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EX. NO.6
DATE:

Heart attack prediction using MLP

Aim:

To construct a Multi-Layer Perceptron to predict heart attack using Python

Algorithm:

Step 1:Import the required libraries: numpy, pandas, MLPClassifier, train_test_split, StandardScaler, accuracy_score, and matplotlib.pyplot.
Step 2:Load the heart disease dataset from a file using pd.read_csv().
Step 3:Separate the features and labels from the dataset using data.iloc values for features (X) and data.iloc[:, -1].values for labels (y).
Step 4:Split the dataset into training and testing sets using train_test_split().
Step 5:Normalize the feature data using StandardScaler() to scale the features to have zero mean and unit variance.
Step 6:Create an MLPClassifier model with desired architecture and hyperparameters, such as hidden_layer_sizes, max_iter, and random_state.
Step 7:Train the MLP model on the training data using mlp.fit(X_train, y_train). The model adjusts its weights and biases iteratively to minimize the training loss.
Step 8:Make predictions on the testing set using mlp.predict(X_test).
Step 9:Evaluate the model's accuracy by comparing the predicted labels (y_pred) with the actual labels (y_test) using accuracy_score().
Step 10:Print the accuracy of the model.
Step 11:Plot the error convergence during training using plt.plot() and plt.show().

Program:

```
import numpy as np
import pandas as pd
from sklearn.neural_network import MLPClassifier
from sklearn.model_selection import train_test_split
from sklearn.preprocessing import StandardScaler
from sklearn.metrics import accuracy_score
import matplotlib.pyplot as plt

# Load the dataset (assuming it's stored in a file)
df= pd.read_csv('heart.csv')
df.head()

# Separate features and labels
X = df.drop("target", axis=1)
y = df["target"]

X
y
```

```
# Split the dataset into training and testing sets
X_train, X_test, y_train, y_test = train_test_split(X, y, test_size=0.2, random_state=42)
# Normalize the feature data
scaler = StandardScaler()
X_train = scaler.fit_transform(X_train)
X_test = scaler.transform(X_test)

# Create and train the MLP model
classifier = MLPClassifier(hidden_layer_sizes=(20,20,20), max_iter=1000).fit(X_train,y_trai
# Make predictions on the testing set
predictions = classifier.predict(X_test)

res_df = pd.DataFrame({"Predicted": predictions, "Actual Labels": y_test})
res_df

# Evaluate the model
accuracy = accuracy_score(y_test, predictions)
print(f"Accuracy: {accuracy*100:.2f}%")
# Plot the error convergence
training_loss = classifier.fit(X_train,y_train).loss_curve_

plt.plot(training_loss)
plt.xlabel("Epochs")
plt.ylabel("Loss")
plt.show()

from sklearn.metrics import confusion_matrix, classification_report

print(confusion_matrix(y_test, predictions))

print(classification_report(y_test, predictions))
```

Output:

Features

	age	sex	cp	trestbps	chol	fbs	restecg	thalach	exang	oldpeak	slope	ca	thal
0	52	1	0	125	212	0	1	168	0	1.0	2	2	3
1	53	1	0	140	203	1	0	155	1	3.1	0	0	3
2	70	1	0	145	174	0	1	125	1	2.6	0	0	3
3	61	1	0	148	203	0	1	161	0	0.0	2	1	3
4	62	0	0	138	294	1	1	106	0	1.9	1	3	2
...	...	...	...	...	...	...	...	...	...	...	...	...	...
1020	59	1	1	140	221	0	1	164	1	0.0	2	0	2
1021	60	1	0	125	258	0	0	141	1	2.8	1	1	3
1022	47	1	0	110	275	0	0	118	1	1.0	1	1	2
1023	50	0	0	110	254	0	0	159	0	0.0	2	0	2
1024	54	1	0	120	188	0	1	113	0	1.4	1	1	3

Target

```
0       0
1       0
2       0
3       0
4       0
       ..
1020    1
1021    0
1022    0
1023    1
1024    0
Name: target, Length: 1025, dtype: int64
```

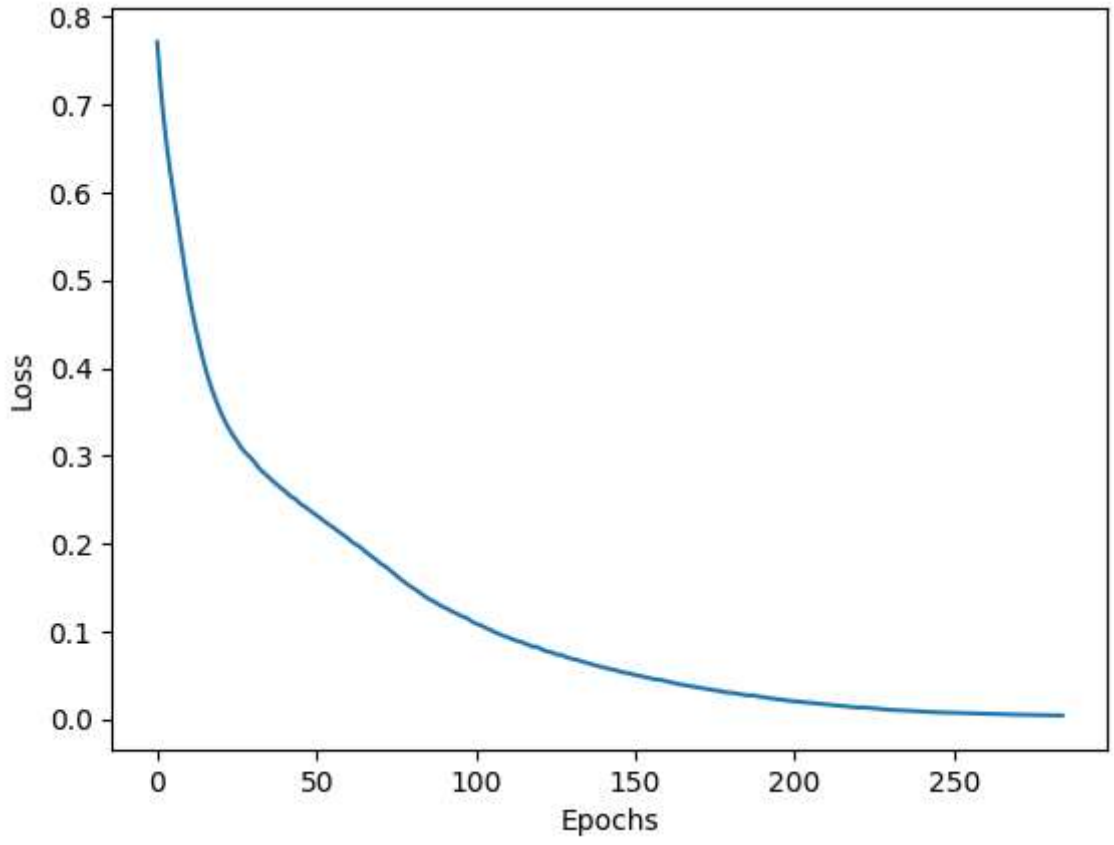
Predicted vs actual labels

	Predicted	Actual Labels
527	1	1
359	1	1
447	0	0
31	1	1
621	0	0
...	...	...
832	1	1
796	1	1
644	1	1
404	0	0
842	0	0

Accuracy

```
Accuracy: 98.54%
```

Error convergence curve



Confusion Matrix

```
[[102   0]
 [  3 100]]
```

Classification Report

	precision	recall	f1-score	support
0	0.97	1.00	0.99	102
1	1.00	0.97	0.99	103
accuracy			0.99	205
macro avg	0.99	0.99	0.99	205
weighted avg	0.99	0.99	0.99	205

Results:

Thus, an ANN with MLP is constructed and trained to predict the heart attack using python.