Ghulam Ishaq Khan Institute of Engineering Sciences and Technology
Department of Computer Science

Course Information

Course Code: CS 351L
Course Title: Artificial Intelligence Lab
Instructor: Mr. Usama Arshad, PhD CS
Program: BS Cybersecurity
Semester: 5th
Reference for Lab Resources:
[CS 351L - AI Lab GitHub Repository]
(https://github.com/usamajanjua9/CS-351L---AI-Lab-)

Lab Task Details

Lab Task: 08

Lab Title: Basics of Neural Networks - Building, Training, and Evaluating

Assigned Date: 20th November 2024

Submission Deadline: 26th November 2024

Task Type: Individual

Submission Instructions

- Make a public repository on GitHub with following name:
  CS 351L - AI Lab GitHub Repository_Your_reg_no.
- Submit each completed lab task on repository and share the link to my email with screenshots of output.
  usama.arshad@giki.edu.pk
- File Naming Convention: [YourName]_CS351L_Lab08.ipynb

Late Submissions: Will incur a deduction of marks unless approved in advance by the instructor.

<div align="center">**Task Overview**</div>

Scenario:

In this lab, you explored neural networks by building and training a simple feedforward network. To deepen your understanding, you will modify and extend the existing model, apply it to a different dataset, and evaluate its performance.

Part 1: Modify the Neural Network
1. Add an additional hidden layer with 16 neurons and the ReLU activation function.
2. Train the modified network on the Iris dataset with the same training and evaluation procedure.
3. Compare the performance of the modified network with the original one using metrics such as:
   - Training loss and accuracy.
   - Validation loss and accuracy.
   - Test accuracy.

Part 2: Apply to a New Dataset
1. Use the Wine dataset from Scikit-Learn as the new dataset.
2. Preprocess the dataset:
   - Standardize the features using a scaler (e.g., StandardScaler).
   - One-hot encode the target labels
3. Build, train, and evaluate a neural network for classification using the following settings:
   - At least two hidden layers with 8 and 16 neurons respectively.
   - ReLU activation for all layers except the output layer.
   - Softmax activation for the output layer.
4. Visualize the results:
   - Training and validation loss/accuracy over epochs.
   - Confusion matrix for test predictions.

Deliverables
1. Modified Neural Network Implementation: Include detailed comments for each modification.
2. Training and Evaluation Results: Compare the original and modified networks.
3. Wine Dataset Neural Network: Provide a complete implementation with visualizations.
4. Discussion and Analysis: Write a short conclusion summarizing:
   - The effect of adding additional layers.
   - The difference in performance between the Iris and Wine datasets.

<div align="center">-----------------------------*to err is human*----------------------------</div>