Captcha image recognition

Zizhao Zhang(u5925324)
Supervisor: Ramesh Sankaranarayana
COMP4560
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Introduction

• CAPTCHA (“Completely Automated Public Turing test to tell Computers and Humans Apart”): Distinguish bot and human
• Restricting access to content
• Stop information retrieval
• Not infallible
Darknet captcha

- Few examples:
Introduction

• Collect data on darknet marketplaces: DDOS protections
• a guard site that holds a custom CAPTCHA
• Regenerate frequently
• Efficient captcha solver needed
Background & Motivation

- Reinforcement learning
- Deep learning
- No general method on most captchas up until now
- Relative general on some captcha type
- Useful on others
General methods

- Binarization [0, 255]
- Noise line / point
- 8 around pixels
- Filter
- Erosion & dilation
- Segmentation

Source: opencv
Noise lines/points

- Filter? Not work when intensive
- Check 8 neighborhood pixels
- 0-2 black: Remove

- Zoom in lines:
Noise lines/points

• General Step:
  – Check Neighborhood
  – Remove $\leq 2$ neighbors;
  – Update position
  – Remove individual area $<$ threshold;

• Repeat until no update

• Thicker line: erosion & dilation
Segmentation

- Drop Falling
- Stuck when connected
- Where to start

Source: [3]
Segmentation

• Projection
• Threshold
• Range
• Variance
SVM (Support Vector Machine)

- Segment
- Collect letter
- Extract feature

Sum \{0:row; 4: number of black; 1: 3; 2: 4 \ldots\}

Center symmetry: \textbackslash\textbackslash \textbar \textbar or distort

Resize

- >95\% if well segment
CNN

- Popular, accurate than SVM
- Overfit
- Large training set
- Time-consuming
Example

3500CcV

3500CcV
Other type:

- Laxer parser:
- Image segmentation:

1 + 6 =
### Result & Future work

<table>
<thead>
<tr>
<th>Symbol accuracy</th>
<th>Connection</th>
<th>Noise</th>
<th>Semantic</th>
<th>Mix</th>
</tr>
</thead>
<tbody>
<tr>
<td>General method</td>
<td>78.1%</td>
<td>70.4%</td>
<td>92.3%</td>
<td>&lt;10%</td>
</tr>
<tr>
<td>This method</td>
<td>91.6%</td>
<td>86.9%</td>
<td>95.3%</td>
<td>31.1%</td>
</tr>
<tr>
<td>Tesseract OCR</td>
<td>51.0%</td>
<td>30.4% (after preprocess)</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

Captcha accuracy: a bit lower

Locate the position

More general method


Image source

- [1] https://docs.opencv.org/2.4/doc/tutorials/imgproc/erosion_dilatation/erosion_dilatation.html
- [5] http://i5kjii2y2jumlye6etmouksvdhech357urmj4txctnee4l4vkybsqd.onion/ (Have been modified)
Q&A