# DIP HW4

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## Optical Character Recognition

Training Set:

1. Clip the training image to 0, 255 (threshold = 128).
2. Label the connected components.
3. Combine near objects (Deal with " i ", " j ", " ! ", " % ") ⇒ get 70 objects.
4. Get the upper / lower / left / right boundary of all objects.

Testing Set:

1. Do median filtering (to get rid of the thin stripes and salt/pepper of sample2).
2. Clip the training image to 0, 255 (threshold = 128).
3. Label the connected components.
4. Combine near objects (Deal with " i ", " j ", " ! ", " % ") ⇒ get 5 / 6 objects.
5. Get the upper / lower / left / right boundary of all objects.

Identifying Objects:

1. Sort the objects by left boundary ⇒ identify from left to right.
2. Calculate the testing object's width-height ratio.
3. Run through all the Training Set objects, calculate the width-height ratio.
4. Skip those whose ratio difference is more than 0.2.
5. Run through all the pixels of every training object. Calculate the relative position against the testing object.
    a. relative_x = test_upper + (x - train_upper / train_h * test_h)
    b. relative_y = test_left + (y - train_left / train_w * test_w)
6. Calculate the true positive / true negative / false positive / false negative counts of all the pixels between training object and testing object.
    a. True positive: Both are 0
    b. True negative: Both are 255
    c. False positive: Test is 255 and Train is 0
    d. False negative: Test is 0 and Train is 255

7. Choose the training object which has the maximum value of
   (true positive + 0.3*true negative - 0.5*false positive - false negative)

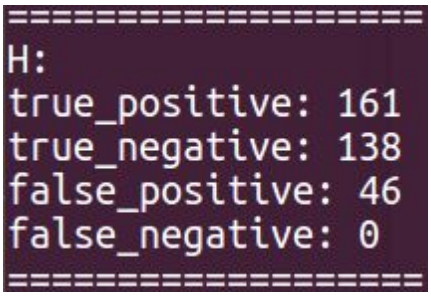
Problems I met:

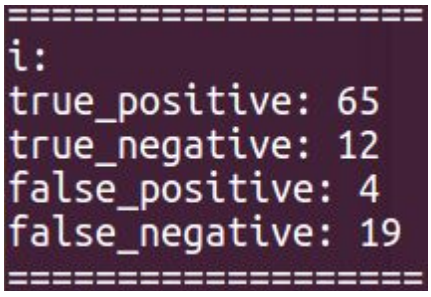
1. Deal with " i ".
   There is an extra strike on the left which would cause misrecognition when I'm trying to identify the " i " in sample 1.
   The best match would be " ! ".
   *Sol: I move the left bound of the training object " i ", so that I would not take the strike on the left into consideration*

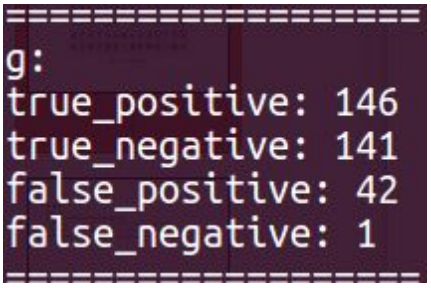
2. Deal with " 4 ".
   The " 4 " in Training Set is not connected while the one in Testing Set is.
   This would make my program identify " 4 " as " A ".
   *Sol: Connect the " 4 " in Training Set. ⇒ recognize correctly.*

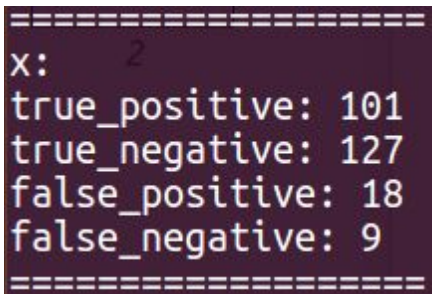
Results:

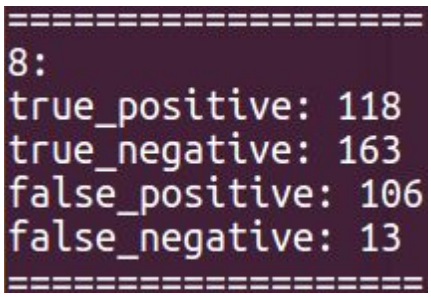
Sample 1:



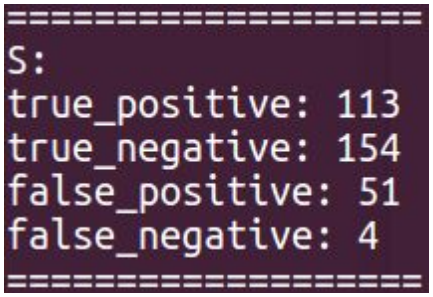



Sample 2: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S:
true_positive: 113
true_negative: 154
false_positive: 51
false_negative: 4
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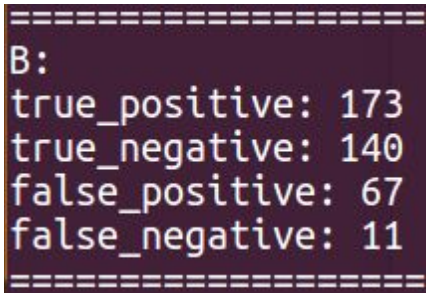
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B:
true_positive: 173
true_negative: 140
false_positive: 67
false_negative: 11
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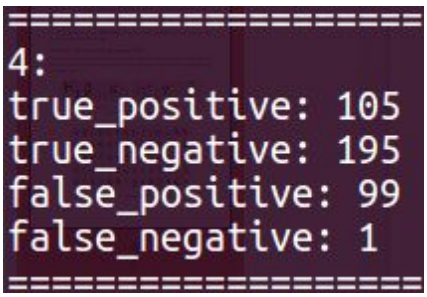
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4:
true_positive: 105
true_negative: 195
false_positive: 99
false_negative: 1
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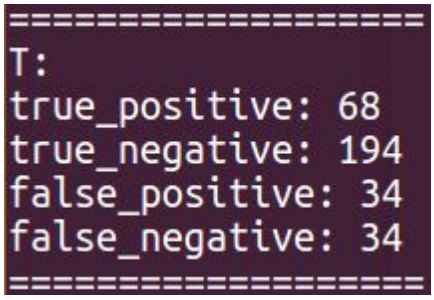
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T:
true_positive: 68
true_negative: 194
false_positive: 34
false_negative: 34
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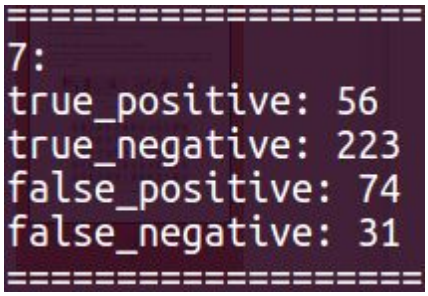
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7:
true_positive: 56
true_negative: 223
false_positive: 74
false_negative: 31
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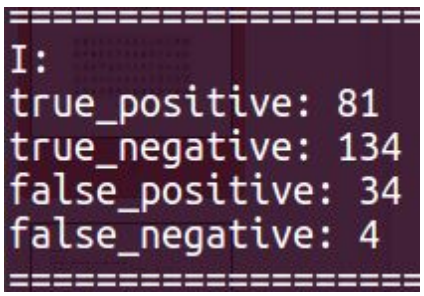
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I:
true_positive: 81
true_negative: 134
false_positive: 34
false_negative: 4
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