Captcha Automatic Segmentation and Recognition

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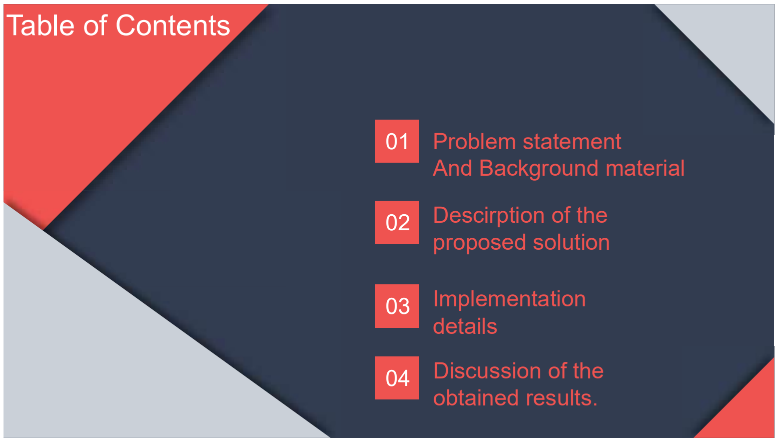


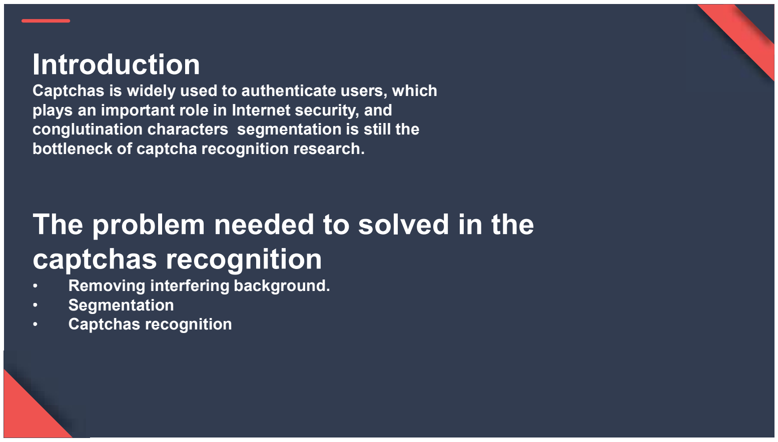
Table of Contents

01 Problem statement
And Background material

02 Description of the proposed solution

03 Implementation details

04 Discussion of the obtained results.



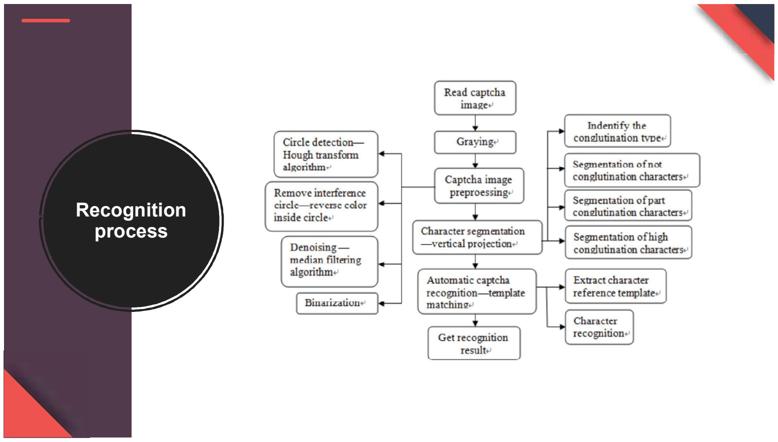
Introduction

Captchas is widely used to authenticate users, which plays an important role in Internet security, and conglutination characters segmentation is still the bottleneck of captcha recognition research.

The problem needed to solved in the captchas recognition

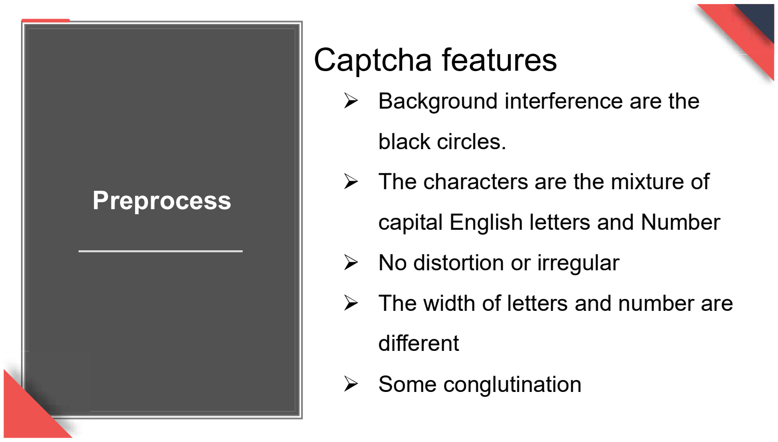
- Removing interfering background.
- Segmentation
- Captchas recognition

The Dataset that we used



Recognition process

Read captcha image
Graying
Captcha image preproessing
Circle detection—Hough transform algorithm
Remove interference circle—reverse color inside circle
Denoising — median filtering algorithm
Binarization
Character segmentation —vertical projection
Indentify the conglutination type
Segmentation of not conglutination characters
Segmentation of part conglutination characters
Segmentation of high conglutination characters
Automatic captcha recognition—template matching
Extract character reference template
Character recognition
Get recognition result



Preprocess

Captcha features

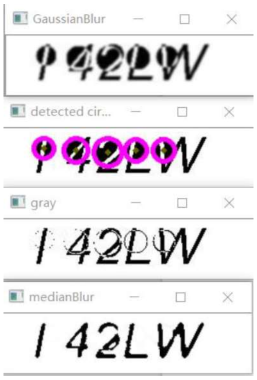
- Background interference are the black circles.
- The characters are the mixture of capital English letters and Number
- No distortion or irregular
- The width of letters and number are different
- Some conglutination

Preprocess

step

- ➢ Using Gaussion blur preprocess image
- ➢ Remove circular interference based on hough algorithm
- ➢ Denoise by median filtering algorithm
- ➢ Binarizationon

Preprocess



Segmentation

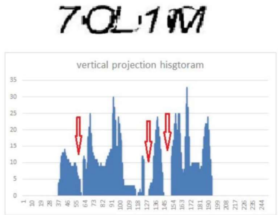
Improved Vertical Projection

- Identify the conglutination type
  - ➢ No conglutination
  - ➢ Edge tangent conglutination
  - ➢ Edge horn conglutination
- Segmentation of conglutination characters

Segmentation

Conglutination Example

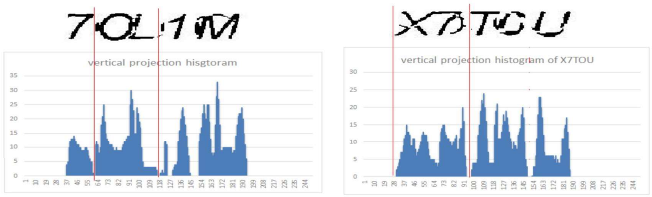
- ➢ No conglutination



Vertical projection histogram of captcha image

Conglutination Example

- ➢ Edge tangent conglutination and edge horn conglutination

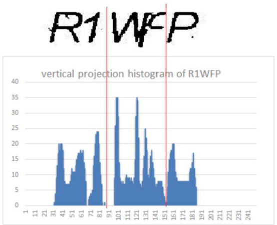


Vertical projection histogram of part conglutination

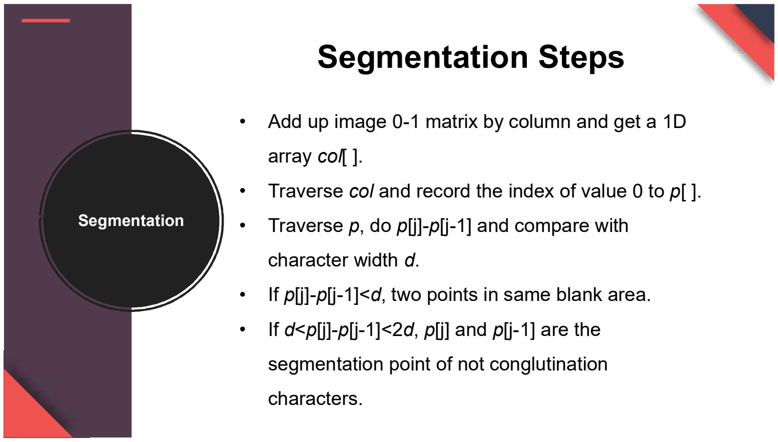
Segmentation

Conglutination Example

- ➢ High conglutination



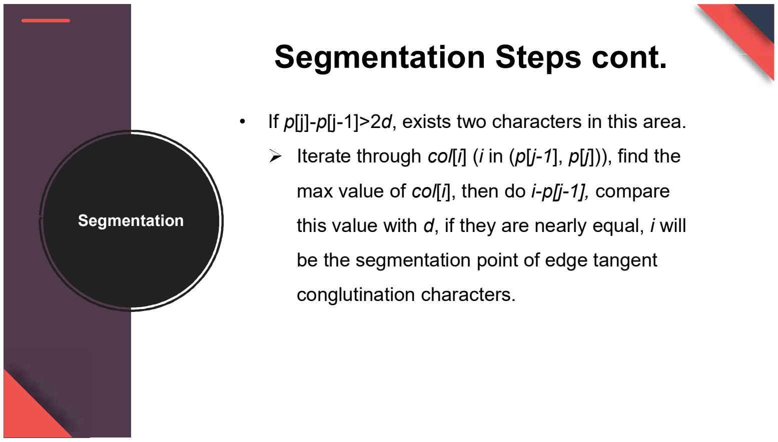
Vertical projection histogram of high conglutination characters



Segmentation

Segmentation Steps

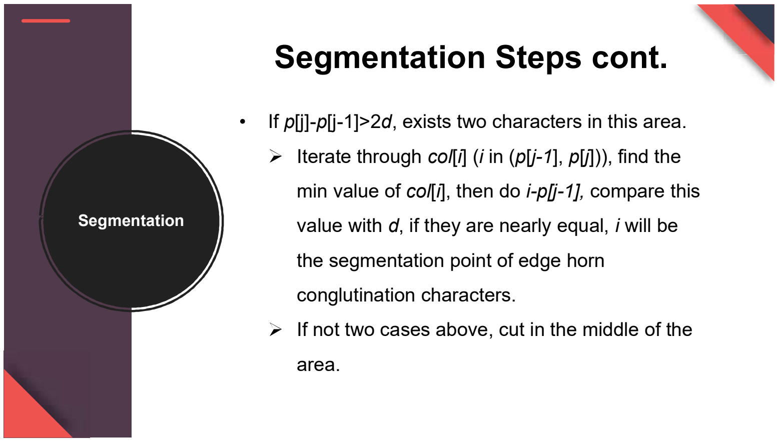
- Add up image 0-1 matrix by column and get a 1D array $col[\ ]$.
- Traverse col and record the index of value 0 to $p[\ ]$.
- Traverse p, do $p[j]-p[j-1]$ and compare with character width d.
- If $p[j]-p[j-1]<d$, two points in same blank area.
- If $d<p[j]-p[j-1]<2d$, $p[j]$ and $p[j-1]$ are the segmentation point of not conglutination characters.



Segmentation

Segmentation Steps cont.

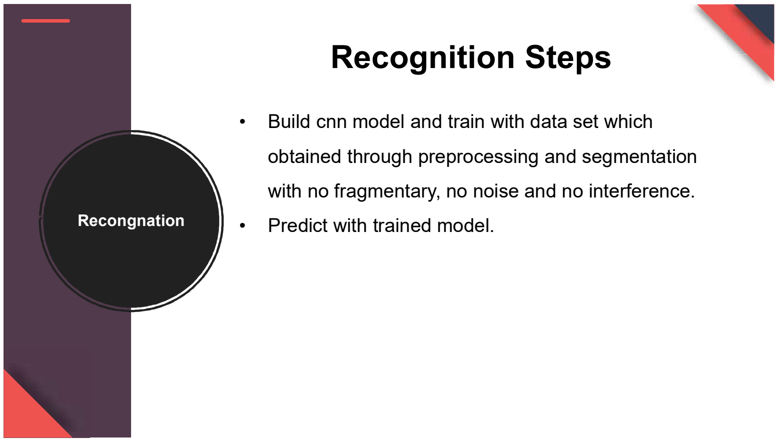
- If $p[j]-p[j-1]>2d$, exists two characters in this area.
  - ➢ Iterate through $col[i]$ (i in ($p[j-1]$, $p[j]$)), find the max value of $col[i]$, then do $i-p[j-1]$, compare this value with d, if they are nearly equal, i will be the segmentation point of edge tangent conglutination characters.



Segmentation

Segmentation Steps cont.

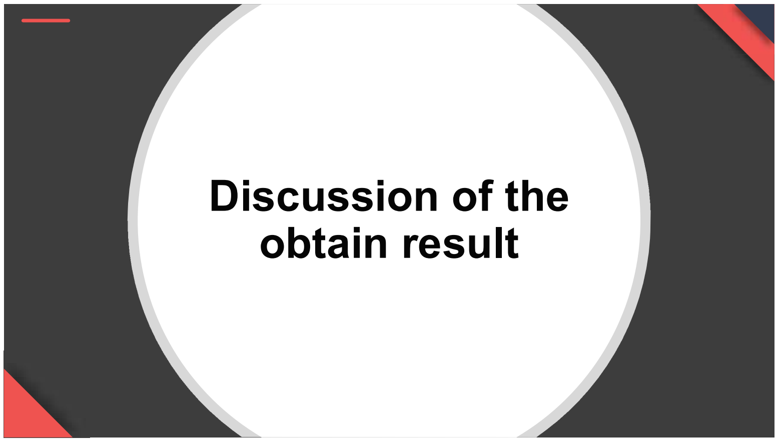
- If $p[j]-p[j-1]>2d$, exists two characters in this area.
  - ➢ Iterate through $col[i]$ (i in ($p[j-1]$, $p[j]$)), find the min value of $col[i]$, then do $i-p[j-1]$, compare this value with d, if they are nearly equal, i will be the segmentation point of edge horn conglutination characters.
  - ➢ If not two cases above, cut in the middle of the area.



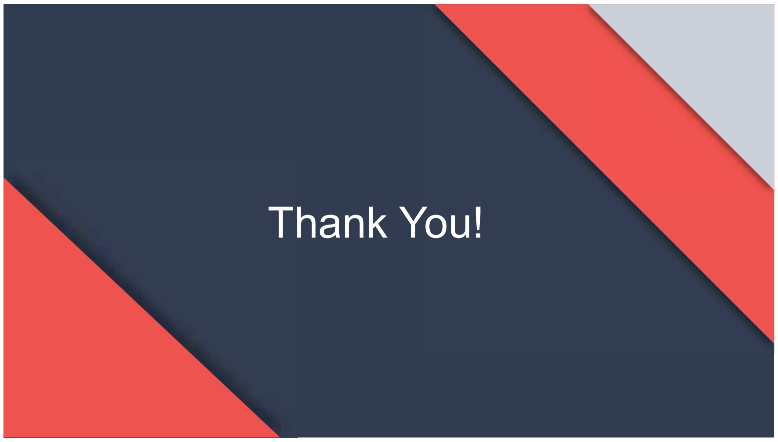
Recongnation

Recognition Steps

- Build cnn model and train with data set which obtained through preprocessing and segmentation with no fragmentary, no noise and no interference.
- Predict with trained model.



Discussion of the obtain result



Thank You!