x, y, width, height = cv2.boundingRect(contour)
    aspect_ratio = (width*1.0)/(height*1.0)
    area = (width*1.0)*(height*1.0)
    if aspect_ratio < 0.25 or aspect_ratio > 1 or (area <= 100):
        return False
    return True and not cv2.isContourConvex(contour)
```

If the contour **is a child** then it at least has one parent:

-we **get** the first **parent** of the contour by looping through all the hierarchy and it stops when it does not have more than 0 parent, or it is not a possible character then we return this parent .

```
def get_parent(i, hierarchy):
    pt = hierarchy[i][3]
    while possible_char(contours[pt]) and pt > 0:
        pt = hierarchy[pt][3]
    return pt
```

-we also count the **number of same level contours** of this contour : if it has parent then loop on it as long as it is not -1 then count the child of this parent (through this way we can get the same level contours of any contour ).

```
def count_siblings(i, hierarchy, contour):
    count = 0
    p = hierarchy[i][0]
    while p > 0:
        if possible_char(contours[p]):
            count += cc(p, hierarchy, contour)
        p = hierarchy[p][0]
    return count
```

There is also **include\_box** method which takes the index , hierarchy and the contour . this method determine if this is a necessary box or not by returning false if the contour is a child and if the contour is less than or equal 2 and true other wise.

```
def include_box(i, hierarchy, contour):  
    if is_c(i, hierarchy) and cc(get_parent(i, hierarchy), hierarchy, contour) <= 2:  
        return False  
    return True
```

These are all the functions needed .

In the main code-since we add it into the function that called test- first we read the image and get the edges using canny in cv2 and setting the min , max threshold with proper values .

```
def test():  
    global contours  
    global OUT  
    txt=""  
    global image, yimage, ximage  
    image = cv2.imread(filename)  
    yimage = len(image)  
    ximage = len(image[0])  
    edges=cv2.Canny(image,400, 1000)
```

Then we need to find the contours and the hierarchy of the edges. for each contour we find the bounding rectangle parameter (x,y,width ,height) and if this contours is a possible char and of an acceptable box then we take it with us as follow :

```
_,contours, hierarchy = cv2.findContours(edges.copy(), cv2.RETR_TREE, cv2.CHAIN_APPROX_NONE)  
hierarchy = hierarchy[0]  
  
ind the bounding rect for each one in the contours  
for i, contourr in enumerate(contours):  
    x, y, width, height = cv2.boundingRect(contourr)  
    if possible_char(contourr) and include_box(i, hierarchy, contourr):  
        OUT.append([contourr, [x, y, width, height]])  
  
final_image = edges.copy()  
final_image.fill(255)
```

Then for each box we get the foreground intensity. To get the foreground intensity we calculate the average intensities of the edge pixels.

```
for i, (contourr, box) in enumerate(OUT):  
    foreg_intensity = 0.0  
    for p in contourr:  
        foreg_intensity += pixel_intensity(p[0][0], p[0][1])  
  
    foreg_intensity /= len(contourr)  
  
    x, y, width, height = box
```

After that we loop on the box in the 2 dimensions and if the pixel intensity of this point greater than foreground intensity then put the new image is set with 255 else it is set with 0 .

```
for xx in range(x, x + width):  
    for yy in range(y, y + height):  
        if pixel_intensity(xx, yy) > foreg_intensity:  
            final_image[yy][xx] = 255  
        else:  
            final_image[yy][xx] = 0
```

Then blur the final image for the ocr operation and we write this new image with name 'out.png' to allow to read it in tesseract

the function that called tesseract take the image and if there is any letter in that image , it will transform it into text.

```
final_image = cv2.blur(final_image, (3, 3))  
cv2.imwrite("out.png", final_image)  
OUT=[]  
new_image='out.png'  
file=PIL.Image.open(new_image)  
txt = pytesseract.image_to_string(file)  
labell.configure(text=txt)
```

## Here we come to the GUI part .. so

- first we specialize a canvas to show the output image before the process of tesseract function .

```
window=tk.Tk()

window.title('License Plate Recognition')
canvas=Canvas(window,width=1000,height=500)
canvas.config(scrollregion=[0,0,400,400])
canvas.pack()
```

-Then there is a button (Select input image) to let you select the input image , then the path of selected image is stored in a variable which called (filename) ,since it the same variable that used in imread function to read the input image at the first step of the whole process .

```
btn2=Button(window,text='Select Input Image',command=PhotoCallBack)
btn2.pack()
```

-There is also another button to let you show the output image after applying all the processes mentioned above , and it will be showed into the canvas we mentioned before .

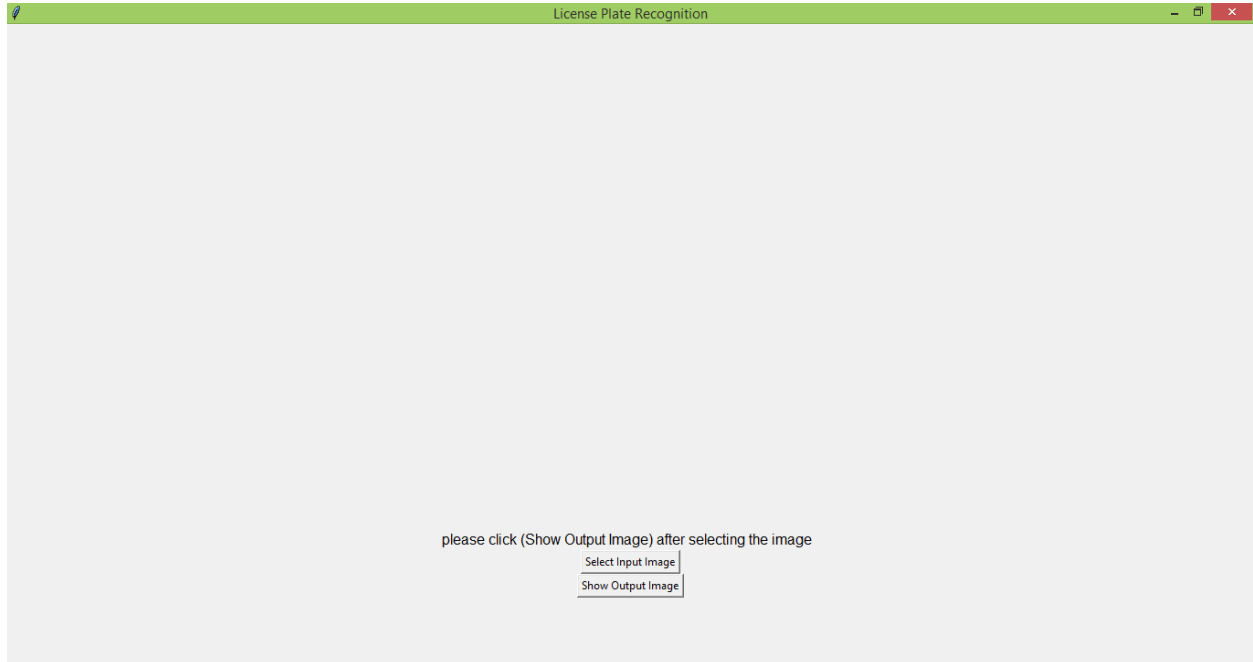
```
btn2=Button(window,text='Select Input Image',command=PhotoCallBack)
btn2.pack()
```

-Finally the last part of the process is to show the text extracted from the image as the license number , so we define a label to display that text as follow .

```
label1 = Label(window, text='')
label1.pack()
label1.place(x = 10, y = 60)
```

**Hint : Wait a little time between two run operation for load code**

# GUI



## Test cases

Input image





## Output



## Input





## Output

