Lab Task: 05

——————————786——————————

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Roll No: 20p-0101

Subject: Artificial Intelligence Lab

Submitted To Respected Ma’am: Hurmat Hidayat

Section: BCS-6C

Task Description:

1. Load the iris dataset using scikit-learn library
2. Create a Pandas DataFrame with the dataset and add column names
3. Convert the problem into a binary classification problem by only considering two classes and removing the third one. For example, we can keep only "setosa" and "versicolor" classes and remove "virginica". Visualize the data using a scatter plot.
4. Split the data into train and test sets
5. Remove the target column from the train and test sets
6. Apply the built-in Perceptron algorithm from scikit-learn
7. Evaluate the accuracy, precision, recall, and F1 score of the model.
8. Apply the Perceptron algorithm from scratch using above code snippets
9. Evaluate the accuracy, precision, recall, and F1 score of the model.

.ipynb file:

https://s3-us-west-2.amazonaws.com/secure.notion-static.com/0342fbee-78c7-4d9b-97b5-178d9e78f3e4/20p_0101_Muhammad_Sherjeel_Akhtar_BCS_6C_786_Lab_5.ipynb

Code:

```
import pandas as pd
import numpy as np
from sklearn.datasets import load_iris
from sklearn.model_selection import train_test_split
from sklearn.metrics import accuracy_score, precision_score, recall_score, f1_score
from sklearn.linear_model import Perceptron
import matplotlib.pyplot as plt

iris = load_iris()

df = pd.DataFrame(data= np.c_[iris['data'], iris['target']], columns= iris['feature_names'] + ['target'])

df = df[df.target != 2]

df.target = (df.target == 0).astype(int)

X_train, X_test, y_train, y_test = train_test_split(df.drop('target', axis=1), df.target, test_size=0.2, random_state=42)

clf_sklearn = Perceptron() #PERCEPTRON OBJECT

clf_sklearn.fit(X_train, y_train)

y_pred_sklearn = clf_sklearn.predict(X_test)

accuracy_sklearn = accuracy_score(y_test, y_pred_sklearn)
precision_sklearn = precision_score(y_test, y_pred_sklearn)
recall_sklearn = recall_score(y_test, y_pred_sklearn)
f1_sklearn = f1_score(y_test, y_pred_sklearn)

print("Results for Perceptron:")
print("Accuracy:", accuracy_sklearn)
print("Precision:", precision_sklearn)
print("Recall:", recall_sklearn)
print("F1 score:", f1_sklearn)

plt.scatter(X_train.iloc[:, 0], X_train.iloc[:, 1], c=y_train)
plt.xlabel('sepal length (cm)')
plt.ylabel('sepal width (cm)')
plt.show()

class PerceptronScratch: #PERCEPTRONS ALGORITHM FROM SCRATCH

    def __init__(self, learning_rate=0.1, n_iterations=100):
        self.learning_rate = learning_rate
        self.n_iterations = n_iterations

    def fit(self, X, y):
        n_samples, n_features = X.shape
        self.weights = np.zeros(n_features + 1)
        X = np.concatenate([X, np.ones((n_samples, 1))], axis=1)
        for i in range(self.n_iterations):
            for j in range(n_samples):
                y_pred = self.predict_single(X[j])
                error = y[j] - y_pred
                self.weights += self.learning_rate * error * X[j]

    def predict_single(self, x):
        return 1 if np.dot(x, self.weights) >= 0 else 0

clf_scratch = PerceptronScratch() #PERCEPTRON OBJECT

clf_scratch.fit(X_train.values, y_train.values)

X_test_scratch = np.concatenate([X_test, np.ones((X_test.shape[0], 1))], axis=1)
y_pred_scratch = [clf_scratch.predict_single(x) for x in X_test_scratch]
```

```
accuracy_scratch = accuracy_score(y_test, y_pred_scratch)
precision_scratch = precision_score(y_test, y_pred_scratch)
recall_scratch = recall_score(y_test, y_pred_scratch)
f1_scratch = f1_score(y_test, y_pred_scratch)

print("Results for PerceptronScratch:")
print("Accuracy:", accuracy_scratch)
print("Precision:", precision_scratch)
print("Recall:", recall_scratch)
print("F1 score:", f1_scratch)

plt.scatter(X_train.iloc[:, 0], X_train.iloc[:, 1], c=y_train)
plt.xlabel('sepal length (cm)')
plt.ylabel('sepal width (cm)')
plt.show()
```

Elaboration:

Splitting Test And Train Data:

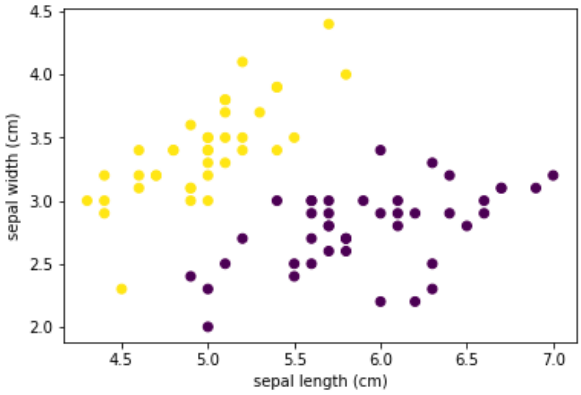
```
import pandas as pd
import numpy as np
from sklearn.datasets import load_iris
from sklearn.model_selection import train_test_split
from sklearn.metrics import accuracy_score, precision_score, recall_score, f1_score
from sklearn.linear_model import Perceptron
import matplotlib.pyplot as plt

iris = load_iris()

df = pd.DataFrame(data= np.c_[iris['data'], iris['target']], columns= iris['feature_names'] + ['target'])

df = df[df.target != 2]

df.target = (df.target == 0).astype(int)

X_train, X_test, y_train, y_test = train_test_split(df.drop('target', axis=1), df.target, test_size=0.2, random_sta
```

Using Built-In Perceptron Algorithm From sklearn And Plotting The Results:

```
clf_sklearn = Perceptron() #PERCEPTRON OBJECT

clf_sklearn.fit(X_train, y_train)

y_pred_sklearn = clf_sklearn.predict(X_test)

accuracy_sklearn = accuracy_score(y_test, y_pred_sklearn)
precision_sklearn = precision_score(y_test, y_pred_sklearn)
recall_sklearn = recall_score(y_test, y_pred_sklearn)
f1_sklearn = f1_score(y_test, y_pred_sklearn)

print("Results for Perceptron:")
print("Accuracy:", accuracy_sklearn)
print("Precision:", precision_sklearn)
print("Recall:", recall_sklearn)
print("F1 score:", f1_sklearn)

plt.scatter(X_train.iloc[:, 0], X_train.iloc[:, 1], c=y_train)
plt.xlabel('sepal length (cm)')
plt.ylabel('sepal width (cm)')
plt.show()
```

Conclusion:

```
Results for Perceptron:
Accuracy: 1.0
Precision: 1.0
Recall: 1.0
F1 score: 1.0
```



Building Perceptron Algorithm From Scratch:

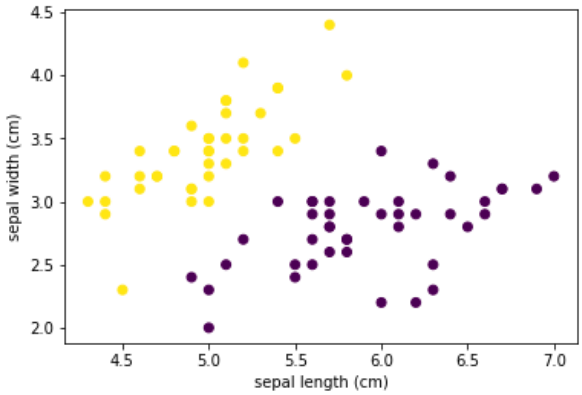
```python
class PerceptronScratch: #PERCEPTRONS ALGORITHM FROM SCRATCH

    def __init__(self, learning_rate=0.1, n_iterations=100):
        self.learning_rate = learning_rate
        self.n_iterations = n_iterations

    def fit(self, X, y):
        n_samples, n_features = X.shape
        self.weights = np.zeros(n_features + 1)
        X = np.concatenate([X, np.ones((n_samples, 1))], axis=1)
        for i in range(self.n_iterations):
            for j in range(n_samples):
                y_pred = self.predict_single(X[j])
                error = y[j] - y_pred
                self.weights += self.learning_rate * error * X[j]

    def predict_single(self, x):
        return 1 if np.dot(x, self.weights) >= 0 else 0
```

Creating Instance/Object Of Our Class And After Precision And Accuracy Calculations, Plotting The Results:

```
clf_scratch = PerceptronScratch() #PERCEPTRON OBJECT

clf_scratch.fit(X_train.values, y_train.values)

X_test_scratch = np.concatenate([X_test, np.ones((X_test.shape[0], 1))], axis=1)
y_pred_scratch = [clf_scratch.predict_single(x) for x in X_test_scratch]

accuracy_scratch = accuracy_score(y_test, y_pred_scratch)
precision_scratch = precision_score(y_test, y_pred_scratch)
recall_scratch = recall_score(y_test, y_pred_scratch)
f1_scratch = f1_score(y_test, y_pred_scratch)

print("Results for PerceptronScratch:")
print("Accuracy:", accuracy_scratch)
print("Precision:", precision_scratch)
print("Recall:", recall_scratch)
print("F1 score:", f1_scratch)

plt.scatter(X_train.iloc[:, 0], X_train.iloc[:, 1], c=y_train)
plt.xlabel('sepal length (cm)')
plt.ylabel('sepal width (cm)')
plt.show()
```

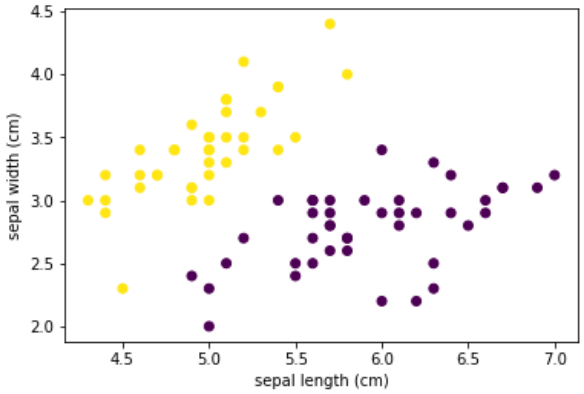
Conclusion:

```
Results for PerceptronScratch:
Accuracy: 1.0
Precision: 1.0
Recall: 1.0
F1 score: 1.0
```

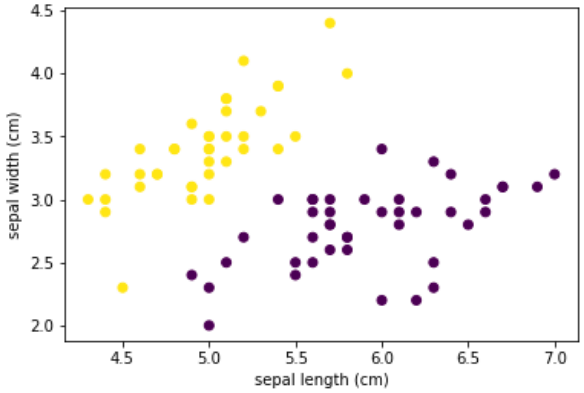


Overview:

```
Results for Perceptron:
Accuracy: 1.0
Precision: 1.0
Recall: 1.0
F1 score: 1.0
```




```
Results for PerceptronScratch:
Accuracy: 1.0
Precision: 1.0
Recall: 1.0
F1 score: 1.0
```



FIN!