Project1 - Report

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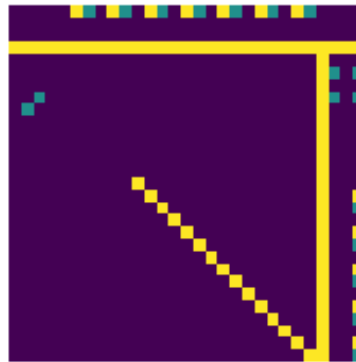
301449387

Q 1.1 Inner Product Layer
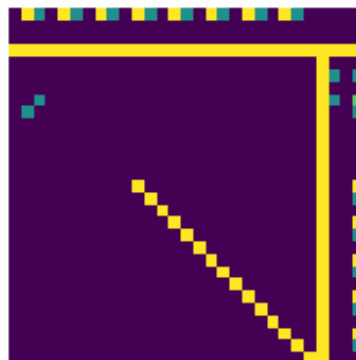

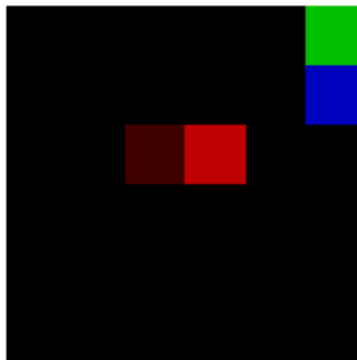## Q 1.2 Pooling Layer

Pooling Test

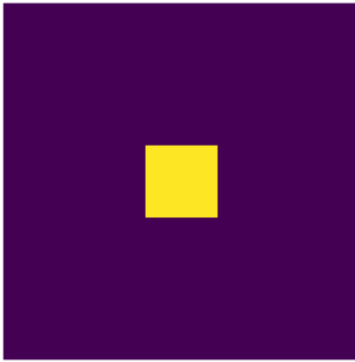### Input 1
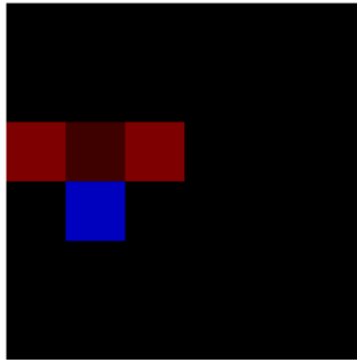
Output 1

Input 2

Output 2

Q 1.3 Convolution Layer
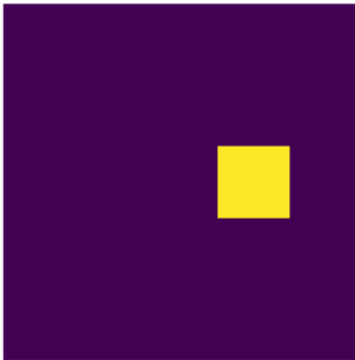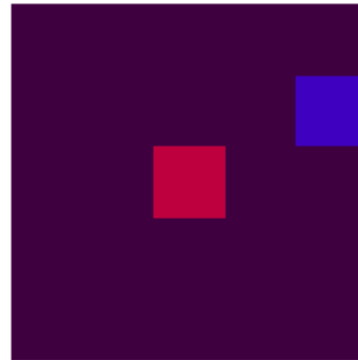
Convolution Test 1

Input 1

Output 1
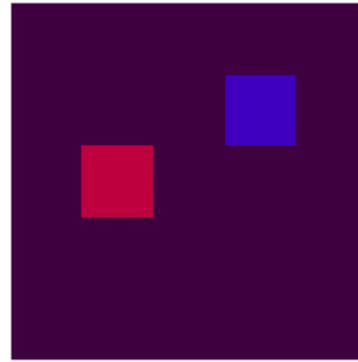
Input 2

Output 2

Convolution Test 2
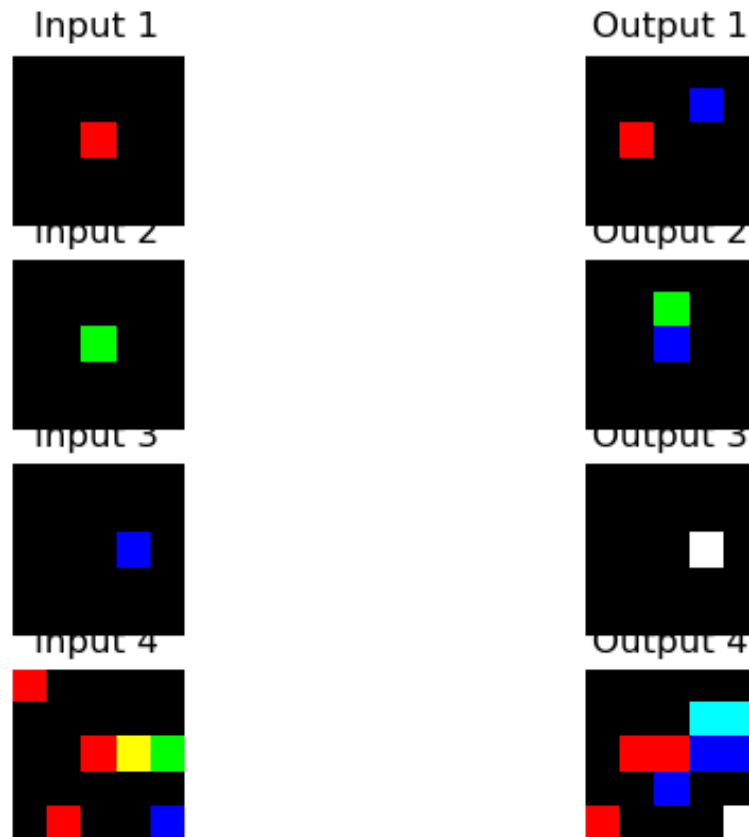
Q 1.4 ReLU

Problem I meet:

When I am running train_lenet to train my network there will report a warning:

"RuntimeWarning: divide by zero encountered in log nll = -np.sum(np.log(P[I == 1]))"

Solution:

I think there is sth wrong caused by copying pointer in relu forward. I don't know how to fix it so i just implemented it in another way. Then the network worked and accuracy reached 95. I have tried np.maximum() function. It works for me. (My original method is out = in; out[out<0]=0 which returns error)

Q 2.1 ReLU

Problem I meet:

Solution:

Q 2.2 Inner Product layer

Problem I meet:

Solution:

Q 3.1 Training

0
test accuracy: 0.104

500
test accuracy: 0.954

1000
test accuracy: 0.948
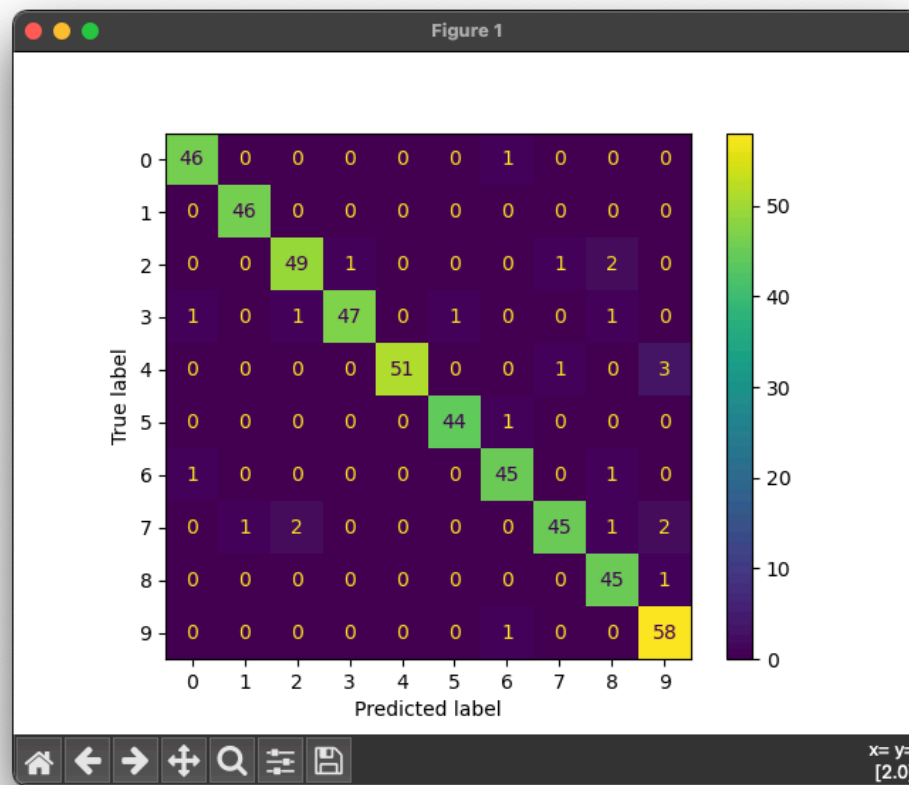
1500
test accuracy: 0.952

2000
test accuracy: 0.956

Q 3.2 Test the network

```
[[46.  0.  0.  0.  0.  0.  1.  0.  0.  0.]
 [ 0. 46.  0.  0.  0.  0.  0.  0.  0.  0.]
 [ 0.  0. 49.  1.  0.  0.  0.  1.  2.  0.]
 [ 1.  0.  1. 47.  0.  1.  0.  0.  1.  0.]
 [ 0.  0.  0.  0. 51.  0.  0.  1.  0.  3.]
 [ 0.  0.  0.  0.  0. 44.  1.  0.  0.  0.]
 [ 1.  0.  0.  0.  0.  0. 45.  0.  1.  0.]
 [ 0.  1.  2.  0.  0.  0.  0. 45.  1.  2.]
 [ 0.  0.  0.  0.  0.  0.  0.  0. 45.  1.]
 [ 0.  0.  0.  0.  0.  0.  1.  0.  0. 58.]]
```

```
1            precision    recall  f1-score   support
2
3       0.0       0.82      1.00      0.90         9
4       1.0       1.00      1.00      1.00        11
5       2.0       0.92      1.00      0.96        11
6       3.0       1.00      0.75      0.86         8
7       4.0       1.00      1.00      1.00         7
8       5.0       0.86      1.00      0.92         6
9       6.0       1.00      0.91      0.95        11
10      7.0       1.00      0.71      0.83         7
11      8.0       1.00      0.94      0.97        18
12      9.0       0.86      1.00      0.92        12
13
14   accuracy                         0.94       100
15  macro avg       0.94      0.93      0.93       100
16 weighted avg     0.95      0.94      0.94       100
```

Q 3.3 Real-world testing

predict: [2]; label: 2
predict: [9]; label: 9
predict: [4]; label: 4
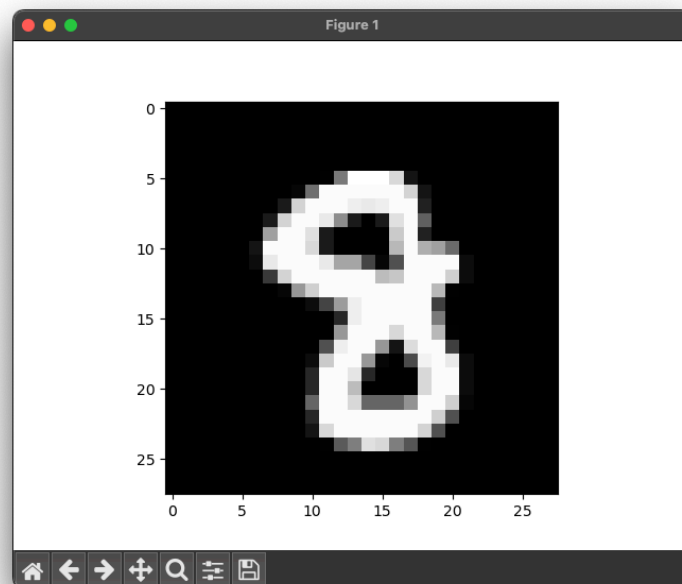predict: [0]; label: 0
predict: [7]; label: 7

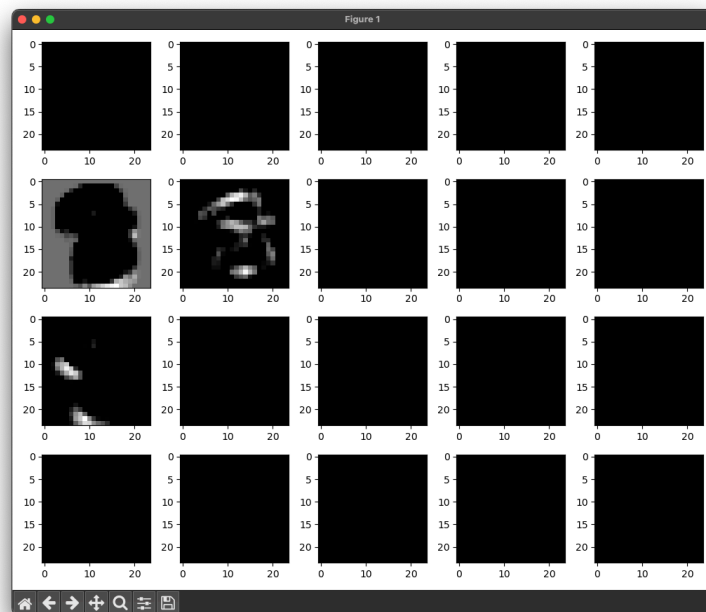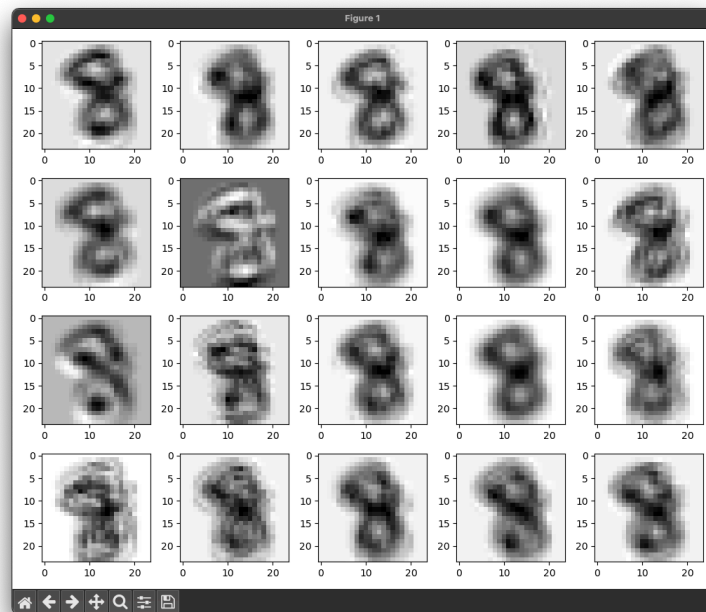## Part 4 Visualization

Q 4.1

Q 4.2 Compare