CS156 (Introduction to AI), Spring 2021

Assignment_6

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References and sources

https://machinelearningmastery.com/why-one-hot-encode-data-in-machine-learning/ https://scikit-learn.org/stable/modules/generated/sklearn.preprocessing.StandardScaler.html https://scikit-learn.org/stable/modules/generated/sklearn.datasets.load_digits.html https://pandas.pydata.org/pandas-docs/stable/reference/api/pandas.DataFrame.html

Solution

In [132…

```
import pandas as pd
import numpy as np
from sklearn.datasets import load_digits
from sklearn.model_selection import train_test_split
from sklearn.preprocessing import StandardScaler
from sklearn.linear_model import Perceptron
from sklearn.metrics import plot_confusion_matrix
import matplotlib.pyplot as plt
from sklearn.metrics import accuracy_score
```

## in this problem we have number ranging from 1-9 , and we have to use single layer perceptron model which isa binary classifier for the predicitons

### The MNIST database (Modified National Institute of Standards and Technology database is a large database of handwritten digits that is commonly used for training various image processing systems

In [101…

```
digits = load_digits(as_frame=True)
```

In [102…

```
digits.data.head()
```

Out[102…

	pixel_0_0	pixel_0_1	pixel_0_2	pixel_0_3	pixel_0_4	pixel_0_5	pixel_0_6	pixel_0_7	pixel_1_0	pixel_1_
0	0.0	0.0	5.0	13.0	9.0	1.0	0.0	0.0	0.0	0
1	0.0	0.0	0.0	12.0	13.0	5.0	0.0	0.0	0.0	0
2	0.0	0.0	0.0	4.0	15.0	12.0	0.0	0.0	0.0	0
3	0.0	0.0	7.0	15.0	13.0	1.0	0.0	0.0	0.0	8

	pixel_0_0	pixel_0_1	pixel_0_2	pixel_0_3	pixel_0_4	pixel_0_5	pixel_0_6	pixel_0_7	pixel_1_0	pixel_1_
4	0.0	0.0	0.0	1.0	11.0	0.0	0.0	0.0	0.0	0

5 rows × 64 columns

In [103…

```
scaler=StandardScaler()
normalized_data = scaler.fit_transform(digits.data)
```

In [104…

```
digits.target
```

Out[104…

```
0       0
1       1
2       2
3       3
4       4
       ..
1792    9
1793    0
1794    8
1795    9
1796    8
Name: target, Length: 1797, dtype: int32
```

In [105…

```
print(digits.feature_names)
```

```
['pixel_0_0', 'pixel_0_1', 'pixel_0_2', 'pixel_0_3', 'pixel_0_4', 'pixel_0_5', 'pixel_0_
6', 'pixel_0_7', 'pixel_1_0', 'pixel_1_1', 'pixel_1_2', 'pixel_1_3', 'pixel_1_4', 'pixel
_1_5', 'pixel_1_6', 'pixel_1_7', 'pixel_2_0', 'pixel_2_1', 'pixel_2_2', 'pixel_2_3', 'pi
xel_2_4', 'pixel_2_5', 'pixel_2_6', 'pixel_2_7', 'pixel_3_0', 'pixel_3_1', 'pixel_3_2',
'pixel_3_3', 'pixel_3_4', 'pixel_3_5', 'pixel_3_6', 'pixel_3_7', 'pixel_4_0', 'pixel_4_
1', 'pixel_4_2', 'pixel_4_3', 'pixel_4_4', 'pixel_4_5', 'pixel_4_6', 'pixel_4_7', 'pixel
_5_0', 'pixel_5_1', 'pixel_5_2', 'pixel_5_3', 'pixel_5_4', 'pixel_5_5', 'pixel_5_6', 'pi
xel_5_7', 'pixel_6_0', 'pixel_6_1', 'pixel_6_2', 'pixel_6_3', 'pixel_6_4', 'pixel_6_5',
'pixel_6_6', 'pixel_6_7', 'pixel_7_0', 'pixel_7_1', 'pixel_7_2', 'pixel_7_3', 'pixel_7_
4', 'pixel_7_5', 'pixel_7_6', 'pixel_7_7']
```

# Converting the output data into binary form using one hot encoding

In [139…

```
new_data=pd.get_dummies(digits.target,columns=digits.target[0:])
print(new_data.head())
new_data.shape
#new_data.columns

print(new_data[0])
```

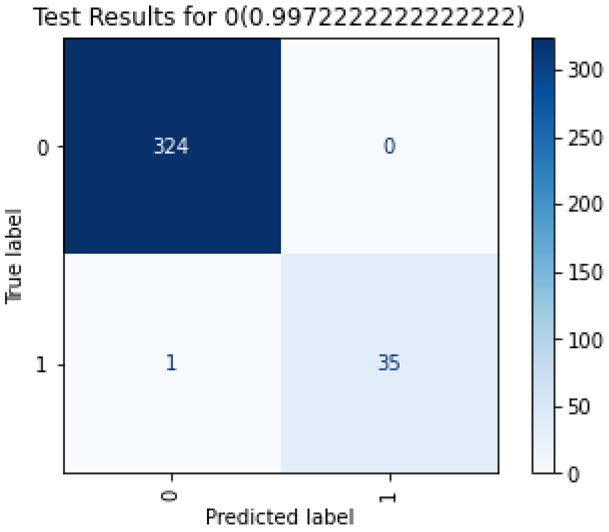
```
   0  1  2  3  4  5  6  7  8  9
0  1  0  0  0  0  0  0  0  0  0
1  0  1  0  0  0  0  0  0  0  0
2  0  0  1  0  0  0  0  0  0  0
3  0  0  0  1  0  0  0  0  0  0
4  0  0  0  0  1  0  0  0  0  0
0       1
1       0
2       0
3       0
4       0
       ..
1792    0
1793    1
1794    0
```

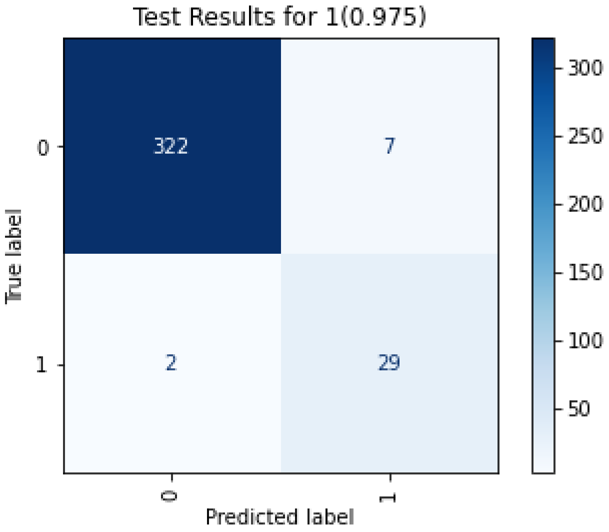
```
1795    0
1796    0
Name: 0, Length: 1797, dtype: uint8
```

In [140…

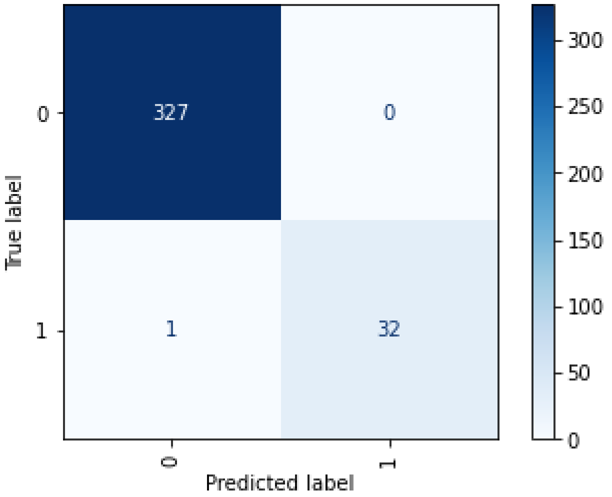
```
for x in range(0, 10):
    Xtrain,Xtest,Ytrain,Ytest = train_test_split(normalized_data,new_data[x],random_sta
    model = Perceptron(tol=1e-3, random_state=0)
    model.fit(Xtrain, Ytrain)
    pred_values = model.predict(Xtest)
    disp = plot_confusion_matrix(model, Xtest, Ytest, cmap=plt.cm.Blues, normalize=None
    disp.ax_.set_title("Test Results for " + str(x) + "("+ str( accuracy_score(Ytest, p

    plt.show
```

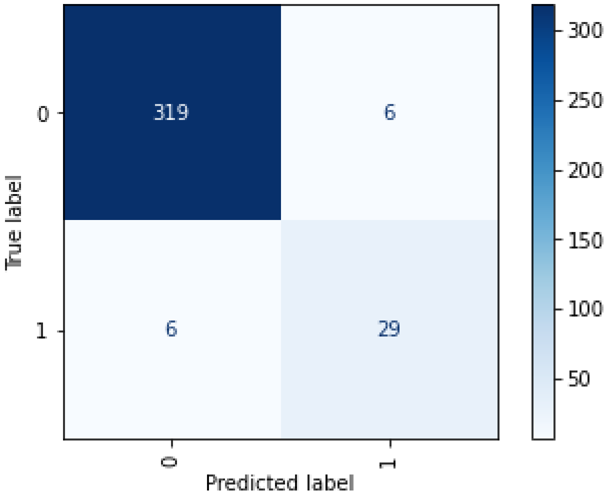




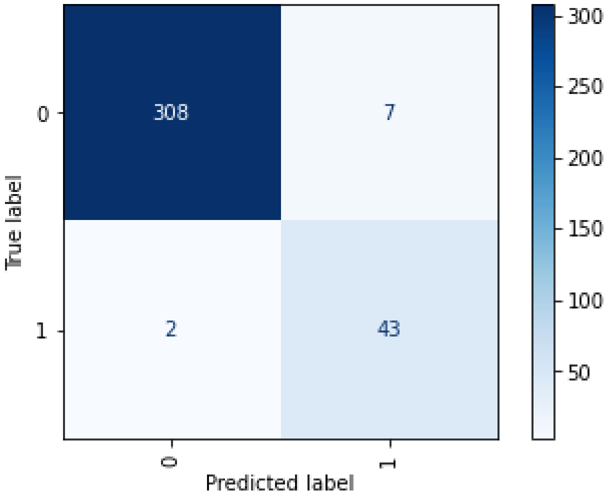
Test Results for 2(0.9972222222222222)



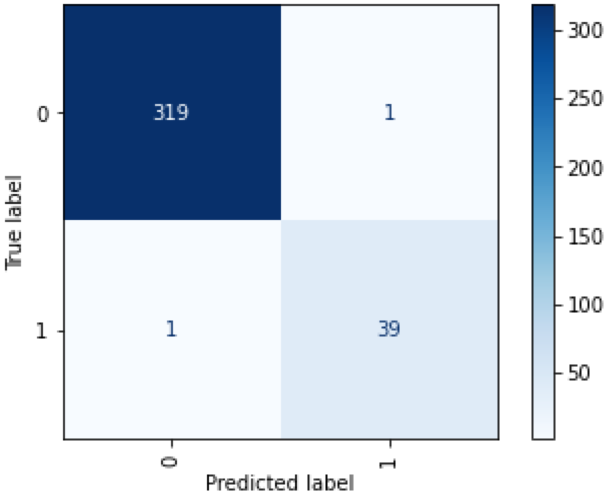
Test Results for 3(0.9666666666666667)



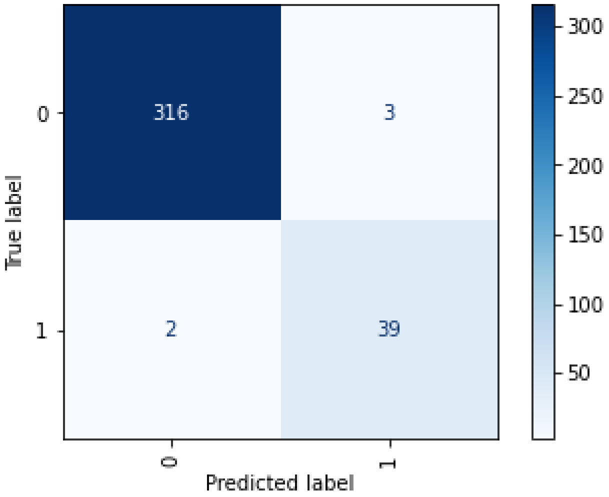
Test Results for 4(0.975)



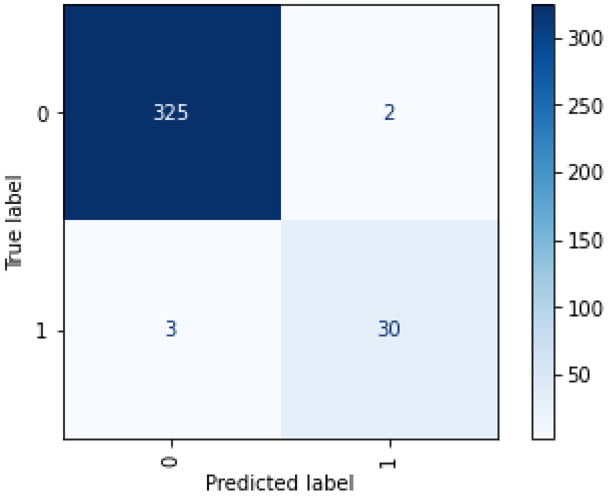
Test Results for 5(0.9944444444444445)

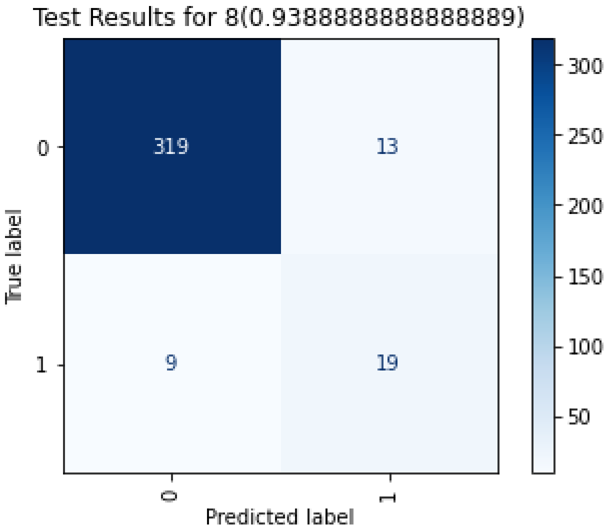


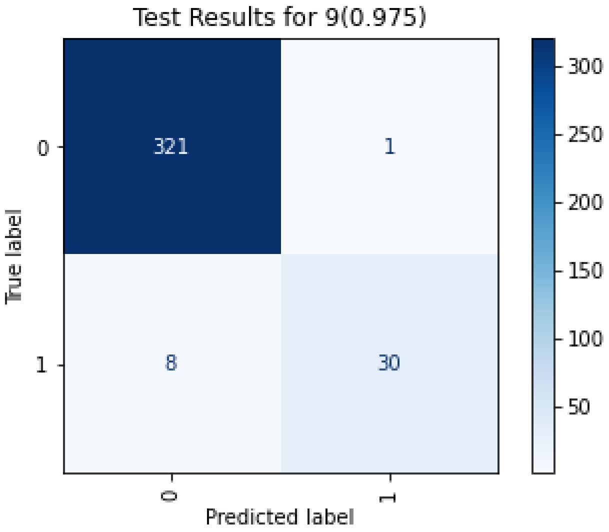
Test Results for 6(0.9861111111111112)



Test Results for 7(0.9861111111111112)




Test Results for 8(0.9388888888888889)
0
1
True label
319
13
9
19
0
1
Predicted label
300
250
200
150
100
50


Test Results for 9(0.975)
0
1
True label
321
1
8
30
0
1
Predicted label
300
250
200
150
100
50

```
In [ ]:
```

```
In [ ]:
```

```
In [ ]:
```