# Practice Lab Assignment 1

# Neural Network Implementation from Scratch

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**Neural Network Implementation from Scratch for Titanic Dataset:**

**Objective:**
**Implement a simple feedforward neural network from scratch in Python without using any in-built deep learning libraries. This implementation will focus on the basic components: forward pass, backward propagation (backpropagation), and training using gradient descent.**

**1. Problem Definition:**

- **Dataset: We'll use the Titanic dataset, which contains passenger information like age, gender, and ticket class to predict survival (binary classification: survived or not).**
- **Task: The task is a binary classification problem, where we predict whether a passenger survived or not based on their features.**

**2. Neural Network Architecture:**

- **Input Layer: 8 neurons (since we have 8 preprocessed features).**
- **Hidden Layer: 10 neurons (this is a hyperparameter).**
- **Output Layer: 2 neurons (since we have 2 output classes: survived or not).**

**3. Methodology:**

**Activation Functions:**
**a. Hidden layer: ReLU (Rectified Linear Unit).**
**b. Output layer: Softmax (to compute probabilities for binary classification).**

**Loss Function:**
**Cross-Entropy Loss (as it's a classification problem).**

**Optimization:**
**Gradient Descent (batch gradient descent).**

**Data Preprocessing:**

1. **Loading Titanic dataset:**
   **The dataset is loaded using pandas.**
2. **Handling missing values:**
   - **For numerical features like Age, missing values are filled with the median.**
   - **For categorical features like Embarked, missing values are filled with the mode.**
3. **One-hot encoding:**
   **Categorical features (Sex and Embarked) are one-hot encoded.**
4. **Feature standardization:**
   **Numerical features are standardized using StandardScaler for better performance.**
5. **Feature and target selection:**
   **Input features include Pclass, Age, SibSp, Parch, Fare, and one-hot-encoded Sex and Embarked.**
   **The target is Survived.**

**Neural Network Initialization:**

- **The input layer has 8 neurons (for the 8 features).**
- **The hidden layer has 50 neurons, and the output layer has 2 neurons (binary classification: survived or not).**
- **We initialize weights (W1, W2) and biases (b1, b2) with small random values.**

**Activation Functions:**

**a. ReLU for the hidden layer to introduce non-linearity.**
**b. Softmax for the output layer to compute probabilities.**

**Loss Function:**

**We use Cross-Entropy Loss, suitable for binary classification tasks.**

**Gradient Descent (Backpropagation):**

**Gradients of the loss with respect to weights and biases are computed, and parameters are updated using gradient descent.**

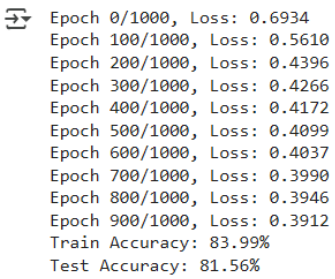
**Training and Evaluation:**

- **The model is trained for 1000 epochs (you can adjust this).**
- **The training loss is printed every 100 epochs.**
- **After training, the model is evaluated on both the training and test sets by computing accuracy.**

**Code File:**
**https://colab.research.google.com/drive/1V4o20QJMnNz9X9WKomCW6kdw01J9yzJM?usp=sharing**

**Dataset Link: https://www.kaggle.com/datasets/yasserh/titanic-dataset**

**Screenshot of Model Performance Metrics:**




**GitHub Link: https://github.com/ayushrewatkar/Deep_Learning_Projects.git**

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