BSc in Information Technology

Lab Exercise 2

SE4050 – Deep Learning 2023

Lab 2: Introduction to Backpropagation and Feed-Forward Neural Networks

Objectives

Students are expected to gain knowledge about backpropagation algorithm and to apply that knowledge to develop a TensorFlow based feed-forward neural network.

Tasks

For this lab, you can either use Anaconda python distribution or use google colab.

To install the Anaconda python distribution: https://www.anaconda.com/products/individual

1. Upload the Backprop.ipynb to Jupyter notebook (or google colab) and see if you can understand the code. Increase the number of iterations (epochs) and see whether it improves the prediction accuracy.

   Note: You may have to copy the image.png file to the home directory

2. Upload the NN_sample.ipynb to Jupyter notebook (or google colab) and see if you can understand the code. Add the following text cell and the code cell to the notebook and run it again.
   1. What happens when the number of hidden nodes increase?
   2. Can you explain the pattern of the accuracy when the hidden nodes increase?

   Note: Copy the planar_utils.py and testCases.py files to the home directory.

Text cell:

Now, let's try out several hidden layer sizes.

Tuning hidden layer size (optional/ungraded exercise)¶

Run the following code. It may take 1-2 minutes. You will observe different behaviors of the model for various hidden layer sizes.

Code cell:

```
# This may take about 2 minutes to run
```

```
hidden_layer_sizes = [1, 2, 3, 4, 5, 20, 50]

for i, n_h in enumerate(hidden_layer_sizes):

  parameters = nn_model(X, Y, n_h, num_iterations = 5000)

  # plot_decision_boundary(lambda x: predict(parameters, x.T), X, Y)

  predictions = predict(parameters, X)

  accuracy = float((np.dot(Y,predictions.T) + np.dot(1-Y,1-predictions.T))/float(Y.size)*100)

  print ("Accuracy for {} hidden units: {} %".format(n_h, accuracy))
```

3. Run the MLP_with_MNIST_dataset.ipynb using Jupyter notebook (or google colab) and see if you can understand the code.
    a. Improve the test accuracy of the model by changing the hyperparameters.
    b. Add L1 and L2 regularization terms to the model and retrain the model.
    c. Visualize class-wise test dataset performance using a confusion matrix.
4. (**Optional/No need to submit anything**) Open the neural network playground and see whether you can run it with different hyperparameters. See whether the L1 and L2 regularization can be used to reduce overfitting.

    https://playground.tensorflow.org/

Submission

Create a github repository for the lab 2 submission.

Export the modified notebook used in ex. 1 as an ipynb file and upload it the repository.

Export the modified notebook used for ex. 2 as an ipynb file. Provide your answer to the question in a text file as well. Add this to the repository as well.

Export the modified notebook used for ex. 3 as an ipynb file. Upload to the repository as well.

Add the repository link to a text file. The text file name should be your registration number. Add this text file to the lab 2 submission link.

Make sure results are visible in the notebooks.