

**EXPT NO : 5      A python program to implement Multi Layer**

**Perceptron With Backpropagation**

**DATE: 20.9.24**

**AIM:**

To write a python program to implement Multilayer perceptron with backpropagation .

**PROCEDURE:**

Implementing Multilayer perceptron with backpropagation using the Keras dataset involve the following steps:

**Step 1: Import Necessary Libraries**

First, import the libraries that are essential for data manipulation, visualization, and model building.

```
# importing modules

import tensorflow as tf

import numpy as np


from tensorflow.keras.models import Sequential


from tensorflow.keras.layers import Flatten
```

```
from tensorflow.keras.layers import Dense

from tensorflow.keras.layers import Activation

import matplotlib.pyplot as plt
```

## Step 2: Load the Keras Dataset

The Keras dataset can be loaded.

```
(x_train, y_train), (x_test, y_test) = tf.keras.datasets.mnist.load_data()
```

## OUTPUT :

```
📄 Downloading data from https://storage.googleapis.com/tensorflow/tf-keras-datasets/mnist.npz  
11490434/11490434 — 0s 0us/step
```

## Step 3: Data Preprocessing

Ensure the data is clean and ready for modeling. Since the Iris dataset is clean, minimal preprocessing is needed.

```
# Cast the records into float values

x_train = x_train.astype('float32')

x_test = x_test.astype('float32')


# normalize image pixel values by dividing

# by 255

gray_scale = 255

x_train /= gray_scale

x_test /= gray_scale
```

```
print("Feature matrix:", x_train.shape)

print("Target matrix:", x_test.shape)

print("Feature matrix:", y_train.shape)

print("Target matrix:", y_test.shape)
```

## OUTPUT :

```
⇒ Feature matrix: (60000, 28, 28)
   Target matrix: (10000, 28, 28)
   Feature matrix: (60000,)
   Target matrix: (10000,)
```

## Step 4 : Train a Model

```
model = Sequential([

    # reshape 28 row * 28 column data to 28*28 rows

    Flatten(input_shape=(28, 28)),
```

```
# dense layer 1

Dense(256, activation='sigmoid'),

# dense layer 2

Dense(128, activation='sigmoid'),

# output layer

Dense(10, activation='sigmoid'),

1)
```

## OUTPUT:

 `/usr/local/lib/python3.10/dist-packages/keras/src/layers/reshaping/flatten.py:37: UserWarning: super().__init__(**kwargs)`

## Step 5 : Make Predictions

Use the model to make predictions based on the independent variable.

```
model.compile(optimizer='adam',
```

```

        loss='sparse_categorical_crossentropy', metrics=['accuracy'])

model.fit(x_train, y_train, epochs=10,

        batch_size=2000,

        validation_split=0.2)

```

## OUTPUT:

```

Epoch 1/10
24/24 ————— 5s 115ms/step - accuracy: 0.3546 - loss: 2.1596 - val_accuracy: 0.68
Epoch 2/10
24/24 ————— 4s 53ms/step - accuracy: 0.7116 - loss: 1.3743 - val_accuracy: 0.826
Epoch 3/10
24/24 ————— 1s 53ms/step - accuracy: 0.8221 - loss: 0.8221 - val_accuracy: 0.872
Epoch 4/10
24/24 ————— 3s 65ms/step - accuracy: 0.8720 - loss: 0.5676 - val_accuracy: 0.892
Epoch 5/10
24/24 ————— 2s 99ms/step - accuracy: 0.8907 - loss: 0.4444 - val_accuracy: 0.902
Epoch 6/10
24/24 ————— 3s 102ms/step - accuracy: 0.8993 - loss: 0.3852 - val_accuracy: 0.91
Epoch 7/10
24/24 ————— 3s 104ms/step - accuracy: 0.9088 - loss: 0.3416 - val_accuracy: 0.91
Epoch 8/10
24/24 ————— 2s 92ms/step - accuracy: 0.9119 - loss: 0.3188 - val_accuracy: 0.922
Epoch 9/10
24/24 ————— 2s 92ms/step - accuracy: 0.9191 - loss: 0.2911 - val_accuracy: 0.926
Epoch 10/10
24/24 ————— 3s 99ms/step - accuracy: 0.9245 - loss: 0.2704 - val_accuracy: 0.929
<keras.src.callbacks.history.History at 0x7d9ca1406a40>

```

## Step 6 : Evaluate the Model

Evaluate the model performance.

```

results = model.evaluate(x_test, y_test, verbose = 0)

print('test loss, test acc:', results)

fig, ax = plt.subplots(10, 10)

k = 0

```

```
for i in range(10):
```

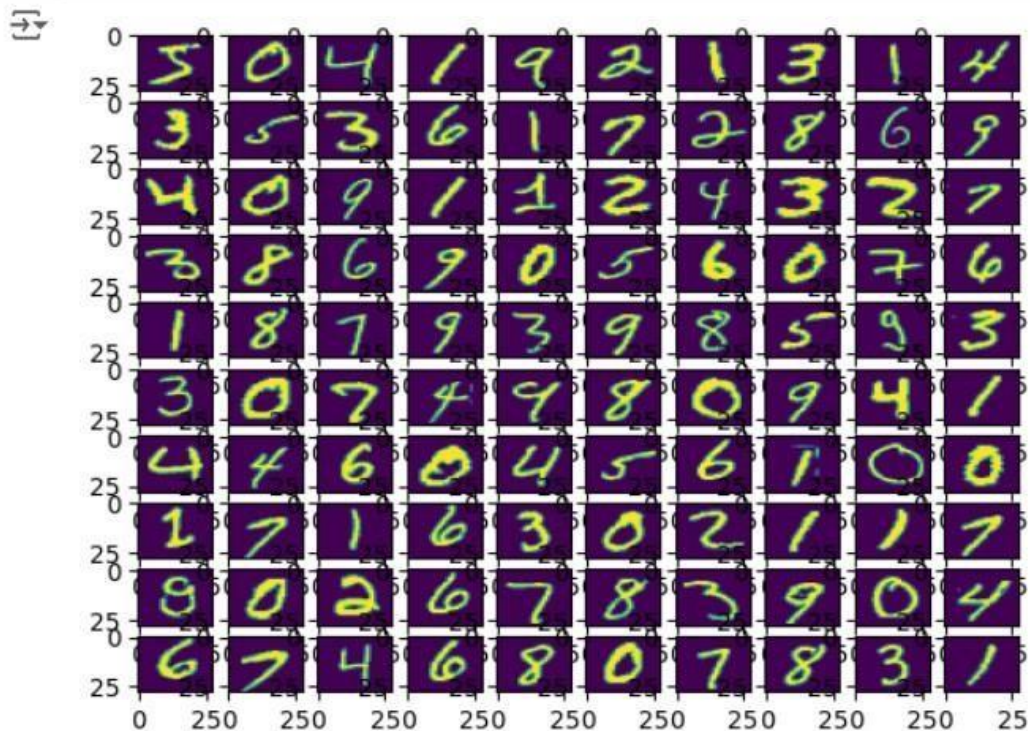
```
    for j in range(10):
```

```
        ax[i][j].imshow(x_train[k].reshape(28, 28),  
                        aspect='auto')
```

```
        k += 1 plt.show()
```

## OUTPUT :

⇒ test loss, test acc: [0.2589016258716583, 0.9277999997138977]



## RESULT:

This step-by-step process will help us to implement MultiLayer Perceptron with Backpropagation models using the Keras dataset and analyze their performance.