ENGM 4676/6676 – Machine Learning for Engineers

Assignment #3: Deep Learning Using Keras

In this assignment, you will deepen your understanding of deep learning by using Keras to build Dense Neural Networks (DNNs). For the DNN, continue to work with the dataset selected in Assignment #2 or select a new dataset.

Question 0: Revisiting Your Dataset (0 points, or -2 points if excluded)

To ensure a smooth transition from Assignment #2, start by including your answer to question #1 from the assignment #2 where you described your dataset. If you've decided to switch to a different dataset, please provide a detailed description along with the appropriate citation. Additionally, share your reasons for making the change.

If you wish to work with CNNs or timeseries data and your previous dataset doesn't support that you can select new dataset. Please redescribe the new dataset and it's source if this is the case.

Question 1: DNNs for Regression or Classification (20 points)

Using the dataset selected in Assignment #2, build a Dense Neural Network (DNN) model with Keras, either for regression or classification, based on your dataset's nature *Note: You have the option to either use regular DNNs or CNNs, or LSTMs depending on your dataset and problem.*

- If applicable, preprocess the dataset to be suitable for the deep learning models model.
- Design two or more deep learning architectures, specifying the number of layers, units, activation functions, etc. Compare between different architecture. (This can include two DNNs, CNN and DNN, two CNNs, DNN and LSTM, it is upto you).
- Train your model using an appropriate training/test split.
- Evaluate your model using relevant metrics.
- Demonstrate if regularization helped your model generalization. Comment on the regularization results.
- Visualize the training process and results.
- Obtain the confusion matrix and classification reports. Identify any weaknesses.
- Discuss the results and any challenges you encountered during this phase.
- Compare the DNN results with the machine learning results from Assignment #2. Do you think utilizing a DNN is a better option?

Note: Make sure to Include clear and commented code for each step of your work.

Evaluation metric:

For each question, you will be evaluated based on your presentation quality, results quality, code quality, visualization quality, clarity, completeness of answers, and code comments. A rating of 1 to 10 will be used as follows (Guideline):

No Answer (0)

Limited (1-4): Poor quality and incomplete answers.

Basic (5-9): Below-average quality and partially complete answers.

Adequate (10-13): Satisfactory quality.

Proficient (14-17): Good quality.

Excellent (18-20): Excellent quality.

Submission Guidelines:

Write a Jupyter Notebook (.ipynb file) to perform the tasks mentioned in each question.

Include comments in your code to explain the steps you are taking and the rationale behind your decisions. Ensure that your code is well-organized and follows best practices for coding style.

If you encounter any challenges or limitations during the assignment, document them along with your approach to overcoming them.

Submission Deadline: Nov 8th, 2024, by 11:59pm.

Please submit:

1- **Jupyter Notebook file (with the output)**
2- **A PDF print of that Jupyter Notebook file.**

Please name them as ***"[Your Banner]_[Your Name]_A3. IPYNB"*** and ***"[Your Banner]_[Your Name]_A3".PDF***

- **No PDF:** If you do not include the PDF we will assess your assignment based on the ipynb file alone. Please note that your marks will negatively impact even further if we are unable to reproduce the results from your ipynb file or if the file doesn't contain the outputs. **We will not upload and mount the dataset you utilized.**

- **No ipynb**: **You will lose 5 marks**, not providing the ipynb or the source code files will prevent us from verifying the legitimacy of your work, consequently resulting in a mark deduction.

Late submissions without an approved reason will incur a penalty of 2 mark per day (10%).

If you have any questions, please ask them during the tutorial or use the discussion board.

Good luck!