EXP NO: 02 DATE: 02/08/2025	**MULTI LAYER PERCEPTRON**

AIM: To develop a Multi-Layer Perceptron (MLP) model for a simple classification task using the Iris dataset, and experiment with different numbers of hidden layers and activation functions. The performance is evaluated using accuracy and loss.

ALGORITHM:

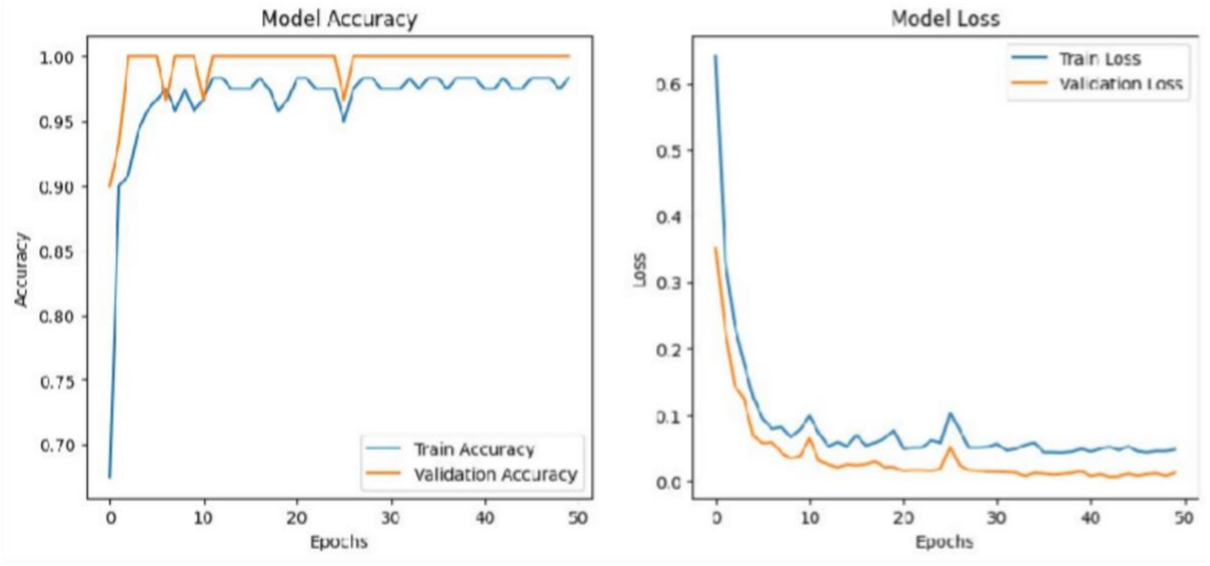
1. Load the Iris dataset and separate the input features and target labels.
2. Normalize input features using StandardScaler to improve learning.
3. Convert class labels into one-hot encoded format for multi-class classification.
4. Split the dataset into training and testing sets.
5. Build a Multi-Layer Perceptron with different hidden layers and activation functions.
6. Train the model using the Adam optimizer and categorical cross-entropy loss.
7. Evaluate performance using accuracy and loss, and visualize results with learning curves.

CODE:

```
import numpy as np

import matplotlib.pyplot as plt

from sklearn.datasets import load_iris

from sklearn.model_selection import train_test_split

from sklearn.preprocessing import StandardScaler, LabelBinarizer

from tensorflow.keras.models import Sequential

from tensorflow.keras.layers import Dense

from tensorflow.keras.optimizers import Adam


# Load dataset

iris = load_iris()

X = iris.data
```

```
y = iris.target


# Normalize features

scaler = StandardScaler()

X = scaler.fit_transform(X)


# One-hot encode labels

encoder = LabelBinarizer()

y = encoder.fit_transform(y)


# Train-test split

X_train, X_test, y_train, y_test = train_test_split(

   X, y, test_size=0.2, random_state=42

)


# Build MLP model

model = Sequential()

model.add(Dense(10, input_dim=4, activation='relu'))  # hidden layer 1

model.add(Dense(8, activation='tanh'))               # hidden layer 2

model.add(Dense(3, activation='softmax'))            # output layer


# Compile model

model.compile(optimizer=Adam(0.01),

             loss='categorical_crossentropy',

             metrics=['accuracy'])


# Train model

history = model.fit(X_train, y_train, validation_data=(X_test, y_test),
          epochs=50, batch_size=5, verbose=0)


# Evaluate model

loss, acc = model.evaluate(X_test, y_test, verbose=0)

print(f"Test Accuracy: {acc*100:.2f}%")

print(f"Test Loss: {loss:.4f}")


# Plot accuracy and loss

plt.figure(figsize=(12,5))


# Accuracy plot

plt.subplot(1,2,1)

plt.plot(history.history['accuracy'], label='Train Accuracy')

plt.plot(history.history['val_accuracy'], label='Validation Accuracy')

plt.xlabel("Epochs")

plt.ylabel("Accuracy")

plt.legend()

plt.title("Model Accuracy")


# Loss plot

plt.subplot(1,2,2)

plt.plot(history.history['loss'], label='Train Loss')

plt.plot(history.history['val_loss'], label='Validation Loss')

plt.xlabel("Epochs")

plt.ylabel("Loss")

plt.legend()

plt.title("Model Loss")
plt.show()
```

OUTPUT:



RESULT: The MLP model successfully classified Iris flower species with a test accuracy of 98% and demonstrated good convergence in accuracy and loss graphs.