zl9901 Hw4 Report

1) 11066 is the number of images we would like to train as training set
   1000 is the number of images we would like to train as the validation set
   Batch size will be the size of training set
   Number of epochs: 50
   Learning rate: 0.005
   Loss function: Cross entropy

   For Conv2d (1, 4, kernel_size=3, stride=1, padding=1):
       1 is the number of input channels
       4 is the number of output channels after the first convolution
   For BatchNorm2d (4):
       This is a batch normalization layer.
       4 should be corresponding to the number of output channels after first convolution

   For Conv2d (4, 4, kernel_size=3, stride=1, padding=1):
       4 is the number of input channels, it should be equal to the output channels of first convolution
       4 is the number of output channels after the second convolution
   For BatchNorm2d (4):
       This is a batch normalization layer.
       4 should be corresponding to the number of output channels after second convolution

   There will always be a ReLU activation layer after convolution layer.

   For Linear (4*12*12, 2):
       4 is the output channels after second convolution, since the size of our original image is 48*48, after two pooling operations, the size should be 12*12
       Since the problem of homework is binary classification problem, the output node should be 2

2) The accuracy score from training is 0.698
   The accuracy score from test is 0.688
   They are not significantly different

3) The accuracy score from ANN training dataset with sigmoid is 0.6565154527381167
   The accuracy score from ANN test dataset with sigmoid is 0.652

Final train classification_rate: 0.6565154527381167
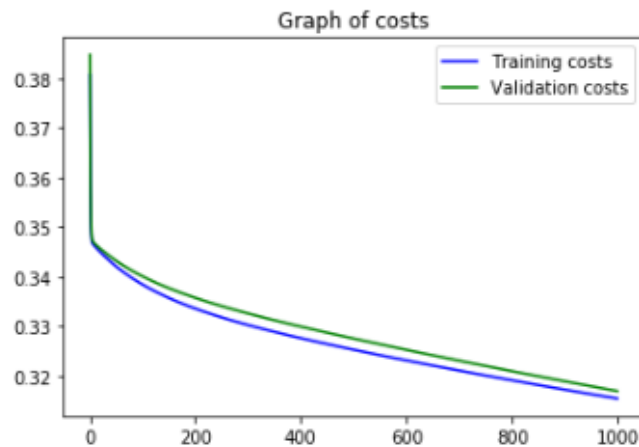Final validation classification_rate: 0.652

Graph of costs

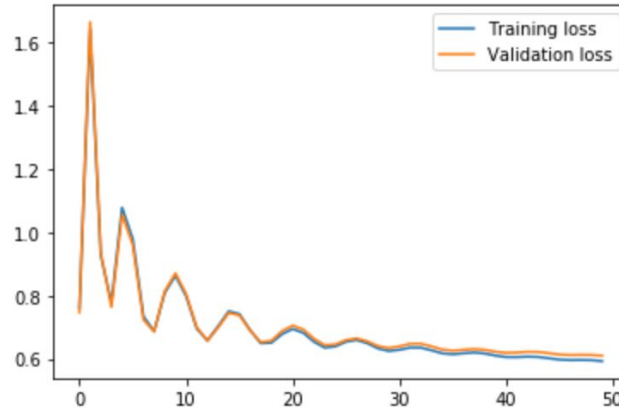**Figure 1 ANN training and validation cost**

Figure 2 CNN training and validation loss

We can see from the figures above. CNN can converge faster than ANN because of relatively simple computation complexity

Because CNNs are often used in image recognition systems.

when applied to facial recognition, CNNs achieved a large decrease in error rate. If we lower the learning rate and increase epochs in homework4, we can see the improvement of CNN over ANN.

Because of the pooling operation, CNN can significantly reduce computational complexity.