

## A PYTHON PROGRAM TO IMPLEMENT LOGISTIC MODEL

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Code:

```
import pandas as pd
```

```
import numpy as np
```

```
from numpy import log, dot, exp, shape
```

```
from sklearn.model_selection import train_test_split
```

```
from sklearn.preprocessing import StandardScaler
```

```
from sklearn.metrics import confusion_matrix, accuracy_score
```

```
# Load dataset
```

```
data = pd.read_csv("C:\\Users\\Shyam Ganesh\\Documents\\  
\\kaggle\\headbrain.csv") print("Shape:", data.shape)
```

```
print("Columns:", data.columns.tolist())
```

```
print(data.head())
```

```
# Automatically detect features (last column as target)
```

```
x = data.iloc[:, :-1].values
```

```
y = data.iloc[:, -1].values
```

```
# Split data
```

```
x_train, x_test, y_train, y_test = train_test_split(x, y,  
test_size=0.10, random_state=0)
```

```
# Standardize
```

```
sc = StandardScaler()
```

```
x_train = sc.fit_transform(x_train)
```

```
x_test = sc.transform(x_test)
```

```
print(x_train[0:10, :])
```

```
# In-built Logistic Regression
```

```
from sklearn.linear_model import LogisticRegression as  
SkLogReg
```

```
classifier = SkLogReg(random_state=0)
```

```
classifier.fit(x_train, y_train)
```

```
y_pred = classifier.predict(x_test)
```

```
cm = confusion_matrix(y_test, y_pred)
```

```
print("Confusion Matrix:\n", cm)
print("Accuracy:", accuracy_score(y_test, y_pred))
```

# User-defined functions

```
def standardize(X_tr):
    for i in range(shape(X_tr)[1]):
        X_tr[:, i] = (X_tr[:, i] - np.mean(X_tr[:, i])) / np.std(X_tr[:, i])

def F1_score(y, y_hat):
    tp, tn, fp, fn = 0, 0, 0, 0
    for i in range(len(y)):
        if y[i] == 1 and y_hat[i] == 1:
            tp += 1
        elif y[i] == 1 and y_hat[i] == 0:
            fn += 1
        elif y[i] == 0 and y_hat[i] == 1:
            fp += 1
        elif y[i] == 0 and y_hat[i] == 0:
            tn += 1
```

```
precision = tp / (tp + fp)
recall = tp / (tp + fn)
f1_score = 2 * precision * recall / (precision + recall)
return f1_score
```

```
class LogisticRegression:
    def sigmoid(self, z):
        return 1 / (1 + exp(-z))

    def initialize(self, X):
        weights = np.zeros((shape(X)[1] + 1, 1))
        X = np.c_[np.ones((shape(X)[0], 1)), X]
        return weights, X

    def fit(self, X, y, alpha=0.001, iter=400):
        weights, X = self.initialize(X)

    def cost(theta):
        z = dot(X, theta)
```

```
cost0 = y.T.dot(log(self.sigmoid(z)))
cost1 = (1 - y).T.dot(log(1 - self.sigmoid(z)))
cost = -((cost1 + cost0)) / len(y)
return cost
```

```
cost_list = np.zeros(iter,)
for i in range(iter):
    weights = weights - alpha * dot(X.T, self.sigmoid(dot(X,
weights))) - np.reshape(y, (len(y), 1)))
    cost_list[i] = cost(weights)
self.weights = weights
return cost_list
```

```
def predict(self, X):
    z = dot(self.initialize(X)[1], self.weights)
    lis = []
    for i in self.sigmoid(z):
        if i > 0.5:
            lis.append(1)
    else:
```

```
lis.append(0)  
return lis
```

```
standardize(x_train)  
standardize(x_test)  
obj1 = LogisticRegression()  
model = obj1.fit(x_train, y_train)  
y_pred = obj1.predict(x_test)  
y_trainn = obj1.predict(x_train)  
f1_score_tr = F1_score(y_train, y_trainn)  
f1_score_te = F1_score(y_test, y_pred)  
print("Train F1 Score:", f1_score_tr)  
print("Test F1 Score:", f1_score_te)  
output:
```

Shape: (237, 4)

Columns: ['Gender', 'Age Range', 'Head Size(cm^3)', 'Brain Weight(grams)']

	Gender	Age Range	Head Size(cm^3)	Brain Weight(grams)
0	1	1	4512	1530
1	1	1	3738	1297
2	1	1	4261	1335
3	1	1	3777	1282
4	1	1	4177	1590

```
[[-0.87196937 -1.06301458  0.48575306]
 [-0.87196937 -1.06301458  0.33409191]
 [ 1.14682928 -1.06301458 -1.22855956]
 [-0.87196937 -1.06301458  0.04160256]
 [-0.87196937  0.94072087  2.18110804]
 [ 1.14682928 -1.06301458 -2.07894528]
 [ 1.14682928  0.94072087 -0.96586079]
 [-0.87196937  0.94072087 -0.09651742]
 [ 1.14682928  0.94072087 -0.39442325]
 [ 1.14682928 -1.06301458  1.03010825]]
```

Confusion Matrix:

[illegible]

Accuracy: 0.0