Importing Libraries And Dataset

```
import numpy as np
import pandas as pd
import matplotlib.pyplot as plt
import seaborn as sns

from sklearn.datasets import load_breast_cancer
from sklearn.model_selection import train_test_split
from sklearn.preprocessing import StandardScaler
from sklearn.linear_model import LogisticRegression
from sklearn.metrics import (
    confusion_matrix, classification_report, roc_auc_score,
    roc_curve, accuracy_score
)
```

```
df = pd.read_csv("/content/data.csv")
df.head(10)
```

	id	diagnosis	radius_mean	texture_mean	perimeter_mean	area_mean	smoo
0	842302	M	17.99	10.38	122.80	1001.0	
1	842517	M	20.57	17.77	132.90	1326.0	
2	84300903	M	19.69	21.25	130.00	1203.0	
3	84348301	M	11.42	20.38	77.58	386.1	
4	84358402	M	20.29	14.34	135.10	1297.0	
5	843786	M	12.45	15.70	82.57	477.1	
6	844359	M	18.25	19.98	119.60	1040.0	
7	84458202	M	13.71	20.83	90.20	577.9	
8	844981	M	13.00	21.82	87.50	519.8	
9	84501001	M	12.46	24.04	83.97	475.9	

10 rows × 33 columns

Preprocessing The Dataset

```
df.describe()
```

	id	radius_mean	texture_mean	perimeter_mean	area_mean	smoot
count	5.690000e+02	569.000000	569.000000	569.000000	569.000000	
mean	3.037183e+07	14.127292	19.289649	91.969033	654.889104	
std	1.250206e+08	3.524049	4.301036	24.298981	351.914129	
min	8.670000e+03	6.981000	9.710000	43.790000	143.500000	
25%	8.692180e+05	11.700000	16.170000	75.170000	420.300000	
50%	9.060240e+05	13.370000	18.840000	86.240000	551.100000	
75%	8.813129e+06	15.780000	21.800000	104.100000	782.700000	
max	9.113205e+08	28.110000	39.280000	188.500000	2501.000000	

8 rows × 32 columns

```
df.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 569 entries, 0 to 568
Data columns (total 33 columns):
 #   Column                   Non-Null Count  Dtype
---  ------                   --------------  -----
 0   id                       569 non-null    int64
 1   diagnosis                569 non-null    object
 2   radius_mean              569 non-null    float64
 3   texture_mean             569 non-null    float64
 4   perimeter_mean           569 non-null    float64
 5   area_mean                569 non-null    float64
 6   smoothness_mean          569 non-null    float64
 7   compactness_mean         569 non-null    float64
 8   concavity_mean           569 non-null    float64
 9   concave points_mean      569 non-null    float64
 10  symmetry_mean            569 non-null    float64
 11  fractal_dimension_mean   569 non-null    float64
 12  radius_se                569 non-null    float64
 13  texture_se               569 non-null    float64
 14  perimeter_se             569 non-null    float64
 15  area_se                  569 non-null    float64
 16  smoothness_se            569 non-null    float64
 17  compactness_se           569 non-null    float64
 18  concavity_se             569 non-null    float64
 19  concave points_se        569 non-null    float64
 20  symmetry_se              569 non-null    float64
 21  fractal_dimension_se     569 non-null    float64
 22  radius_worst             569 non-null    float64
 23  texture_worst            569 non-null    float64
 24  perimeter_worst          569 non-null    float64
 25  area_worst               569 non-null    float64
 26  smoothness_worst         569 non-null    float64
 27  compactness_worst        569 non-null    float64
 28  concavity_worst          569 non-null    float64
 29  concave points_worst     569 non-null    float64
```

```
 30  symmetry_worst           569 non-null    float64
 31  fractal_dimension_worst  569 non-null    float64
 32  Unnamed: 32              0 non-null      float64
dtypes: float64(31), int64(1), object(1)
memory usage: 146.8+ KB
```

```
df.isnull().sum()
```

	0
id	0
diagnosis	0
radius_mean	0
texture_mean	0
smoothness_mean	0
symmetry_mean	0
fractal_dimension_mean	0
radius_se	0
smoothness_se	0
compactness_se	0
concavity_se	0
symmetry_se	0
radius_worst	0
area_worst	0
smoothness_worst	0
compactness_worst	0

Train/Test Splitting The Dataset

```
df = df.drop(['id', 'Unnamed: 32'], axis=1)
```

```
df['diagnosis'] = df['diagnosis'].map({'M': 1, 'B': 0})
```

```
X = df.drop('diagnosis', axis=1)
y = df['diagnosis']
```

```
X_train, X_test, y_train, y_test = train_test_split(X, y, test_size=0.2, random_
```

Standardizing Features

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

Fitting The Model

```
model = LogisticRegression(max_iter=1000)
model.fit(X_train_scaled, y_train)
```

```
LogisticRegression
LogisticRegression(max_iter=1000)
```

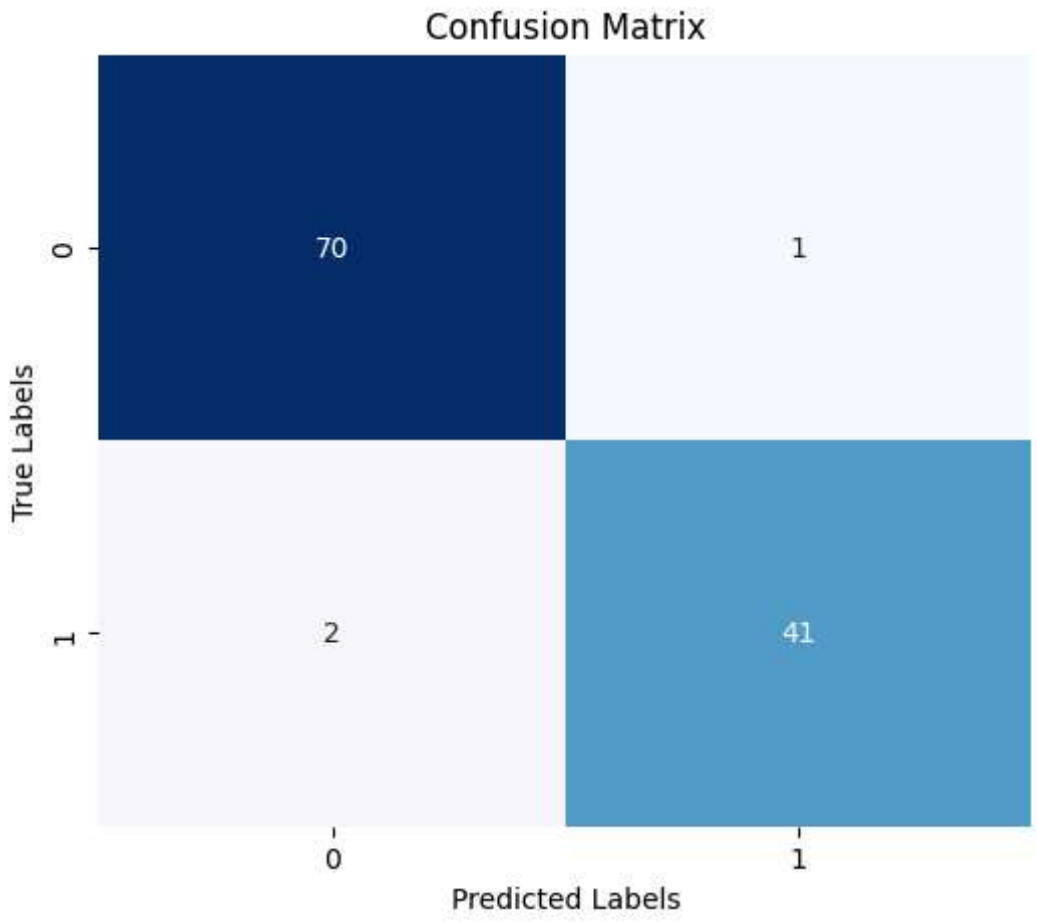
```
y_pred = model.predict(X_test_scaled)
y_prob = model.predict_proba(X_test_scaled)[:, 1]
```

Evaluating With Confusion Matrix, Precision Etc.,

```
cm = confusion_matrix(y_test, y_pred)
plt.figure(figsize=(6, 5))
sns.heatmap(cm, annot=True, fmt='d', cmap='Blues', cbar=False)
plt.title("Confusion Matrix")
plt.xlabel("Predicted Labels")
```

```
plt.ylabel("True Labels")
plt.show()
```

dtype: int64



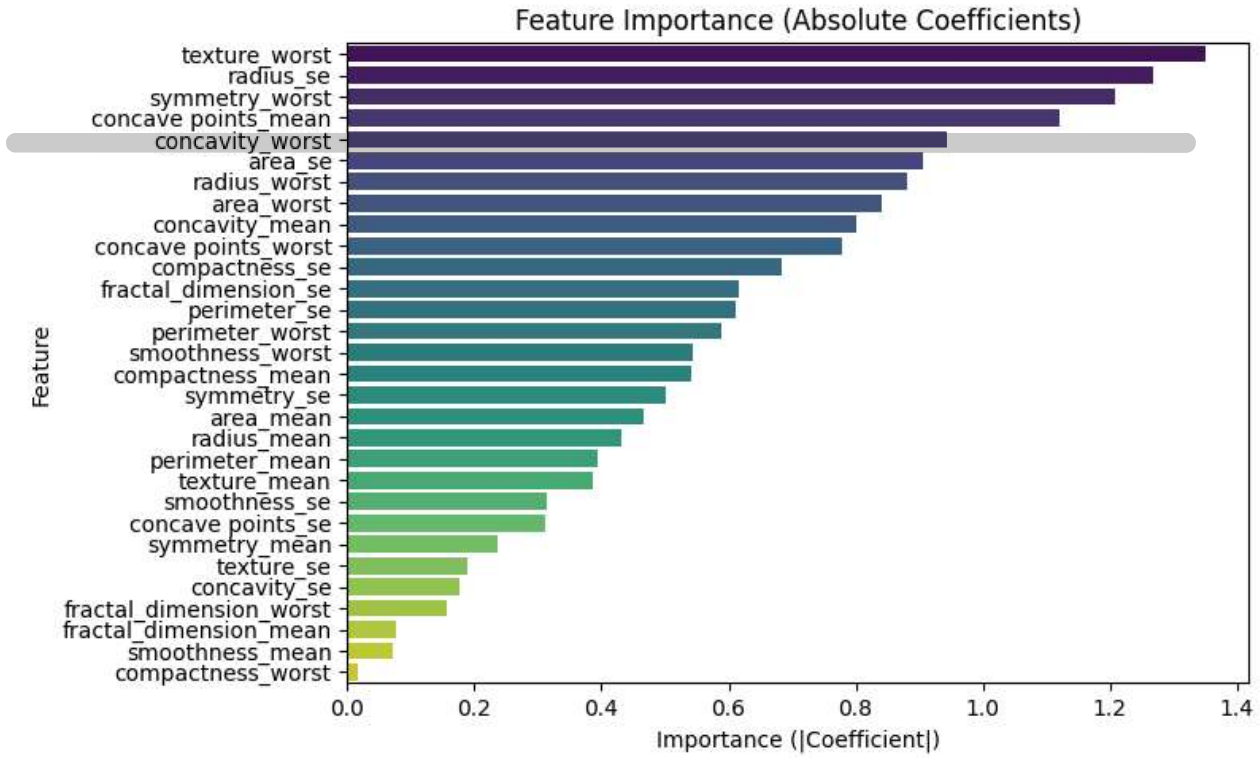

```
print("Classification Report:\n", classification_report(y_test, y_pred))
print("Accuracy:", accuracy_score(y_test, y_pred))
print("ROC-AUC Score:", roc_auc_score(y_test, y_prob))
```

```
Classification Report:
              precision    recall  f1-score   support

           0       0.97      0.99      0.98        71
           1       0.98      0.95      0.96        43

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

Accuracy: 0.9736842105263158
ROC-AUC Score: 0.99737962659679
```

```
feature_importance = pd.DataFrame({
    'Feature': X_train.columns,
    'Importance': np.abs(model.coef_[0])
}).sort_values(by='Importance', ascending=False)

plt.figure(figsize=(8, 5))
sns.barplot(data=feature_importance, x='Importance', y='Feature', palette='virid
plt.title("Feature Importance (Absolute Coefficients)")
plt.xlabel("Importance (|Coefficient|)")
```

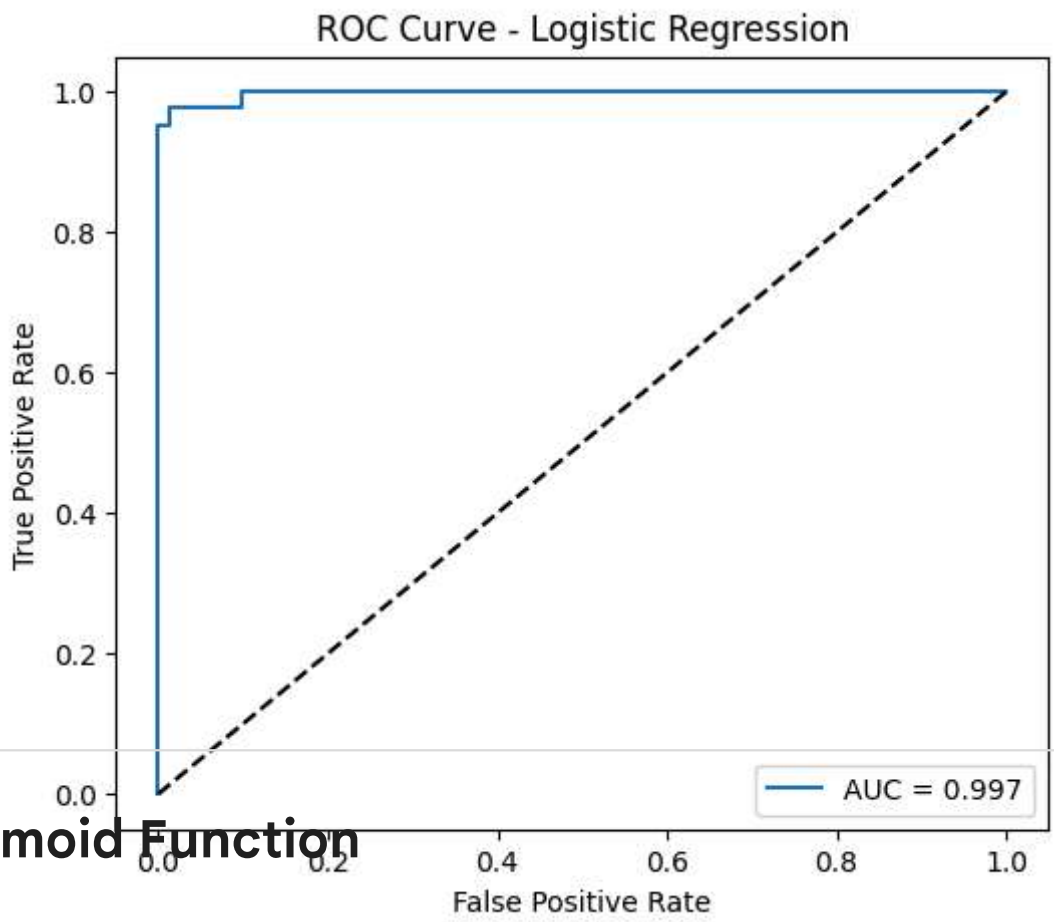
```
plt.ylabel("Feature")
plt.tight_layout()
plt.show()
```

```
/tmp/ipython-input-2534722934.py:7: FutureWarning:

Passing `palette` without assigning `hue` is deprecated and will be removed in v0

  sns.barplot(data=feature_importance, x='Importance', y='Feature', palette='virid
```



Tuning Threshold

```
fpr, tpr, thresholds = roc_curve(y_test, y_prob)
plt.figure(figsize=(6,5))
plt.plot(fpr, tpr, label=f"AUC = {roc_auc_score(y_test, y_prob):.3f}")
plt.plot([0,1], [0,1], 'k--')
plt.xlabel("False Positive Rate")
plt.ylabel("True Positive Rate")
plt.title("ROC Curve - Logistic Regression")
plt.legend()
plt.show()
```



Sigmoid Function

```
def sigmoid(z):
    return 1 / (1 + np.exp(-z))

z vals = np.linspace(-10, 10, 100)
```