

Assignment - 1

Important: Please ensure that all code submitted is your original work. Copying code or using AI tools such as ChatGPT for assistance in coding assignments is strictly forbidden. We will employ tools such as MOSS to detect plagiarism and other tools to identify AI-generated content. Violations of this policy will result in a zero score for the assignment, along with possible additional disciplinary measures.

Points: Students who score the highest mark in the assignment (i.e. out of 10 marks) will receive two bonus points.

	Q1	Q2	Q3	Total
Marks	3	3	4	10

Logistics: To avoid any Python package version conflicts and for seamless evaluation, please run your code in a new Python environment.

1. Download and install Miniconda Python. *# If Anaconda Python not installed.*
2. `conda create -n ail721 python=3.10` *# Create a new conda environment.*
3. `conda activate ail721` *# Activate the new conda environment.*
4. `pip install -r requirement.txt` *# Install Python packages from the requirement.txt.*

Note: We will train your code only for the specified number of epochs, as indicated in the sample code during evaluation. Therefore, do not modify it when you submit your file.

Q1. Figure 1 is a shallow neural network with three input units, one hidden layer with two hidden units, and one output unit.

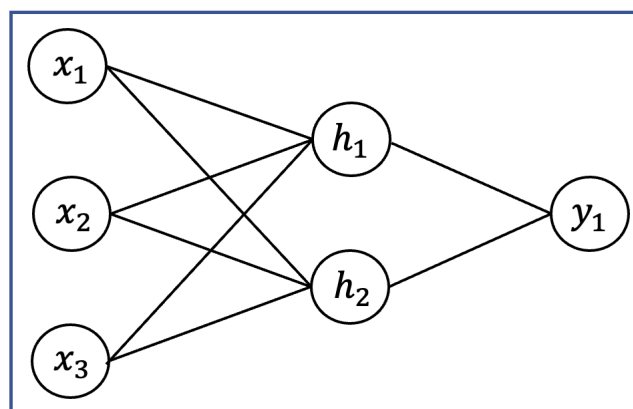


Figure 1: Shallow Neural Network

(a) Implement a 3 bit **OR** logic using the shallow neural network. Use only the Numpy Python package for your implementation. The assignment package includes an initial Python file named *shallow-numpy.py*. Please add your code to this file and submit it with the *loss-numpy.png* and *avg-error-numpy.log* files generated as output of the Python file.

(1.5-Marks)



(b) Implement a 3 bit **AND** logic using the shallow neural network. Use only the Pytorch Python package for your implementation. The assignment package includes an initial Python file named *shallow-pytorch.py*. Please add your code to this file and submit it with the *loss-pytorch.png* and *avg-error-pytorch.log* files generated as output of the Python file. **(1.5-Marks)**

Q2. You are required to perform linear regression and classification tasks using only a neural network based machine learning model. For this task, you can use the PyTorch Python package.

- **Q2.1-** Simple Linear Regression Task: A sample code and training data are provided in the assignment package. **(1.5-Marks)**
- **Q2.2-** Multiclass Classification Task: A sample codebase and training data are included in the assignment package. The total number of classes is 11 (0 - 10). **(1.5-Marks)**

Q3. You are required to perform a classification task on a noisy MNIST dataset using only a Multi-Layer Perceptron (MLP) model. For this task, you can use the PyTorch Python package. The training data is available on the following link: <https://tinyurl.com/noisymnist>. **(4-Marks)**

Submission Deadline: 7th Feb 11:59 PM.

Submission Portal: Please submit your code in a zipped file in a Dropbox folder (link in Piazza).

Late Submission: You will lose 10% of the score for every late day in submission.

Happy Coding!