CSE 4/574: Introduction to Machine Learning
Summer 2021

Instructor: Nitin Kulkarni

Assignment 2 - Neural Networks for Classification

Checkpoint: August 13, Fri, 11:59pm

Due Date: August 20, Fri, 11:59pm

1 Assignment Overview

The goal of the assignment is to work with neural networks for classification. In the first part of the assignment you will implement a simple neural network with 1 hidden layer. In the second part of the assignment we will implement deeper neural networks using techniques such as regularization and reduced learning rate. The purpose of this assignment is to understand how neural networks work.

Dataset

You have been given a diabetes dataset. There are 768 samples in the dataset. The features include information about an individual such as the number of pregnancies, glucose level, blood pressure, skin thickness, insulin, BMI, Diabetes Pedigree Function and their age. The target is 1 or 0 indicating whether a person has diabetes or not respectively.

You will figure out which features you want to use and split the dataset into a train and test datase tsuch that the train dataset contains 80% of the data and test dataset contains 20% of the data.

Part 1 [40 points] - Implementing a Neural Network with One Hidden Layer

Implement a neural network with one hidden layer to classify whether a person has diabetes or not.

Plan of Work

1. Prepare the data for training (normalize, split between train and test sets)
2. Build a Neural Network with one hidden layer, that takes the features as input and gives as output whether a person has diabetes or not.
3. Discuss the results and provide the graphs showing the train vs validation accuracy and train vs validation loss.

Part 2 [60 points] - Implementing a Neural Network with Three Hidden Layers

Implement a neural network with three hidden layers with each using l2 regularization. Use reduced learning rate with a minimum learning rate of 0.00001. Classify whether a person has diabetes or not.

Plan of Work

1. Prepare the data for training (normalize, split between train and test sets)
2. Build a Neural Network with three hidden layers, (use l2 regularization and reduced learning rate with a minimum learning rate of 0.00001) that takes the features as input and gives as output whether a person has diabetes or not.
3. Discuss the results and provide the graphs showing the train vs validation accuracy and train vs validation loss.

Extra Points [max + 5 points]

The top 5 teams who get the highest accuracy will get bonus points.

2 Deliverables

Submit your work using UBLearns group in both cases if you work individually or in a team of two. There are two parts in your submission:

2.1 Report

The report should be delivered as a separate pdf file, and it is recommended for you to use the NIPS template to structure your report. You may include comments in the Jupyter Notebook, however you will need to duplicate the results in the separate pdf file. For the final submission, combine the reports for both Part 1 and Part 2 into one file.

2.2 Code

Python is the only code accepted for this project. You can submit the code in Jupyter Notebook (.ipynb) or Python script (.py). You can submit multiple files, but they all need to have a clear name. After executing command python main.py in the first level directory or Jupyter Notebook, it should generate all the results and plots you used in your report and should be able to be printed out in a clear manner. Additionally you can submit the trained parameters, so that the grader can fully replicate your results. For the final submission you can combine the code from both parts into one.

3 References

- NIPS Styles (docx, tex)
- Overleaf (LaTex based online document generator) - a free tool for creating professional reports
- Lecture slides

4 Checkpoint Submission [Due date: August 13]

Complete Part 1 and submit the code and draft report. To submit your work, add your pdf, ipynb/python script to zip file with UBIT $TEAMMATE1\_TEAMMATE2\_assignment1\_checkpoint.zip$ (e.g. $nitinvis\_soumyyak\_assignment1\_checkpoint.zip$ and upload it to UBlearns (Assignments section). Checkpoint will be evaluated after the final submission.

5 Final Submission [Due date: August 20]

Add your combined pdf and ipynb/python script for Part 1 and Part 2 to a zip file $TEAMMATE1\_TEAMMATE2\_assignment1\_final.zip$ (e.g. $nitinvis\_soumyyak\_assignment1\_final.zip$) and upload it to UBlearns using group submission (Assignments section).

6 Important Information

This assignment can be completed in groups of two or individually. The standing policy of the Department is that all students involved in any academic integrity violation (e.g. plagiarism in any way, shape, or form) will receive an F grade for the course. The catalog describes plagiarism as "Copying or receiving material from any source and submitting that material as one's own, without acknowledging and citing the particular debts to the source, or in any other manner representing the work of another as one's own.". Updating the hyperparameters or modifying the existing code is not part of the assignment's requirements and will result in a zero. Please refer to the UB Academic Integrity Policy.

7 Late Days Policy

You can use up to 3 late days throughout the course toward any assignments' checkpoint or final submission. You don't have to inform the instructor, as the late submission will be tracked in UBlearns. If you work in teams the late days used will be subtracted from both partners. E.g. you have 3 late days and your partner has 2 days left. If you submit one day after the due date, you will have 2 days and your partner will have 1 days left.

8 Important Dates

August 13, Friday 11:59pm - Checkpoint is Due

August 20, Friday, 11:59pm - Assignment 2 is Due