Predict Diabetes using Perceptron

Loading the Libraries and Dataset

```
import pandas as pd
import numpy as np
from sklearn import datasets
from sklearn.model_selection import train_test_split
from sklearn.preprocessing import StandardScaler
from sklearn.metrics import accuracy_score
import seaborn as sns
import matplotlib.pyplot as plt
```

```
dat_know = pd.read_csv('diabetes.csv')
```

```
dat_know.head()
```

```
   Pregnancies  Glucose  BloodPressure  SkinThickness  Insulin
BMI  \
0            6      148             72             35        0  33.6

1            1       85             66             29        0  26.6

2            8      183             64              0        0  23.3

3            1       89             66             23       94  28.1

4            0      137             40             35      168  43.1


   DiabetesPedigreeFunction  Age  Outcome
0                     0.627   50        1
1                     0.351   31        0
2                     0.672   32        1
3                     0.167   21        0
4                     2.288   33        1
```

```
dat_know.shape
```

```
(768, 9)
```

```
dat_know.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 768 entries, 0 to 767
Data columns (total 9 columns):
 #   Column                    Non-Null Count  Dtype
---  ------                    --------------  -----
 0   Pregnancies               768 non-null    int64
```

```
 1   Glucose                   768 non-null    int64
 2   BloodPressure             768 non-null    int64
 3   SkinThickness             768 non-null    int64
 4   Insulin                   768 non-null    int64
 5   BMI                       768 non-null    float64
 6   DiabetesPedigreeFunction  768 non-null    float64
 7   Age                       768 non-null    int64
 8   Outcome                   768 non-null    int64
dtypes: float64(2), int64(7)
memory usage: 54.1 KB
```

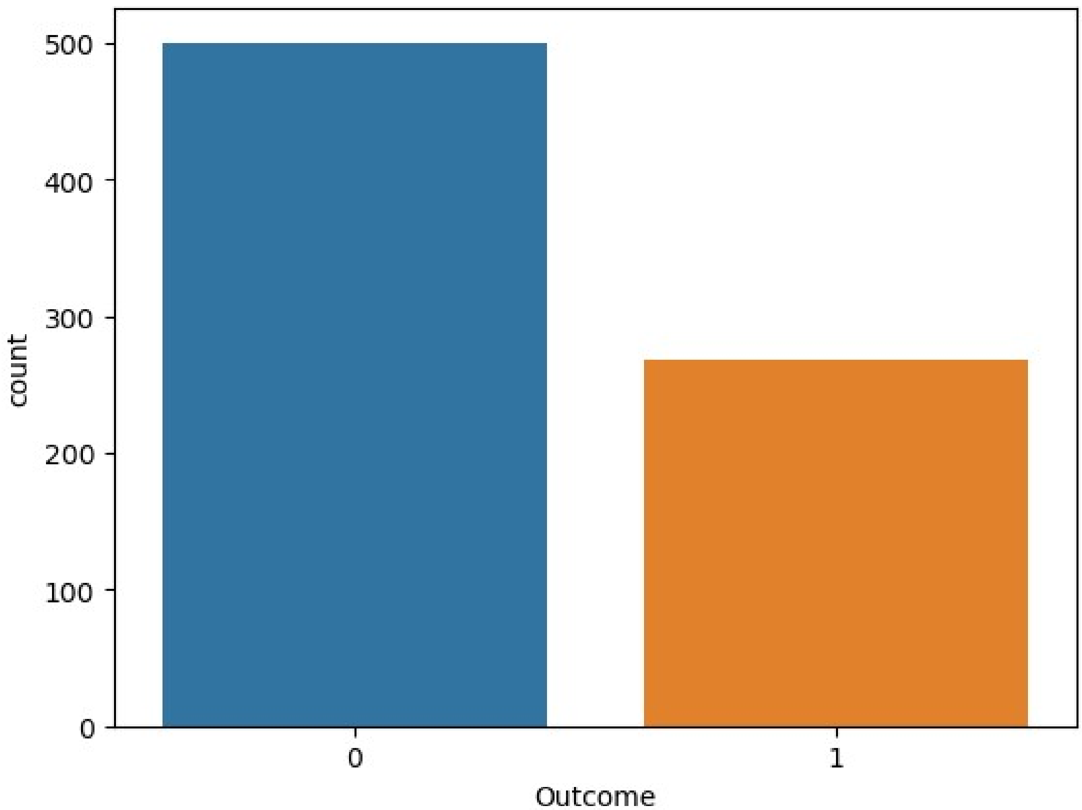
Exploratory Data Analysis

```
dat_know.describe()
```

```
       Pregnancies     Glucose  BloodPressure  SkinThickness
Insulin  \
count   768.000000  768.000000     768.000000     768.000000
768.000000
mean      3.845052  120.894531      69.105469      20.536458
79.799479
std       3.369578   31.972618      19.355807      15.952218
115.244002
min       0.000000    0.000000       0.000000       0.000000
0.000000
25%       1.000000   99.000000      62.000000       0.000000
0.000000
50%       3.000000  117.000000      72.000000      23.000000
30.500000
75%       6.000000  140.250000      80.000000      32.000000
127.250000
max      17.000000  199.000000     122.000000      99.000000
846.000000

              BMI  DiabetesPedigreeFunction         Age     Outcome
count  768.000000                768.000000  768.000000  768.000000
mean    31.992578                  0.471876   33.240885    0.348958
std      7.884160                  0.331329   11.760232    0.476951
min      0.000000                  0.078000   21.000000    0.000000
25%     27.300000                  0.243750   24.000000    0.000000
50%     32.000000                  0.372500   29.000000    0.000000
75%     36.600000                  0.626250   41.000000    1.000000
max     67.100000                  2.420000   81.000000    1.000000
```

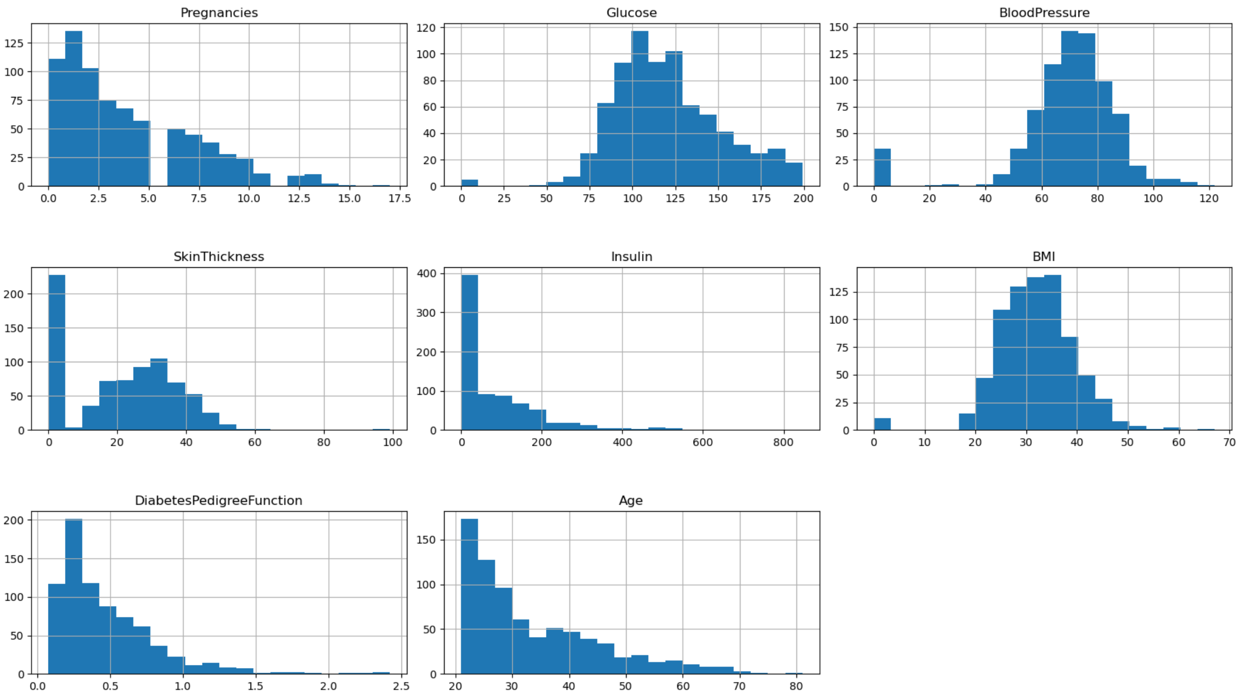
```
sns.countplot(x = 'Outcome',data = dat_know)
```

```
<Axes: xlabel='Outcome', ylabel='count'>
```

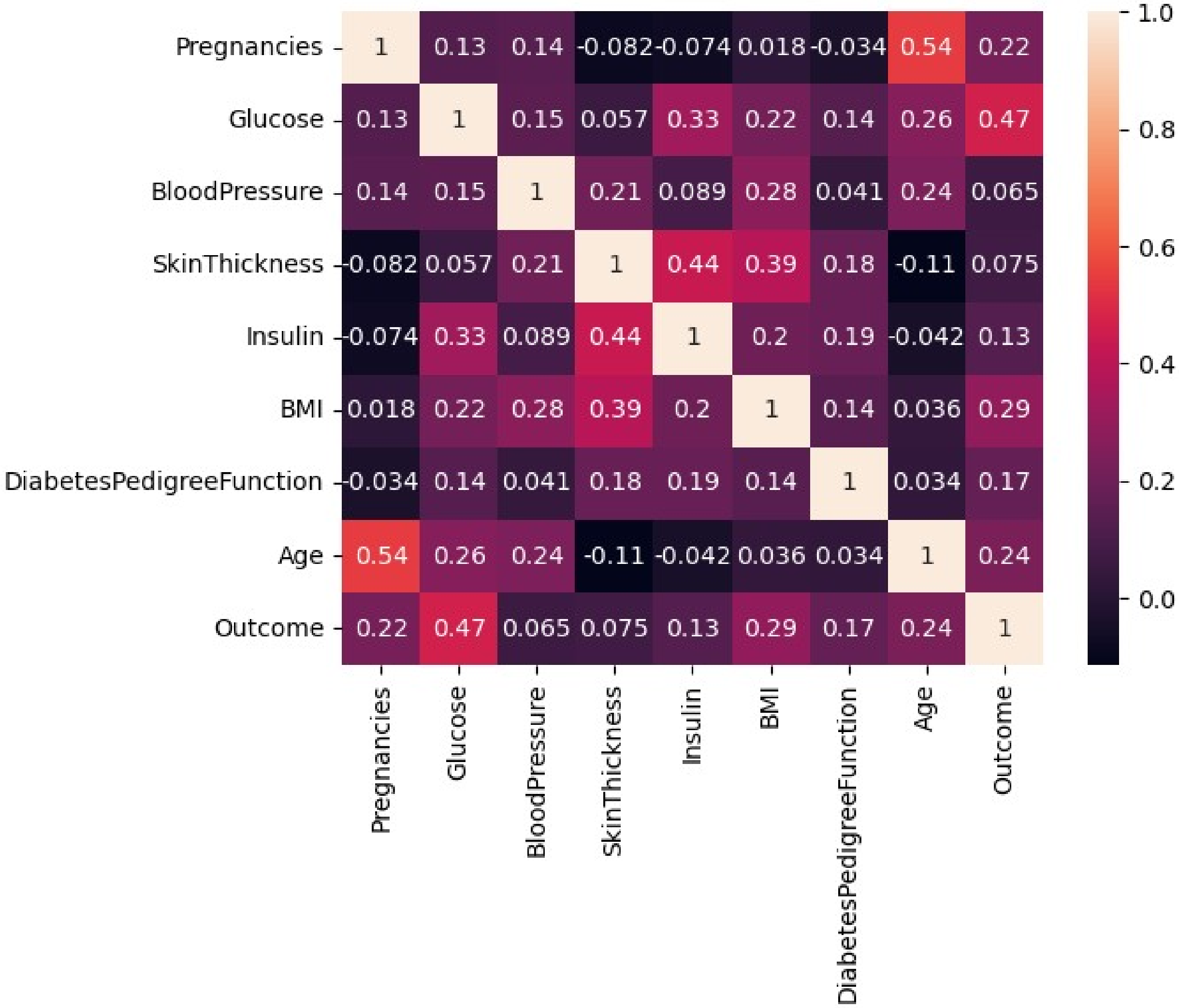



```
import itertools
import math

col = dat_know.columns[:8]
plt.subplots(figsize = (20, 15))
length = len(col)
num_rows = math.ceil(length/2)

for i, j in itertools.zip_longest(col, range(length)):
    plt.subplot(num_rows, 3, j + 1)
    plt.subplots_adjust(wspace = 0.1,hspace = 0.5)
    dat_know[i].hist(bins = 20)
    plt.title(i)
plt.show()
```

```
C:\Users\Vineeth M R\AppData\Local\Temp\
ipykernel_15728\957727032.py:10: MatplotlibDeprecationWarning: Auto-
removal of overlapping axes is deprecated since 3.6 and will be
removed two minor releases later; explicitly call ax.remove() as
needed.
  plt.subplot(num_rows, 3, j + 1)
```




```python
sns.heatmap(dat_know.corr(), annot = True)
plt.show()
```




```
dat_new_1 = dat_know

dat_new_1[["Glucose", "BloodPressure", "SkinThickness", "Insulin",
"BMI"]] = dat_new_1[["Glucose", "BloodPressure", "SkinThickness",
"Insulin", "BMI"]].replace(0, np.NaN)

dat_new_1.isnull().sum()

Pregnancies                   0
Glucose                       5
BloodPressure                35
SkinThickness               227
Insulin                     374
BMI                          11
DiabetesPedigreeFunction      0
Age                           0
Outcome                       0
dtype: int64
```

```
dat_new_1["Glucose"].fillna(dat_new_1["Glucose"].mean(), inplace =
True)
dat_new_1["BloodPressure"].fillna(dat_new_1["BloodPressure"].mean(),
inplace = True)
dat_new_1["SkinThickness"].fillna(dat_new_1["SkinThickness"].mean(),
inplace = True)
dat_new_1["Insulin"].fillna(dat_new_1["Insulin"].mean(), inplace =
True)
dat_new_1["BMI"].fillna(dat_new_1["BMI"].mean(), inplace = True)

dat_new_1.describe()
```

```
       Pregnancies     Glucose  BloodPressure  SkinThickness
Insulin  \
count   768.000000  768.000000     768.000000     768.000000
768.000000
mean      3.845052  121.686763      72.405184      29.153420
155.548223
std       3.369578   30.435949      12.096346       8.790942
85.021108
min       0.000000   44.000000      24.000000       7.000000
14.000000
25%       1.000000   99.750000      64.000000      25.000000
121.500000
50%       3.000000  117.000000      72.202592      29.153420
155.548223
75%       6.000000  140.250000      80.000000      32.000000
155.548223
max      17.000000  199.000000     122.000000      99.000000
846.000000

              BMI  DiabetesPedigreeFunction         Age     Outcome
count  768.000000                768.000000  768.000000  768.000000
mean    32.457464                  0.471876   33.240885    0.348958
std      6.875151                  0.331329   11.760232    0.476951
min     18.200000                  0.078000   21.000000    0.000000
25%     27.500000                  0.243750   24.000000    0.000000
50%     32.400000                  0.372500   29.000000    0.000000
75%     36.600000                  0.626250   41.000000    1.000000
max     67.100000                  2.420000   81.000000    1.000000
```

Training the Dataset

```
from sklearn.preprocessing import MinMaxScaler
sc = MinMaxScaler(feature_range = (0, 1))
data_scale = sc.fit_transform(dat_new_1)

data_scale = pd.DataFrame(data_scale)
```

```
X = data_scale.iloc[:, [1,2, 4, 5, 7]].values
y = data_scale.iloc[:, 8].values

from sklearn.model_selection import train_test_split
X_train, X_test, y_train, y_test = train_test_split(X, y, test_size =
0.8, random_state = 50, stratify = dat_new_1['Outcome'] )

print("X_train shape:", X_train.shape)
print("X_test shape:", X_test.shape)
print("Y_train shape:", y_train.shape)
print("Y_test shape:", y_test.shape)

X_train shape: (153, 5)
X_test shape: (615, 5)
Y_train shape: (153,)
Y_test shape: (615,)
```

Perceptron Algorithm

```
class Perceptron:
    def __init__(self, learning_rate=0.01, epochs=100):
        self.learning_rate = learning_rate
        self.epochs = epochs

    def fit(self, X, y):
        self.weights = np.zeros(1 + X.shape[1])

        self.errors = []

        for _ in range(self.epochs):
            error = 0
            for xi, target in zip(X, y):
                update = self.learning_rate * (target -
self.predict(xi))
                #print("Ypredict = ", self.predict(xi))
                #print("Y = ", target)
                self.weights[1:] += update * xi
                self.weights[0] += update
                error += int(update != 0.0)

            self.errors.append(error)


        return self
        print(self.errors)
    def net_input(self, X):
        return np.dot(X, self.weights[1:]) + self.weights[0]

    def predict(self, X):
        return np.where(self.net_input(X) >= 0.0, 1, 0)
```

```
    def plot_linear_sep(self, X, y):
      plt.figure(figsize=(8, 6))
      plt.scatter(X[:, 0], X[:, 1], c=y, cmap=plt.cm.Paired,
marker='o')

      ax = plt.gca()
      xlim = ax.get_xlim()
      ylim = ax.get_ylim()

      xx, yy = np.meshgrid(np.linspace(xlim[0], xlim[1], 50),
                           np.linspace(ylim[0], ylim[1], 50))

      Z = self.predict(np.c_[xx.ravel(), yy.ravel()])
      Z = Z.reshape(xx.shape)

      plt.contourf(xx, yy, Z, cmap=plt.cm.Paired, alpha=0.6)
      plt.xlim(xlim)
      plt.ylim(ylim)

      plt.title('Linearly separable classes')
      plt.xlabel('X')
      plt.ylabel('Y')
      plt.show()

perceptron = Perceptron(learning_rate=0.01, epochs=100)
perceptron.fit(X_train, y_train)
```

```
<__main__.Perceptron at 0x199c1171090>
```

```
y_pred = perceptron.predict(X_test)
```

Accuracy

```
accuracy = accuracy_score(y_test, y_pred)
print(f"Accuracy: {accuracy * 100:.2f}%")
```

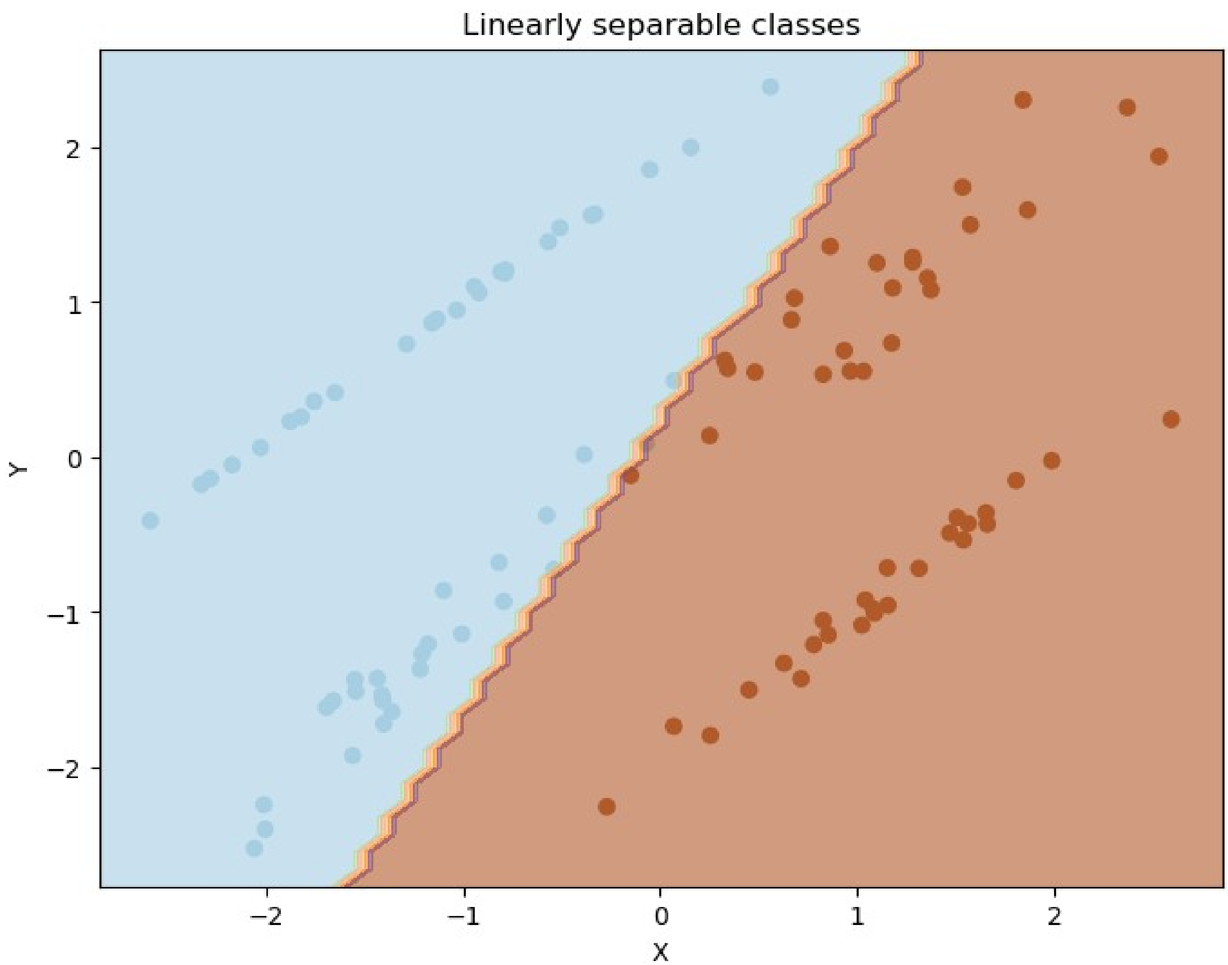
```
Accuracy: 76.42%
```

```
from sklearn.metrics import confusion_matrix
cm = confusion_matrix(y_test, y_pred)
cm
```

```
array([[355,  45],
       [100, 115]], dtype=int64)
```

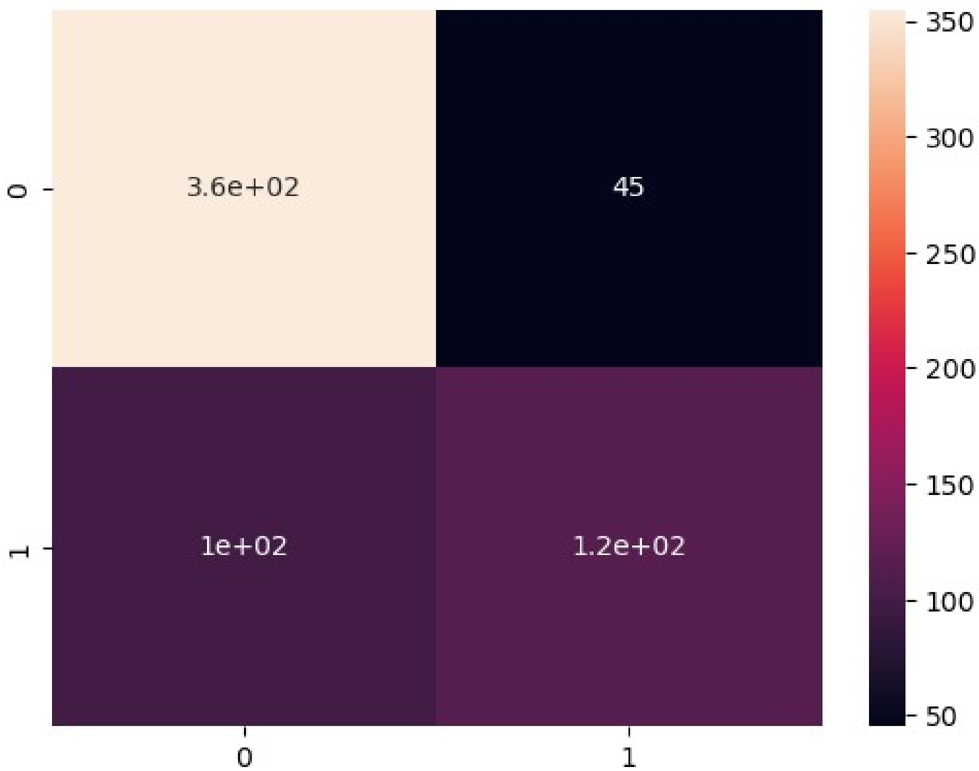
```
from sklearn.datasets import make_classification

# Generate a synthetic dataset for demonstration
X, y = make_classification(n_samples=100, n_features=2,
n_informative=2, n_redundant=0, random_state=42)
```

```python
# Create and train a perceptron model
clf = Perceptron()
clf.fit(X, y)

# Plot the decision boundary
clf.plot_linear_sep(X, y)
```




```python
sns.heatmap(pd.DataFrame(cm), annot=True)
```

```
<Axes: >
```


3.6e+02
45
1e+02
1.2e+02
0
1
0
1
350
300
250
200
150
100
50