

## **A PYTHON PROGRAM TO IMPLEMENT MULTI LAYER PERCEPTRON WITH BACK PROPOGATION**

EXP NO. 5

Name: MOHAMED FUZAIL A

Roll no: 241801162

Code:

```
import pandas as pd
import numpy as np
from sklearn.model_selection import train_test_split
from sklearn.neural_network import MLPClassifier
from sklearn.metrics import classification_report, confusion_matrix

bnotes = pd.read_csv("C:\\Users\\Shyam
Ganesh\\Documents\\kaggle\\bank_note_data.csv")
print(bnotes.head(10))

x = bnotes.drop('Class', axis=1)
y = bnotes['Class']
print(x.head(2))
print(y.head(2))

# train_test ratio = 0.2
x_train, x_test, y_train, y_test = train_test_split(x, y, test_size=0.2)
```

```
# activation function : relu
mlp = MLPClassifier(max_iter=500, activation='relu')
mlp.fit(x_train, y_train)
pred = mlp.predict(x_test)
print(pred)
print(confusion_matrix(y_test, pred))
print(classification_report(y_test, pred))
```

```
# activation function : logistic
mlp = MLPClassifier(max_iter=500, activation='logistic')
mlp.fit(x_train, y_train)
pred = mlp.predict(x_test)
print(pred)
print(confusion_matrix(y_test, pred))
print(classification_report(y_test, pred))
```

```
# activation function : tanh
mlp = MLPClassifier(max_iter=500, activation='tanh')
mlp.fit(x_train, y_train)
pred = mlp.predict(x_test)
print(pred)
print(confusion_matrix(y_test, pred))
```

```
print(classification_report(y_test, pred))
```

```
# activation function : identity
```

```
mlp = MLPClassifier(max_iter=500, activation='identity')
```

```
mlp.fit(x_train, y_train)
```

```
pred = mlp.predict(x_test)
```

```
print(pred)
```

```
print(confusion_matrix(y_test, pred))
```

```
print(classification_report(y_test, pred))
```

```
# train_test ratio = 0.3
```

```
x_train, x_test, y_train, y_test = train_test_split(x, y, test_size=0.3)
```

```
# activation function : relu
```

```
mlp = MLPClassifier(max_iter=500, activation='relu')
```

```
mlp.fit(x_train, y_train)
```

```
pred = mlp.predict(x_test)
```

```
print(pred)
```

```
print(confusion_matrix(y_test, pred))
```

```
print(classification_report(y_test, pred))
```

```
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```

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# activation function : identity
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mlp.fit(x_train, y_train)
pred = mlp.predict(x_test)
print(pred)
print(confusion_matrix(y_test, pred))
print(classification_report(y_test, pred))
```

output:

	Image.Var	Image.Skew	Image.Curt	Entropy	Class
0	3.62160	8.6661	-2.80730	-0.44699	0
1	4.54590	8.1674	-2.45860	-1.46210	0
2	3.86600	-2.6383	1.92420	0.10645	0
3	3.45660	9.5228	-4.01120	-3.59440	0
4	0.32924	-4.4552	4.57180	-0.98880	0
5	4.36840	9.6718	-3.96060	-3.16250	0
6	3.59120	3.0129	0.72888	0.56421	0
7	2.09220	-6.8100	8.46360	-0.60216	0
8	3.20320	5.7588	-0.75345	-0.61251	0
9	1.53560	9.1772	-2.27180	-0.73535	0
	Image.Var	Image.Skew	Image.Curt	Entropy	
0	3.6216	8.6661	-2.8073	-0.44699	
1	4.5459	8.1674	-2.4586	-1.46210	
0	0				
1	0				
Name: Class, dtype: int64					
[0 1 1 0 0 0 0 0 0 1 1 1 1 0 0 0 1 1 1 0 1 1 0 0 0 0 1 0 1 0 1 0 1 1 1 0 0					
1 0 1 0 1 1 1 0 1 1 1 0 0 1 1 1 1 1 1 0 1 0 0 0 1 0 1 1 0 1 1 0 0 0 1 1 0					
0 0 0 0 0 0 1 1 0 0 0 0 0 1 0 1 0 0 0 0 1 0 0 0 1 0 1 0 0 0 1 1 1 0 0 0 1					
0 1 1 0 0 0 1 1 1 0 1 1 1 1 1 1 1 1 1 0 0 0 1 0 1 0 1 1 1 0 0 1 0 1 1 0					
1 0 0 0 0 0 1 0 0 0 0 0 0 1 0 0 1 1 1 0 0 0 0 0 0 1 0 0 1 1 1 1 1 0 0 0 1					
0 1 1 1 1 1 0 1 0 0 1 1 1 0 0 1 0 1 1 0 0 1 1 1 0 1 1 0 1 0 0 1 1 0 0 1 0					
1 1 0 1 1 0 1 1 0 0 1 0 0 0 0 0 0 0 1 0 0 1 0 1 1 0 1 1 1 0 0 1 0 0 1 0 1					
0 0 1 0 1 0 1 0 0 0 1 1 0 1 1 0]					
[[144 0]					
[ 0 131]]					
	precision	recall	f1-score	support	
0	1.00	1.00	1.00	144	
1	1.00	1.00	1.00	131	
accuracy			1.00	275	
macro avg	1.00	1.00	1.00	275	
weighted avg	1.00	1.00	1.00	275	

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```
[0 1 1 0 0 0 0 0 0 1 1 1 1 0 0 0 1 1 1 0 1 1 0 0 0 0 1 0 1 0 1 0 1 1 1 0 0
1 0 1 0 1 1 1 0 1 1 1 0 0 1 1 1 1 1 1 0 1 0 0 0 1 0 1 1 0 1 1 0 0 0 1 1 0
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0 1 1 0 0 0 1 1 1 0 1 1 1 1 1 1 1 1 1 0 0 0 1 0 1 0 1 1 1 0 0 1 0 1 1 0
1 0 0 0 0 0 1 0 0 0 0 0 0 1 0 0 1 1 1 0 0 0 0 0 0 1 0 0 1 1 1 1 1 0 0 0 1
0 1 1 1 1 1 0 1 0 0 1 1 1 0 0 1 0 1 1 0 0 1 1 1 0 1 1 0 1 0 0 1 1 0 0 1 0
1 1 0 1 1 0 1 1 0 0 1 0 0 0 0 0 0 0 1 0 0 1 0 1 1 1 0 1 1 1 0 0 1 0 0 1 0
0 0 1 0 1 0 1 0 0 0 1 1 0 1 1 0]
```

```
[[144  0]
```

```
[  0 131]]
```

	precision	recall	f1-score	support
0	1.00	1.00	1.00	144
1	1.00	1.00	1.00	131
accuracy			1.00	275
macro avg	1.00	1.00	1.00	275
weighted avg	1.00	1.00	1.00	275

```
[0 1 1 0 0 0 0 0 0 1 1 1 1 0 0 0 1 1 1 0 1 1 0 0 0 0 1 0 1 0 1 0 1 1 1 0 0
1 0 1 0 1 1 1 0 1 1 1 0 0 1 1 1 1 1 1 0 1 0 0 0 1 0 1 1 0 1 1 0 0 0 1 1 0
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0 0 1 0 1 0 1 0 0 0 1 1 0 1 1 0]
```

```
[[144  0]
```

```
[  0 131]]
```

	precision	recall	f1-score	support
0	1.00	1.00	1.00	144
1	1.00	1.00	1.00	131
accuracy			1.00	275
macro avg	1.00	1.00	1.00	275

[0 1 1 0 0 0 0 0 0 1 1 1 1 0 0 0 1 1 1 0 1 1 0 0 0 0 1 0 1 0 1 0 1 1 1 0 0  
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0 0 1 0 1 0 1 0 0 0 1 1 0 1 1 0]

[[144 0]

[ 0 131]]

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0	1.00	1.00	1.00	144
1	1.00	1.00	1.00	131
accuracy			1.00	275
macro avg	1.00	1.00	1.00	275
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[0 1 1 0 0 0 0 0 0 1 1 1 1 0 0 0 1 1 1 0 1 1 0 0 0 0 1 0 1 0 1 0 1 1 1 0 0  
1 0 1 0 1 1 1 0 1 1 1 0 0 1 1 1 1 1 1 0 1 0 0 0 1 0 1 1 0 1 1 0 0 0 1 1 0  
0 0 0 0 0 0 1 1 0 0 0 0 0 1 0 1 0 0 0 0 1 0 0 0 1 0 1 1 0 0 1 1 1 0 0 0 1  
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0 1 1 1 1 1 0 1 0 0 1 1 1 0 0 1 0 1 1 0 0 1 1 1 0 1 1 0 1 0 0 1 1 0 0 1 0  
1 1 0 1 1 0 1 1 0 0 1 0 0 0 0 0 0 0 1 0 0 1 0 1 1 0 1 1 1 0 0 1 0 0 1 0 1  
0 0 1 0 1 0 1 0 0 0 1 1 0 1 1 0]

[[142 2]

[ 1 130]]

```

[1 0 0 1 0 1 1 1 1 0 1 1 0 0 0 1 0 0 0 0 0 1 1 0 0 1 0 1 1 0 1 1 0 0 1 0 1
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0 1 0 0 0 1 1 0 1 1 1 0 0 0 0 0 1 1 0 1 0 0 0 1 1 0 1 1 1 1 0 0 1 1 0 0 0
0 0 1 1 1 0 1 0 0 1 1 0 1 0 0 0 1 0 1 0 0 0 0 1 0 0 0 1 0 0 1 1 1 1 1 0 0
0 1 0 0 0 1 1 0 0 1 1 0 0 0 1 0 0 1 0 1 1 1 1 0 0 0 0 1 0 1 0 1 0 1 0 1 0
0 1 0 1 0]

```

```
[[224  0]
```

```
[  0 188]]
```

	precision	recall	f1-score	support
0	1.00	1.00	1.00	224
1	1.00	1.00	1.00	188
accuracy			1.00	412
macro avg	1.00	1.00	1.00	412
weighted avg	1.00	1.00	1.00	412

```

[1 0 0 1 0 1 1 1 1 0 1 1 0 0 0 1 0 0 0 0 0 1 1 0 0 1 0 1 1 0 1 1 0 0 1 0 1
1 1 1 1 0 1 0 0 0 1 0 1 1 0 1 0 1 0 0 1 0 0 0 0 1 0 0 1 1 1 0 0 1 0 1 1 0
1 0 0 1 1 0 0 0 1 1 0 0 0 0 1 0 1 0 0 1 0 0 1 0 1 1 1 1 1 0 1 0 1 0 0 1 1
1 1 0 0 0 0 0 1 1 1 0 1 0 0 0 0 0 0 0 0 1 0 1 0 1 0 0 1 0 0 0 0 1 0 0 0 0
1 1 1 1 0 1 0 1 0 0 0 1 1 0 1 1 0 0 1 1 0 1 0 1 1 0 0 0 0 0 1 0 0 1 0 1 0
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0 1 1 1 1 0 1 0 0 1 1 0 1 0 0 0 1 0 1 0 0 0 1 1 0 0 0 1 0 0 1 1 1 1 1 0 0
0 1 0 0 0 1 1 0 0 1 1 0 0 0 1 0 0 1 0 1 1 1 1 0 0 0 0 1 0 1 0 1 0 1 0 1 0
0 1 0 1 0]

```

```
[[221  3]
```



```

[ 0 188]]
precision    recall  f1-score   support

      0         1.00      0.99      0.99         224
      1         0.98      1.00      0.99         188

 accuracy         0.99         0.99         0.99         412
 macro avg         0.99         0.99         0.99         412
weighted avg         0.99         0.99         0.99         412

[1 0 0 1 0 1 1 1 1 0 1 1 0 0 0 1 0 0 0 0 0 1 1 0 0 1 0 1 1 0 1 1 0 0 1 0 1
 1 1 1 1 0 1 0 0 0 1 0 1 1 0 1 0 1 0 0 1 0 0 0 0 1 0 0 1 1 1 0 0 1 0 1 1 0
 1 0 0 1 1 0 0 0 1 1 0 0 0 0 1 0 1 0 0 1 0 0 1 0 1 1 1 1 0 1 0 1 0 0 1 1
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 1 1 1 1 0 1 0 1 0 0 0 1 1 0 1 1 0 0 1 1 0 1 0 1 1 0 0 0 0 0 1 0 0 1 0 1 0
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 1 0 0 1 1 1 1 1 0 0 1 1 0 0 0 1 1 1 1 1 0 0 1 0 1 0 1 1 0 1 1 0 1 0 1 1 0
 0 0 0 0 1 0 0 1 0 0 0 1 1 1 0 1 1 0 1 0 1 1 0 1 0 1 1 0 1 0 0 0 0 0 0 1
 0 1 0 0 0 1 1 0 1 1 1 0 0 0 0 0 1 1 0 1 0 0 0 1 1 0 1 1 1 1 0 0 1 1 0 0 0
 0 0 1 1 1 0 1 0 0 1 1 0 1 0 0 0 1 0 1 0 0 0 0 1 0 0 0 1 0 0 1 1 1 1 1 0 0
 0 1 0 0 0 1 1 0 0 1 1 0 0 0 1 0 0 1 0 1 1 1 1 0 0 0 0 1 0 1 0 1 0 1 0 1 0
 0 1 0 1 0]
[[224 0]
[ 0 188]]
precision    recall  f1-score   support

      0         1.00      1.00      1.00         224
      1         1.00      1.00      1.00         188

 accuracy         1.00         1.00         1.00         412
 macro avg         1.00         1.00         1.00         412
weighted avg         1.00         1.00         1.00         412

[1 0 0 1 0 1 1 1 1 0 1 1 0 0 0 1 0 0 0 0 0 1 1 1 0 1 0 1 1 0 1 1 0 0 1 0 1
 1 1 1 1 0 1 0 0 0 1 0 1 1 0 1 0 1 0 0 1 0 0 0 0 1 0 0 1 1 1 0 0 1 0 1 1 0
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 0 1 0 0 0 1 1 0 0 1 1 0 0 0 1 0 0 1 0 1 1 1 1 0 0 0 0 1 0 1 0 1 0 1 0 1 0
 0 1 0 1 0]
[[219 5]
[ 0 188]]
precision    recall  f1-score   support

      0         1.00      0.98      0.99         224
      1         0.97      1.00      0.99         188

 accuracy         0.99         0.99         0.99         412
 macro avg         0.99         0.99         0.99         412
weighted avg         0.99         0.99         0.99         412

```