Importing Necessary Libraries

In [ ]:

```
import numpy as np
import pandas as pd
import matplotlib.pyplot as plt
from sklearn.metrics import confusion_matrix
plt.style.use('seaborn')
```

Importing the Data

In [ ]:

```
df = pd.read_csv("diabetes2.csv")
df.head()
```

Out[ ]:

	Pregnancies	Glucose	BloodPressure	SkinThickness	Insulin	BMI	DiabetesPedigreeFunction	Age
0	6	148	72	35	0	33.6	0.627	50
1	1	85	66	29	0	26.6	0.351	31
2	8	183	64	0	0	23.3	0.672	32
3	1	89	66	23	94	28.1	0.167	21
4	0	137	40	35	168	43.1	2.288	33

In [ ]:

```
df.describe()
```

Out[ ]:

	Pregnancies	Glucose	BloodPressure	SkinThickness	Insulin	BMI	DiabetesPedig
count	768.000000	768.000000	768.000000	768.000000	768.000000	768.000000	
mean	3.845052	120.894531	69.105469	20.536458	79.799479	31.992578	
std	3.369578	31.972618	19.355807	15.952218	115.244002	7.884160	
min	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	
25%	1.000000	99.000000	62.000000	0.000000	0.000000	27.300000	
50%	3.000000	117.000000	72.000000	23.000000	30.500000	32.000000	
75%	6.000000	140.250000	80.000000	32.000000	127.250000	36.600000	
max	17.000000	199.000000	122.000000	99.000000	846.000000	67.100000	

In [ ]:

```
data = df.values
```

Splitting the Data

In [ ]:

```
x = data[:,:-1]
y = data[:,-1]
```

Normalization

In [ ]:

```
#Normalisation
x_mean = x.mean(axis=0)
x_std = x.std(axis=0)

X = (x-x_mean)/x_std
```

In [ ]:

```
X.shape,y.shape
```

Out[ ]:

```
((768, 8), (768,))
```

Logistic Regression

In [ ]:

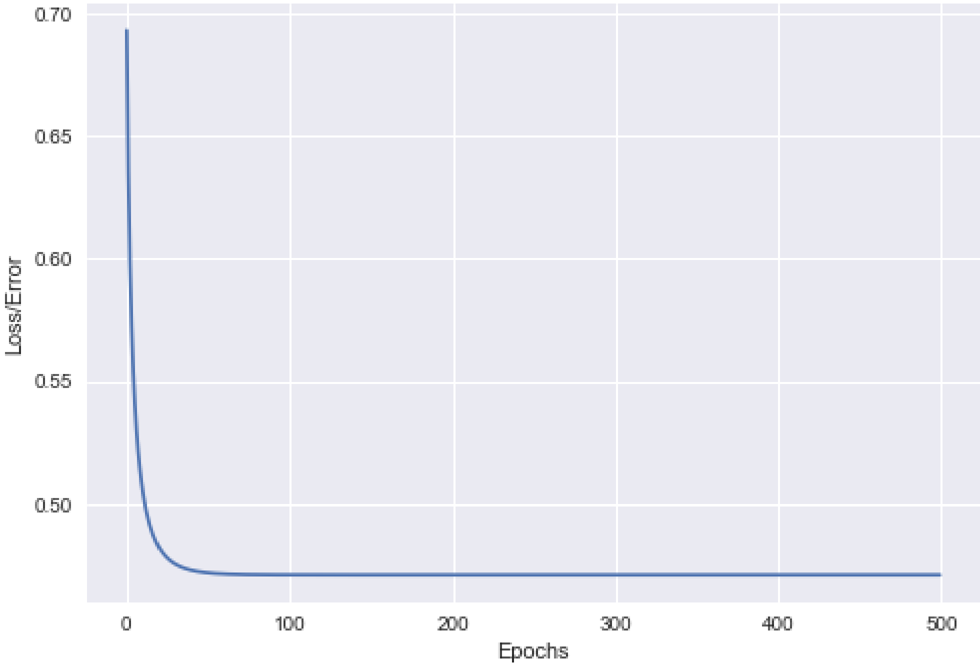
```
def sigmoid(x):
    return 1.0/(1.0 + np.exp(-x))
def hypothesis(X,theta):
    return sigmoid(np.dot(X,theta))
def error(X,y,theta):
    hi = hypothesis(X,theta)
    e = -1*np.mean((y*np.log(hi) + ((1-y)*np.log(1-hi))))
    return e
def gradient(X,y,theta):
    hi = hypothesis(X,theta)
    grad = -(np.dot(X.T,(y-hi)))
    m = X.shape[0]
    return grad/m
def gradientDescent(X,y,lr = 0.1, epochs = 300):
    ones = np.ones((X.shape[0],1))
    X_ = np.hstack((ones,X))
    y = y.reshape((-1,1))

    n = X_.shape[1]
    theta = np.zeros((n,1))
    error_list = []
    for i in range(epochs):
        error_list.append(error(X_,y,theta))
        grad = gradient(X_,y,theta)
        theta = theta - lr*grad
    return theta,error_list
```

In [ ]:

```
theta,err = gradientDescent(X,y, lr=0.5,epochs=500)
```

In [ ]:

```
plt.plot(err)
plt.xlabel("Epochs")
plt.ylabel("Loss/Error")
plt.show()
```



Weights of the Logistic Regression Agorithm

In [ ]:

```
theta
```

Out[ ]:

```
array([[-0.87110174],
       [ 0.41480203],
       [ 1.12354378],
       [-0.25717844],
       [ 0.00986739],
       [-0.13724668],
       [ 0.70675627],
       [ 0.31296112],
       [ 0.17474908]])
```

Making Predictions

In [ ]:

```
def predict(X,theta):
    ones = np.ones((X.shape[0],1))
    X_ = np.hstack((ones,X))
    h = hypothesis(X_,theta)
    output = np.zeros(h.shape)
    output[h>=0.5] = 1
    output = output.astype('int')
    return output
XT_pred = predict(X,theta)
```

Making a Confusion Matrix

In [ ]:

```
CM = confusion_matrix(XT_pred, y, labels=[1,0])
TP=CM[0][0]
FP=CM[0][1]
FN=CM[1][0]
TN=CM[1][1]

ACC = (TP+TN)/(TP+TN+FP+FN)
```

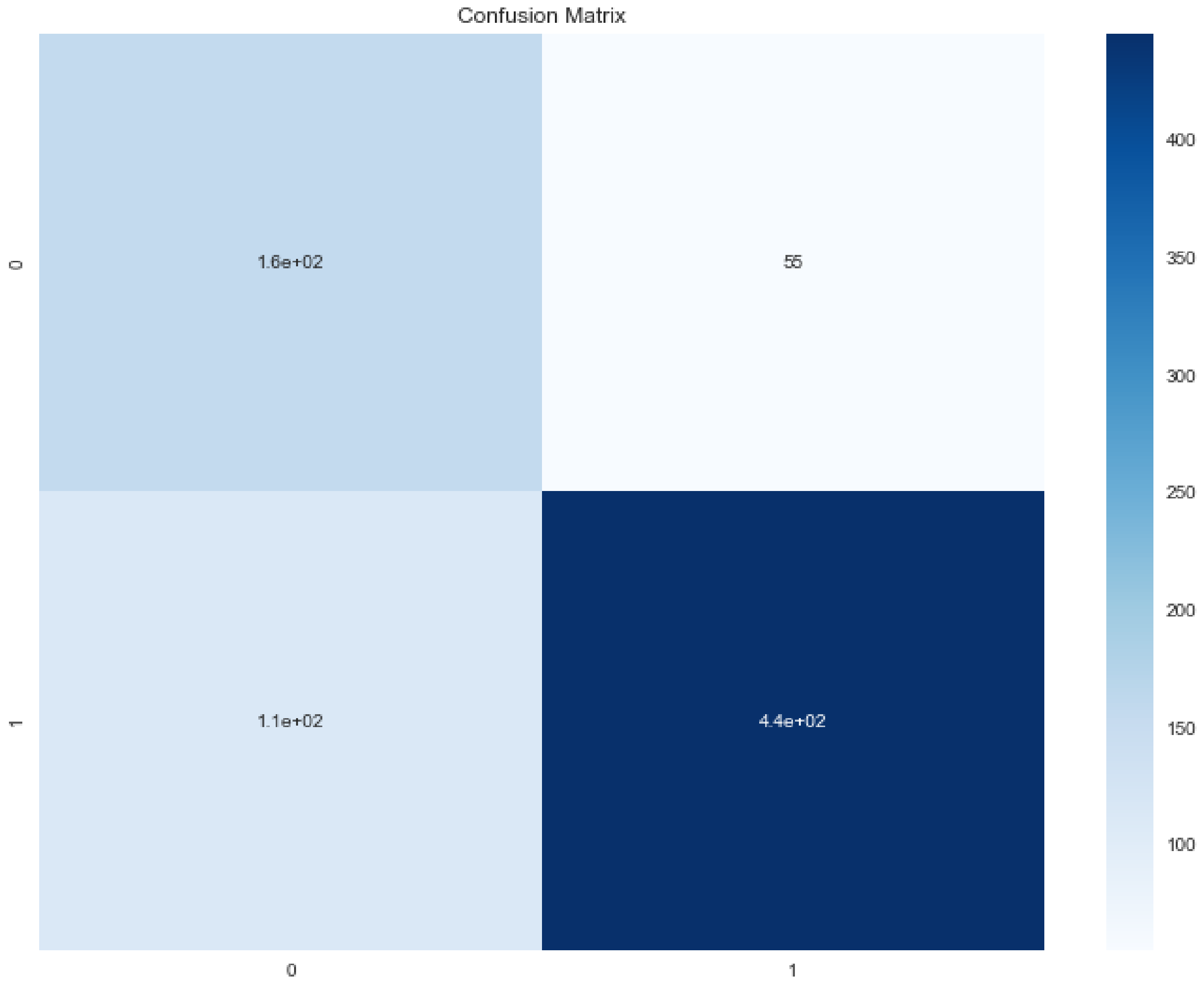
```python
print('Accuracy is : \n', ACC)
print('--------------------------------')
Rec = TP/(TP+FN)
print('Recall is : \n', Rec)
print('--------------------------------')
Prec = TP/(TP+FP)
print('Precsion is : \n', Prec)
print('--------------------------------')
F1 = 2 * ((Prec * Rec)/(Prec + Rec))
print('F1 score is : \n', F1)
print('--------------------------------')
```

```
Accuracy is : 
 0.7825520833333334
--------------------------------
Recall is : 
 0.582089552238806
--------------------------------
Precsion is : 
 0.7393364928909952
--------------------------------
F1 score is : 
 0.651356993736952
--------------------------------
```

In [ ]:

```python
import seaborn as sns

plt.figure(figsize=(12,9))
plt.title("Confusion Matrix")
sns.heatmap(CM,annot=True,cmap=plt.cm.Blues)
plt.plot()
```

Out[ ]: []


Confusion Matrix
1.6e+02
55
1.1e+02
4.4e+02
0
1
0
1
400
350
300
250
200
150
100

In [ ]: