

Deep Learning Lab Course: Assignment 02

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1 Network Architecture

In assignment 02, I implemented a LeNet5-like neural network to classify RGB images with and without depth channel, using two different network architectures, the detailed neural network layers are:

1.1 Architecture 1: LeNet5

- a. convolutional layer 1
- b. pooling layer 1
- c. convolutional layer 2
- d. pooling layer 2
- e. fully connected layer 1
- f. fully connected layer 2
- g. softmax out layer

1.2 Architecture 2: LeNet 5 with 2 more conv layers

- a. convolutional layer 1
- b. pooling layer 1
- c. convolutional layer 2
- d. pooling layer 2
- e. convolutional layer 3
- f. pooling layer 3
- g. convolutional layer 4
- h. pooling layer 4
- i. fully connected layer 1
- j. fully connected layer 2
- k. softmax out layer

2 Implementation results

I trained the two neural networks using AdamOptimizer, with and without the depth channel. The results show that the depth information sometimes can

slightly improve the test error, but sometimes even worse result. Here are the comparison results:

2.1 LeNet5

RGB-D images:

Validation error: 9.0%

Test error: 4.3%

Confusion matrix:

```
[[629 0 0 0 0 0 0 0 0 0]
 [ 0 408 11 144 9 0 10 0 0 0]
 [ 0 0 553 4 0 0 0 0 38 0]
 [ 0 0 0 786 0 0 0 0 0 0]
 [ 0 0 0 0 511 0 0 0 55 0]
 [ 0 0 0 0 0 618 0 0 0 0]
 [ 0 0 0 0 0 0 699 0 0 0]
 [ 0 0 0 0 0 0 0 585 0 0]
 [ 0 0 0 0 0 0 0 0 561 0]
 [ 0 0 0 0 0 0 0 0 0 700]]
```

RGB images:

Validation error: 6.7%

Test error: 9.7%

Confusion matrix:

```
[[629 0 0 0 0 0 0 0 0 0]
 [ 0 371 0 211 0 0 0 0 0 0]
 [ 0 0 556 22 3 0 0 0 14 0]
 [ 0 0 0 786 0 0 0 0 0 0]
 [ 0 0 0 0 374 0 0 0 192 0]
 [ 0 0 0 0 0 618 0 0 0 0]
 [ 0 172 0 0 0 0 527 0 0 0]
 [ 0 0 0 0 0 0 0 585 0 0]
 [ 0 0 0 0 0 0 0 0 561 0]
 [ 0 0 0 0 0 0 0 0 0 700]]
```

2.2 LeNet5 with 2 more conv layers

RGB-D images:

Validation error: 9.7%

Test error: 9.9%

RGB images:

Validation error: 5.3%

Test error: 9.7%