

National University of Computer and Emerging Sciences



Lab Manual 09 Artificial Intelligence Lab

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1 Objectives

After performing this lab, students shall be able to understand the following concepts:

- ✓ Single Perceptron
- ✓ Perceptron Learning Rule
- ✓ Back propagation
- ✓ Training of an MLP

2 Task

Design and implement a Multilayer Perceptron (MLP) using backpropagation algorithm to classify images of flowers from the Flower Recognition Dataset. The MLP should have at least 2 hidden layers, and you can choose the number of neurons in each layer. You should use cross-entropy loss function, stochastic gradient descent optimization algorithm with a learning rate of 0.01. Your implementation should include the following steps:

1. Load the Flower Recognition dataset from this link: <https://www.kaggle.com/alxmamaev/flowers-recognition>. Preprocess the data by scaling the pixel values to the range $[0, 1]$, and split the dataset into training and validation sets.
2. Initialize the weights and biases of the MLP using random values.
3. Implement the forward pass of the MLP, where you compute the output of each neuron in each layer.
4. Implement the backward pass of the MLP, where you compute the gradient of the loss function with respect to each weight and bias in the network.
5. Update the weights and biases using stochastic gradient descent optimization algorithm with a learning rate of 0.01.
6. Train the MLP for 10 epochs, and monitor the accuracy on the validation set after each epoch.
7. Evaluate the final accuracy of the trained MLP on the test set, and calculate the classification report, which includes precision, recall, and F1-score for each class.
8. Plot the ROC curve for the classifier, and calculate the area under the curve (AUC).

To include these additional functionalities, you can use the following libraries:

- `sklearn.metrics` for calculating accuracy and classification report
- `sklearn.metrics.plot_roc_curve` for plotting ROC curve
- `sklearn.metrics.roc_auc_score` for calculating AUC score

To use these functions, you can follow these steps:

- After training the MLP, use it to make predictions on the test set.
- Calculate the accuracy and classification report using `sklearn.metrics.accuracy_score` and `sklearn.metrics.classification_report` functions.

- Plot the ROC curve using `sklearn.metrics.plot_roc_curve` function.
- Calculate the AUC score using `sklearn.metrics.roc_auc_score` function.

3 Submission Instructions

Always read the submission instructions carefully.

- Rename your notebook to your roll number and download the notebook as **.ipynb** extension.
- To download the required file, go to **File->Download .ipynb**
- Only submit the **.ipynb** file. DO NOT **zip** or **rar** your submission file
- Submit this file on Google Classroom under the relevant assignment.
- Late submissions will not be accepted.