lab9

April 19, 2024

[ ]:
```
import pandas as pd
import numpy as np
from sklearn import datasets

#1. Load the iris dataset using scikit-learn library.
iris = datasets.load_iris()
print(iris.feature_names)

#2. Create a Pandas DataFrame with the dataset and add column names.
iris_df = pd.DataFrame(data=iris.data, columns=iris.feature_names)
iris_df['target'] = iris['target']


print(iris_df.head())
```

```
['sepal length (cm)', 'sepal width (cm)', 'petal length (cm)', 'petal width
(cm)']
   sepal length (cm)  sepal width (cm)  petal length (cm)  petal width (cm)  \
0                5.1               3.5                1.4               0.2
1                4.9               3.0                1.4               0.2
2                4.7               3.2                1.3               0.2
3                4.6               3.1                1.5               0.2
4                5.0               3.6                1.4               0.2

   target
0       0
1       0
2       0
3       0
4       0
```

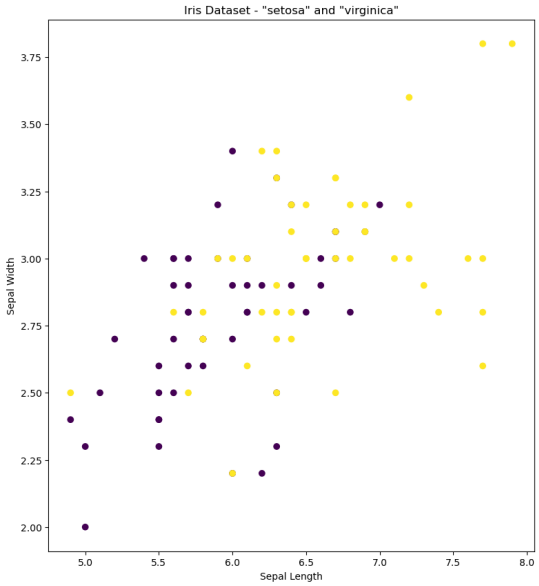
[ ]:
```
# 3. Convert the problem into a binary classification problem by only␣
 ↪considering two classes and removing the third one.
iris_df = iris_df.drop(iris_df[iris_df['target'] == 0].index)
iris_df2 = pd.DataFrame(data=iris.data, columns=iris.feature_names)
iris_df2['target'] = iris['target']
iris_df2 = iris_df2.drop(iris_df2[iris_df2['target'] == 2].index)
print(iris_df)
```

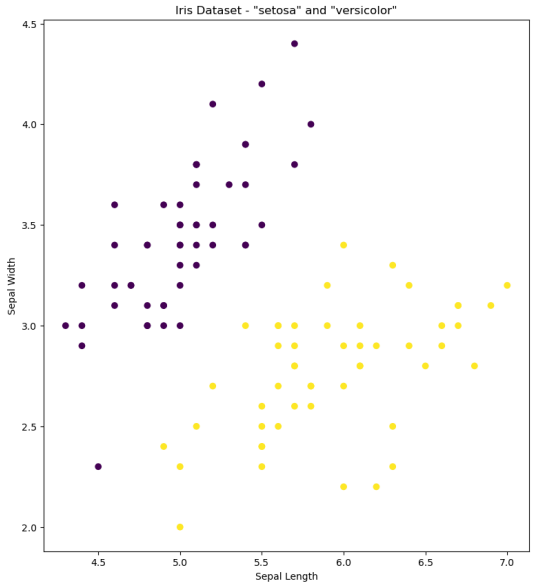
```
print(iris_df2)
```

```
     sepal length (cm)  sepal width (cm)  petal length (cm)  petal width (cm)  \
50                 7.0               3.2                4.7               1.4
51                 6.4               3.2                4.5               1.5
52                 6.9               3.1                4.9               1.5
53                 5.5               2.3                4.0               1.3
54                 6.5               2.8                4.6               1.5
..                 …                 …                  …                 …
145                6.7               3.0                5.2               2.3
146                6.3               2.5                5.0               1.9
147                6.5               3.0                5.2               2.0
148                6.2               3.4                5.4               2.3
149                5.9               3.0                5.1               1.8

     target
50        1
51        1
52        1
53        1
54        1
..      …
145       2
146       2
147       2
148       2
149       2

[100 rows x 5 columns]
    sepal length (cm)  sepal width (cm)  petal length (cm)  petal width (cm)  \
0                 5.1               3.5                1.4               0.2
1                 4.9               3.0                1.4               0.2
2                 4.7               3.2                1.3               0.2
3                 4.6               3.1                1.5               0.2
4                 5.0               3.6                1.4               0.2
..                …                 …                  …                 …
95                5.7               3.0                4.2               1.2
96                5.7               2.9                4.2               1.3
97                6.2               2.9                4.3               1.3
98                5.1               2.5                3.0               1.1
99                5.7               2.8                4.1               1.3

    target
0        0
1        0
2        0
3        0
```

```
4         0
..      …
95        1
96        1
97        1
98        1
99        1

[100 rows x 5 columns]
```

[ ]:
```
# Visualize the data
import matplotlib.pyplot as plt


# sub plot
plt.figure(figsize=(20, 10))

plt.subplot(1, 2, 1)
plt.scatter(iris_df['sepal length (cm)'], iris_df['sepal width (cm)'],␣
 ↪c=iris_df['target'], cmap='viridis')
plt.xlabel('Sepal Length')
plt.ylabel('Sepal Width')
plt.title('Iris Dataset - "setosa" and "virginica"')
plt.subplot(1, 2, 2)
plt.scatter(iris_df2['sepal length (cm)'], iris_df2['sepal width (cm)'],␣
 ↪c=iris_df2['target'], cmap='viridis')
plt.xlabel('Sepal Length')
plt.ylabel('Sepal Width')
plt.title('Iris Dataset - "setosa" and "versicolor"')

plt.show()
```





[ ]:
```
from sklearn.model_selection import train_test_split
from sklearn.preprocessing import StandardScaler

# 4. Remove the target column from the train and test sets.
X = iris_df.drop('target', axis=1)
y = iris_df['target']

X2 = iris_df2.drop('target', axis=1)
y2 = iris_df2['target']


X_train, X_test, y_train, y_test = train_test_split(X, y, test_size=0.3,␣
 ↪random_state=42)

X_train2, X_test2, y_train2, y_test2 = train_test_split(X2, y2, test_size=0.3,␣
 ↪random_state=42)

print(X_train.shape)
print(X_test.shape)
```

```
(70, 4)
(30, 4)
```

[ ]:
```
# 6. Apply the built-in Perceptron algorithm from scikit-learn.
from sklearn.linear_model import Perceptron
from sklearn.metrics import accuracy_score,f1_score,precision_score,recall_score

ann=Perceptron(eta0=0.1,max_iter=500)
```

```
ann.fit(X_train,y_train)
y_pred=ann.predict(X_test)


ann2=Perceptron(eta0=0.1,max_iter=500)
ann2.fit(X_train2,y_train2)
y_pred2=ann2.predict(X_test2)


print('Accuracy:',accuracy_score(y_test,y_pred))
print('F1:',f1_score(y_test,y_pred))
print('Precision:',precision_score(y_test,y_pred))
print('Recall:',recall_score(y_test,y_pred))


print('Accuracy 2:',accuracy_score(y_test2,y_pred2))
print('F1 2:',f1_score(y_test2,y_pred2))
print('Precision 2:',precision_score(y_test2,y_pred2))
print('Recall 2:',recall_score(y_test2,y_pred2))
```

```
Accuracy: 0.9333333333333333
F1: 0.9375
Precision: 1.0
Recall: 0.8823529411764706
Accuracy 2: 1.0
F1 2: 1.0
Precision 2: 1.0
Recall 2: 1.0
```

[ ]:
```
from sklearn.model_selection import cross_val_score

# Assuming ann is your trained Perceptron model
scores = cross_val_score(ann, X, y, cv=5)

print("Cross-validation scores:", scores)
print("Mean cross-validation score:", scores.mean())


scores2 = cross_val_score(ann2, X2, y2, cv=5)

print("Cross-validation scores 2:", scores2)
print("Mean cross-validation score 2:", scores2.mean())
```

```
Cross-validation scores: [0.7  0.9  0.75 0.85 0.9 ]
Mean cross-validation score: 0.8200000000000001
Cross-validation scores 2: [1. 1. 1. 1. 1.]
Mean cross-validation score 2: 1.0
```

[ ]:
```
def train_weights(train, l_rate, n_epoch):

    weights = [0.0 for i in range(len(train[0]))]

    for epoch in range(n_epoch):

        sum_error = 0.0

        for row in train:

            prediction = predict(row, weights)

            error = row[-1] - prediction

            sum_error += error**2

            weights[0] = weights[0] + l_rate * error  #bias(t+1) = bias(t) +␣
 ↪learning_rate * (expected(t) - predicted(t))

            for i in range(len(row)-1):

                weights[i + 1] = weights[i + 1] + l_rate * error * row[i]␣
 ↪#w(t+1) = w(t) + learning_rate * (expected(t) - predicted(t)) * x(t)

        # print('epoch=%d, lrate=%.3f, error=%.3f' % (epoch, l_rate, sum_error))

    return weights

def predict(row, weights):
#     bias value at weights[0]
    activation = weights[0]
    for i in range(len(row)-1):
        activation += weights[i + 1] * row[i]
    return 1.0 if activation >= 0.0 else 0.0

# Define the learning rate and number of epochs
l_rate = 0.01
n_epoch = 1000

# Train the model on the training data
weights = train_weights(X_train.values, l_rate, n_epoch)

# Make predictions on the test data
y_pred = [predict(row, weights) for row in X_test.values]

# Calculate the evaluation metrics
accuracy = accuracy_score(y_test, y_pred)
```

```
precision = precision_score(y_test, y_pred)
recall = recall_score(y_test, y_pred)
f1 = f1_score(y_test, y_pred)

print("Accuracy:", accuracy)
print("Precision:", precision)
print("Recall:", recall)
print("F1 Score:", f1)
```

```
Accuracy: 0.5666666666666667
Precision: 0.5666666666666667
Recall: 1.0
F1 Score: 0.7234042553191489
```

[ ]:
```
weights2 = train_weights(X_train2.values, l_rate, n_epoch)

# Make predictions on the test data
y_pred2 = [predict(row, weights2) for row in X_test2.values]

# Calculate the evaluation metrics
accuracy2 = accuracy_score(y_test2, y_pred2)
precision2 = precision_score(y_test2, y_pred2)
recall2 = recall_score(y_test2, y_pred2)
f12 = f1_score(y_test2, y_pred2)

print("Accuracy 2:", accuracy2)
print("Precision 2:", precision2)
print("Recall 2:", recall2)
print("F1 Score 2:", f12)
```

```
Accuracy 2: 0.6666666666666666
Precision 2: 0.5652173913043478
Recall 2: 1.0
F1 Score 2: 0.7222222222222222
```