

Logistic Regression

```
In [2]: import numpy as np  
import pandas as pd
```

```
In [3]: df = pd.read_csv('C:/Users/SW20407278/Desktop/Final AI/Hands-On/Classification/Social_
```

```
In [4]: df.head()
```

```
Out[4]:
```

	User ID	Gender	Age	EstimatedSalary	Purchased
0	15624510	Male	19	19000	0
1	15810944	Male	35	20000	0
2	15668575	Female	26	43000	0
3	15603246	Female	27	57000	0
4	15804002	Male	19	76000	0

```
In [5]: ## To check the dataset is balanced or not  
df.Purchased.value_counts()
```

```
Out[5]:
```

0	257
1	143

```
Name: Purchased, dtype: int64
```

```
In [23]: df.info()
```

```
<class 'pandas.core.frame.DataFrame'>  
RangeIndex: 400 entries, 0 to 399  
Data columns (total 5 columns):  
 #   Column           Non-Null Count  Dtype    
 ---  --    
 0   User ID          400 non-null    int64   
 1   Gender            400 non-null    object   
 2   Age               400 non-null    int64   
 3   EstimatedSalary  400 non-null    int64   
 4   Purchased         400 non-null    int64  
dtypes: int64(4), object(1)  
memory usage: 15.8+ KB
```

```
In [8]: ## Features and Label  
features = df.iloc[:,[2,3]].values  
label = df.iloc[:,4].values
```

```
In [9]: from sklearn.model_selection import train_test_split  
from sklearn.linear_model import LogisticRegression  
  
for i in range(1,401):  
    X_train,X_test,y_train,y_test = train_test_split(features,label,test_size=0.2,random_state=i)  
    model = LogisticRegression()  
    model.fit(X_train,y_train)  
  
    train_score = model.score(X_train,y_train)
```

```
test_score = model.score(X_test,y_test)

if test_score > train_score:
    print("Test {} Train {} Random State {}".format(test_score,train_score,i))
```

Test 0.6875 Train 0.63125 Random State 3
Test 0.7375 Train 0.61875 Random State 4
Test 0.6625 Train 0.6375 Random State 5
Test 0.65 Train 0.640625 Random State 6
Test 0.675 Train 0.634375 Random State 7
Test 0.675 Train 0.634375 Random State 8
Test 0.65 Train 0.640625 Random State 10
Test 0.6625 Train 0.6375 Random State 11
Test 0.7125 Train 0.625 Random State 13
Test 0.675 Train 0.634375 Random State 16
Test 0.7 Train 0.628125 Random State 17
Test 0.7 Train 0.628125 Random State 21
Test 0.65 Train 0.640625 Random State 24
Test 0.6625 Train 0.6375 Random State 25
Test 0.75 Train 0.615625 Random State 26
Test 0.675 Train 0.634375 Random State 27
Test 0.7 Train 0.628125 Random State 28
Test 0.6875 Train 0.63125 Random State 29
Test 0.6875 Train 0.63125 Random State 31
Test 0.6625 Train 0.6375 Random State 37
Test 0.7 Train 0.628125 Random State 39
Test 0.7 Train 0.628125 Random State 40
Test 0.65 Train 0.640625 Random State 42
Test 0.725 Train 0.621875 Random State 46
Test 0.65 Train 0.640625 Random State 48
Test 0.675 Train 0.634375 Random State 50
Test 0.65 Train 0.640625 Random State 51
Test 0.65 Train 0.640625 Random State 54
Test 0.7 Train 0.634375 Random State 55
Test 0.65 Train 0.640625 Random State 56
Test 0.6625 Train 0.6375 Random State 58
Test 0.6875 Train 0.63125 Random State 59
Test 0.7 Train 0.628125 Random State 60
Test 0.6625 Train 0.6375 Random State 62
Test 0.6875 Train 0.63125 Random State 63
Test 0.65 Train 0.640625 Random State 66
Test 0.7 Train 0.628125 Random State 70
Test 0.65 Train 0.640625 Random State 74
Test 0.65 Train 0.640625 Random State 75
Test 0.6875 Train 0.63125 Random State 76
Test 0.6875 Train 0.63125 Random State 80
Test 0.675 Train 0.634375 Random State 81
Test 0.875 Train 0.8375 Random State 82
Test 0.7 Train 0.628125 Random State 83
Test 0.675 Train 0.634375 Random State 84
Test 0.675 Train 0.634375 Random State 86
Test 0.65 Train 0.640625 Random State 87
Test 0.675 Train 0.634375 Random State 90
Test 0.65 Train 0.640625 Random State 91
Test 0.7 Train 0.628125 Random State 93
Test 0.7375 Train 0.61875 Random State 94
Test 0.65 Train 0.640625 Random State 97
Test 0.7 Train 0.628125 Random State 99
Test 0.675 Train 0.634375 Random State 101
Test 0.6625 Train 0.6375 Random State 102
Test 0.725 Train 0.621875 Random State 103
Test 0.65 Train 0.640625 Random State 106
Test 0.65 Train 0.640625 Random State 109
Test 0.75 Train 0.615625 Random State 114
Test 0.675 Train 0.634375 Random State 116

Test 0.65 Train 0.640625 Random State 117
Test 0.675 Train 0.634375 Random State 119
Test 0.65 Train 0.640625 Random State 120
Test 0.6625 Train 0.6375 Random State 121
Test 0.725 Train 0.621875 Random State 125
Test 0.65 Train 0.640625 Random State 127
Test 0.65 Train 0.640625 Random State 128
Test 0.6875 Train 0.63125 Random State 129
Test 0.6875 Train 0.63125 Random State 130
Test 0.6625 Train 0.6375 Random State 132
Test 0.6875 Train 0.63125 Random State 133
Test 0.675 Train 0.634375 Random State 134
Test 0.675 Train 0.634375 Random State 138
Test 0.7 Train 0.628125 Random State 139
Test 0.7125 Train 0.63125 Random State 141
Test 0.725 Train 0.621875 Random State 142
Test 0.6625 Train 0.6375 Random State 143
Test 0.6625 Train 0.6375 Random State 145
Test 0.7125 Train 0.625 Random State 150
Test 0.65 Train 0.640625 Random State 152
Test 0.6625 Train 0.6375 Random State 154
Test 0.675 Train 0.634375 Random State 155
Test 0.8875 Train 0.834375 Random State 158
Test 0.6625 Train 0.6375 Random State 159
Test 0.7125 Train 0.625 Random State 161
Test 0.675 Train 0.634375 Random State 162
Test 0.6625 Train 0.6375 Random State 163
Test 0.65 Train 0.640625 Random State 165
Test 0.6625 Train 0.6375 Random State 169
Test 0.675 Train 0.634375 Random State 170
Test 0.7125 Train 0.625 Random State 173
Test 0.65 Train 0.640625 Random State 176
Test 0.6625 Train 0.6375 Random State 178
Test 0.6625 Train 0.6375 Random State 179
Test 0.6625 Train 0.6375 Random State 180
Test 0.6625 Train 0.6375 Random State 181
Test 0.65 Train 0.640625 Random State 184
Test 0.6625 Train 0.6375 Random State 185
Test 0.675 Train 0.634375 Random State 188
Test 0.7375 Train 0.61875 Random State 189
Test 0.7 Train 0.628125 Random State 192
Test 0.65 Train 0.640625 Random State 193
Test 0.7 Train 0.628125 Random State 194
Test 0.65 Train 0.640625 Random State 195
Test 0.6625 Train 0.6375 Random State 196
Test 0.675 Train 0.634375 Random State 198
Test 0.8875 Train 0.8375 Random State 199
Test 0.6875 Train 0.63125 Random State 204
Test 0.6625 Train 0.6375 Random State 209
Test 0.7 Train 0.628125 Random State 211
Test 0.65 Train 0.640625 Random State 212
Test 0.6625 Train 0.6375 Random State 215
Test 0.6625 Train 0.6375 Random State 217
Test 0.6875 Train 0.63125 Random State 220
Test 0.6625 Train 0.6375 Random State 223
Test 0.6625 Train 0.6375 Random State 225
Test 0.6625 Train 0.6375 Random State 226
Test 0.6875 Train 0.63125 Random State 229
Test 0.65 Train 0.640625 Random State 232
Test 0.7125 Train 0.625 Random State 233

Test 0.6625 Train 0.6375 Random State 234
Test 0.6625 Train 0.6375 Random State 235
Test 0.6875 Train 0.63125 Random State 238
Test 0.725 Train 0.621875 Random State 239
Test 0.65 Train 0.640625 Random State 241
Test 0.725 Train 0.621875 Random State 242
Test 0.6625 Train 0.6375 Random State 244
Test 0.675 Train 0.634375 Random State 245
Test 0.6875 Train 0.63125 Random State 246
Test 0.7 Train 0.628125 Random State 247
Test 0.6875 Train 0.63125 Random State 248
Test 0.65 Train 0.640625 Random State 251
Test 0.7 Train 0.628125 Random State 252
Test 0.65 Train 0.640625 Random State 253
Test 0.675 Train 0.634375 Random State 255
Test 0.75 Train 0.615625 Random State 257
Test 0.7 Train 0.628125 Random State 260
Test 0.6625 Train 0.6375 Random State 261
Test 0.65 Train 0.640625 Random State 263
Test 0.6625 Train 0.6375 Random State 265
Test 0.8625 Train 0.840625 Random State 266
Test 0.6875 Train 0.63125 Random State 269
Test 0.6625 Train 0.6375 Random State 275
Test 0.7 Train 0.628125 Random State 276
Test 0.6625 Train 0.6375 Random State 277
Test 0.7 Train 0.628125 Random State 278
Test 0.7125 Train 0.625 Random State 279
Test 0.6875 Train 0.63125 Random State 282
Test 0.6875 Train 0.63125 Random State 283
Test 0.7125 Train 0.625 Random State 287
Test 0.6625 Train 0.6375 Random State 292
Test 0.65 Train 0.640625 Random State 293
Test 0.6625 Train 0.6375 Random State 294
Test 0.675 Train 0.634375 Random State 296
Test 0.675 Train 0.634375 Random State 300
Test 0.675 Train 0.634375 Random State 302
Test 0.6625 Train 0.6375 Random State 303
Test 0.8625 Train 0.834375 Random State 305
Test 0.6875 Train 0.63125 Random State 306
Test 0.7 Train 0.628125 Random State 310
Test 0.7125 Train 0.625 Random State 311
Test 0.8625 Train 0.834375 Random State 313
Test 0.9125 Train 0.834375 Random State 314
Test 0.7 Train 0.628125 Random State 315
Test 0.6625 Train 0.6375 Random State 317
Test 0.7625 Train 0.6125 Random State 318
Test 0.6625 Train 0.6375 Random State 319
Test 0.65 Train 0.640625 Random State 321
Test 0.7125 Train 0.625 Random State 322
Test 0.675 Train 0.634375 Random State 323
Test 0.6625 Train 0.6375 Random State 325
Test 0.7125 Train 0.625 Random State 327
Test 0.6625 Train 0.6375 Random State 328
Test 0.7 Train 0.628125 Random State 329
Test 0.65 Train 0.640625 Random State 330
Test 0.65 Train 0.640625 Random State 332
Test 0.675 Train 0.634375 Random State 336
Test 0.6875 Train 0.63125 Random State 340
Test 0.65 Train 0.640625 Random State 344
Test 0.6625 Train 0.6375 Random State 345

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Test 0.7 Train 0.628125 Random State 346
Test 0.65 Train 0.640625 Random State 348
Test 0.725 Train 0.621875 Random State 349
Test 0.6875 Train 0.63125 Random State 350
Test 0.675 Train 0.634375 Random State 352
Test 0.725 Train 0.621875 Random State 353
Test 0.675 Train 0.634375 Random State 354
Test 0.6875 Train 0.63125 Random State 355
Test 0.6625 Train 0.6375 Random State 356
Test 0.7375 Train 0.61875 Random State 357
Test 0.6625 Train 0.6375 Random State 358
Test 0.6625 Train 0.6375 Random State 359
Test 0.7 Train 0.628125 Random State 360
Test 0.65 Train 0.640625 Random State 361
Test 0.6625 Train 0.6375 Random State 362
Test 0.65 Train 0.640625 Random State 363
Test 0.6625 Train 0.6375 Random State 364
Test 0.6875 Train 0.63125 Random State 365
Test 0.6625 Train 0.6375 Random State 366
Test 0.6625 Train 0.6375 Random State 368
Test 0.65 Train 0.640625 Random State 370
Test 0.725 Train 0.621875 Random State 371
Test 0.65 Train 0.640625 Random State 373
Test 0.7 Train 0.628125 Random State 376
Test 0.6875 Train 0.63125 Random State 378
Test 0.675 Train 0.634375 Random State 379
Test 0.65 Train 0.640625 Random State 387
Test 0.6625 Train 0.6375 Random State 393
Test 0.675 Train 0.634375 Random State 396
Test 0.7 Train 0.628125 Random State 397
Test 0.7125 Train 0.625 Random State 400
```

```
In [10]: ## Creation of Train and Test Split and Model building
```

```
X_train,X_test,y_train,y_test = train_test_split(features,label,test_size=0.2,random_state=42)
finalModel = LogisticRegression()
finalModel.fit(X_train,y_train)
```

```
Out[10]: LogisticRegression()
```

```
In [11]: ## Training and Testing Accuracy
```

```
print(finalModel.score(X_train,y_train))
print(finalModel.score(X_test,y_test))
```

```
0.8375
0.8875
```

```
In [12]: ### Confusion Matrix
```

```
from sklearn.metrics import confusion_matrix

#confusion_matrix(actualLabel, predictedLabel)
confusion_matrix(label,finalModel.predict(features))
```

```
Out[12]: array([[237,  20],
   [ 41, 102]], dtype=int64)
```

```
In [13]: from sklearn.metrics import classification_report
```

```
print(classification_report(label,finalModel.predict(features)))
```

	precision	recall	f1-score	support
0	0.85	0.92	0.89	257
1	0.84	0.71	0.77	143
accuracy			0.85	400
macro avg	0.84	0.82	0.83	400
weighted avg	0.85	0.85	0.84	400

In []:

In []: