**Lab Assignment: Artificial Neural Network (ANN) Classification on Tabular Data**

Objective:

Design, train, and evaluate a multi-class classification neural network using Keras on the Iris dataset

Part 1: Data Preparation and Preprocessing

Q1: Data Loading and Initial Exploration

- Load the Iris dataset

- Determine the number of features in each sample

- Identify the number of classes

- List the feature names and class names

Q2: Data Splitting and Scaling

- Split the dataset into training and testing sets

  • Specify test size (recommended 20%)

  • Set a consistent random state

- Explain the importance of feature scaling

- Convert target variables to categorical format

- Discuss the purpose of data splitting and scaling in machine learning

Part 2: Neural Network Architecture Design

Q3: Neural Network Architecture

- Design a sequential neural network architecture

  • Specify number of layers

  • Choose appropriate neuron counts for each layer

  • Select activation functions

- Justify your network design choices

- Explain the role of each layer and activation function

Q4: Model Compilation

- Select an appropriate optimizer for multi-class classification

- Choose the loss function

- Pick relevant evaluation metrics

- Provide reasoning for each selection

Part 3: Model Training and Evaluation

Q5: Model Training

- Determine training hyperparameters

  • Number of epochs

  • Batch size

  • Validation split

- Implement training process

- Discuss the impact of these hyperparameters on model performance

Q6: Performance Evaluation

- Generate and analyze:

  • Training and validation accuracy curves

  • Training and validation loss curves

  • Confusion matrix

  • Classification report

- Calculate and interpret the model's test accuracy

- Identify potential challenges in classification

Part 4: Analysis and Reflection

Q7: Model Performance Analysis

- Analyze model performance across different classes

- Identify classes that are more difficult to predict

- Interpret learning curves

- Discuss signs of overfitting or underfitting