DATA 527 – Predictive Modeling
Project 2
100 points

The problem assignment (65%)

The purpose of this project is to implement the feed forward neural network model with some dynamic implementation of its parameters.

The dataset has various features. This model takes four input features: *altitude, indicated_airspeed, pitch, and roll*. The target to predict is one of the four features, *the pitch*.

The dataset to use contains 5403 entries. The dataset for this project can be found on Blackboard under *Additional Resources*.

Implement the algorithm following the requirements described below on the dataset *input_fl_12477* and report your results in the writeup.

Requirements:

- Normalize the data.
- Split data into training data and testing data
- Implement and test different activation functions, and document the outcomes in the report.
- Save the mean squared error MSE of each iteration in a log file *NNTraining[Iterations][LearningRate]MSE*.
- Save the best iteration and the best mean squared error
- Implement the two learning types, stochastic and batch and report their outcomes in the report
- Implement Dynamic Setting of number of iterations
    - Break the training if the cost error is constant/going up
- Save the model parameters obtained from the training process in a log file *NNModelParameters*.
- Print the parameters: Number of iterations, activation function, learning rate, training type to the consol.
- Plot the cost function per iteration and save the plot in the current directory.
- Report the main tested learning rates and their results in a table.
- The target to predict (pitch in this case), the learning rate, the number of iterations, the training type, the activation function, have to be passed to the program as command line arguments.
- *Optional*: Apply the model to predict the four input values.
- Discuss in the report section *Discussion*, the challenges faced while implementing the model and how they were solved. Also, discuss the straightforward steps in the implementation that took less time to implement compared to the challenging ones.

The problem report (15%)

Possible outline for the report might be:

- Overview/ Description
- Methodology/Strategy
- Implementation
- Results
- Discussion
- Conclusion
- References

The oral presentation (20%)

A ppt presentation and an oral presentation of the model and the results obtained.

Instructions

Using the discussion board on Blackboard for this topic is encouraged to post any questions you may have while working on the project and get back to any of your colleagues' questions that you might know the answer of.

Any sources of help that you use while completing this assignment (other students, textbooks, websites, etc.) must be cited in your PDF report.

This assignment consists of three parts:

- *A problem report,*
- *An oral presentation (using ppt slides),*
- *A program exercise*

1. For the problem report, you write up your solutions electronically and submit it as a single PDF document.
2. Your solution to the programming exercise must be implemented in python. Any plots created in the program or results generated from the program should be reported in the PDF report.
3. A ppt presentation and an oral presentation of the model and the results obtained. The presentation should be approximately 20 minutes. The quality of both the ppt and the oral presentation will be graded. The ppt file should be submitted with the program and the report.

You will be submitting the following files, including the log files:

- project2-yourFullName.pdf (a PDF writeup)
- NNModelFlight.py
- project2Presentation-yourFullName.ppt
- Recorded oral presentation (for Online students Only)

Please follow the naming conventions exactly, and do not submit additional files including data sets. The files should be submitted as a zipped folder. Your name/Team members names, class name, deadline, and term should be included in each file you submit (except the log files). In the program as a comment section on the top and in the report before your start the document.

Due Date and Submission Methods

Due on or before Monday, May 6. **Submission of the full project deliverables should be done by 5/06**.

__For On-campus students__: Presentations will be held in-person to demonstrate your model results, so misunderstanding would be minimized (***Presentation days are 4/29 and 5/02).*** The presentation schedule will be available on Blackboard. The presentation should be approximately **20 minutes**

Support and Feedback

As you progress through your project, I am here to provide support and guidance to ensure you are on the right track and to offer any necessary feedback.

Please feel free to email me anytime with updates on your progress or any questions you may have. Whether you need clarification on certain aspects of the project or want feedback on your ideas.

Additionally, if you encounter any challenges or roadblocks along the way, do not hesitate to reach out. I am more than happy to help brainstorm solutions or provide further resources to aid you in your project.

Remember, **consistent communication is key to a successful outcome**, so please keep me updated on your progress. I look forward to seeing your progress and helping wherever needed.