```
#Hands On Machine Learning ( Logistic Regression )
#Recall, Precision, F1 Score (Mean of recall and precision), Target, Features,
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#
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```
#Understanding Target and Feature
# Instead of treating them as variables, represent the data as a comment or within a stru
# This way, Python won't try to interpret them as undefined variables.

# Example using a comment to represent the data:
# Students, hours_studied, past_grades, passed_exam
# A, 2, 60%, NO
# B, 5, 70%, Yes
# C, 8, 87%, YES

# Example using a list of lists to represent the data:
data = [
    ["Students", "hours_studied", "past_grades", "passed_exam"],
    ["A", 2, "60%", "NO"],
    ["B", 5, "70%", "Yes"],
    ["C", 8, "87%", "YES"]
]

#The columns that you will consider taking as inputs for training your model are called F
#The column(s) that you are trying to predict, is/are called the Targets ( Target is repr
```

```
import numpy as np
import pandas as pd
import matplotlib.pyplot as plt
import seaborn as sns
from sklearn.model_selection import train_test_split
from sklearn.preprocessing import StandardScaler
from sklearn.linear_model import LogisticRegression
from sklearn.metrics import accuracy_score, confusion_matrix, classification_report
```

```
#Loading the dataset
#Some data preprocessing
#Train your model
#Use your model to do some predictions
#Evalaute the model
#Visualize the results

#Point 1. Loading the dataset
from sklearn.datasets import load_breast_cancer
data = load_breast_cancer()
print(data)
df = pd.DataFrame(data.data, columns=data.feature_names)

df['target'] = data.target # Either 1 or 0
```

```
X = df.drop(columns=['target'])
```

```
{'data': array([[1.799e+01, 1.038e+01, 1.228e+02, ..., 2.654e-01, 4.601e-01,
         1.189e-01],
        [2.057e+01, 1.777e+01, 1.329e+02, ..., 1.860e-01, 2.750e-01,
         8.902e-02],
        [1.969e+01, 2.125e+01, 1.300e+02, ..., 2.430e-01, 3.613e-01,
         8.758e-02],
        ...,
        [1.660e+01, 2.808e+01, 1.083e+02, ..., 1.418e-01, 2.218e-01,
         7.820e-02],
        [2.060e+01, 2.933e+01, 1.401e+02, ..., 2.650e-01, 4.087e-01,
         1.240e-01],
        [7.760e+00, 2.454e+01, 4.792e+01, ..., 0.000e+00, 2.871e-01,
         7.039e-02]]), 'target': array([0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0
        0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 1, 0, 0, 0, 0, 0, 0,
        0, 0, 1, 0, 1, 1, 1, 1, 1, 0, 0, 1, 0, 0, 1, 1, 1, 1, 0, 1, 0, 0,
        1, 1, 1, 1, 0, 1, 0, 0, 1, 0, 1, 0, 0, 1, 1, 1, 0, 0, 1, 0, 0, 0,
        1, 1, 1, 0, 1, 1, 0, 0, 1, 1, 1, 0, 0, 1, 1, 1, 1, 0, 1, 1, 0, 1,
        1, 1, 1, 1, 1, 1, 1, 0, 0, 0, 1, 0, 0, 1, 1, 1, 0, 0, 1, 0, 1, 0,
        0, 1, 0, 0, 1, 1, 0, 1, 1, 0, 1, 1, 1, 1, 0, 1, 1, 1, 1, 1, 1, 1,
        1, 1, 0, 1, 1, 1, 1, 0, 0, 1, 0, 1, 1, 0, 0, 1, 1, 0, 0, 1, 1, 1,
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        1, 1, 1, 0, 1, 0, 1, 1, 0, 1, 1, 1, 1, 1, 0, 0, 1, 0, 1, 0, 1, 1,
        1, 1, 1, 0, 1, 1, 0, 1, 0, 1, 0, 0, 1, 1, 1, 0, 1, 1, 1, 1, 1, 1,
        1, 1, 1, 1, 1, 0, 1, 0, 0, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1,
        1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 0, 0, 0, 0, 0, 0, 1]), 'frame': None, 'tar
        'mean smoothness', 'mean compactness', 'mean concavity',
        'mean concave points', 'mean symmetry', 'mean fractal dimension',
        'radius error', 'texture error', 'perimeter error', 'area error',
        'smoothness error', 'compactness error', 'concavity error',
        'concave points error', 'symmetry error',
        'fractal dimension error', 'worst radius', 'worst texture',
        'worst perimeter', 'worst area', 'worst smoothness',
        'worst compactness', 'worst concavity', 'worst concave points',
        'worst symmetry', 'worst fractal dimension'], dtype='<U23'), 'filename': 'brea
```

```
#print(X)
```

```
y = df['target'] #In this dataset we only have 1 column, 80 rows will correlate to traini
```

```
print(y)
```

```
0      0
1      0
2      0
3      0
4      0
      ..
564    0
565    0
566    0
567    0
568    1
Name: target, Length: 569, dtype: int64
```

```
#You should never train your model on the entire dataset
#we split our dataset into 2, one part will be used to train the model and the other woul
#Data Preprocessing
X_train, X_test, y_train, y_test = train_test_split(X, y, test_size=0.2, random_state=42)

scaler = StandardScaler()
X_train = scaler.fit_transform(X_train)
X_test = scaler.transform(X_test)
```

```
#Training the MODEL
model = LogisticRegression()
model.fit(X_train, y_train) # Magic code: Shaka laka boom boom train hojao 😂
```

```
▾ LogisticRegression  ⓘ ?
LogisticRegression()
```

```
#Lets do some predictions

y_predict = model.predict(X_test)
```

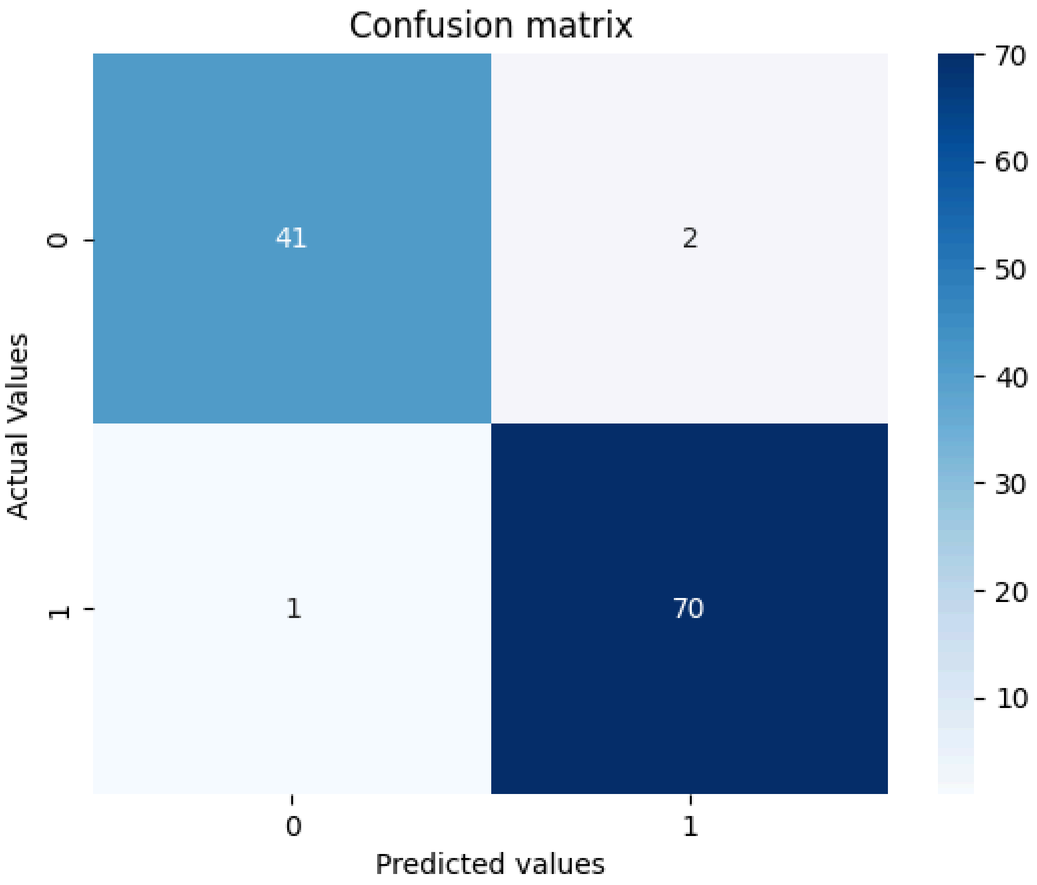
```
print("Accuracy: ", accuracy_score(y_test, y_predict)) #How do you check accuracy? You kn
print("Confusion Matrix: ", confusion_matrix(y_test, y_predict))
print("Classification Report: ", classification_report(y_test, y_predict))
```

```
Accuracy:  0.9736842105263158
Confusion Matrix:  [[41  2]
 [ 1 70]]
Classification Report:                precision    recall  f1-score   support

           0       0.98      0.95      0.96        43
           1       0.97      0.99      0.98        71

    accuracy                           0.97       114
   macro avg       0.97      0.97      0.97       114
weighted avg       0.97      0.97      0.97       114
```

```
sns.heatmap(confusion_matrix(y_test, y_predict), annot=True, cmap="Blues", fmt='d')
plt.xlabel("Predicted values")
plt.ylabel("Actual Values")
plt.title("Confusion matrix")
plt.show()
```


Confusion matrix
Actual Values
Predicted values