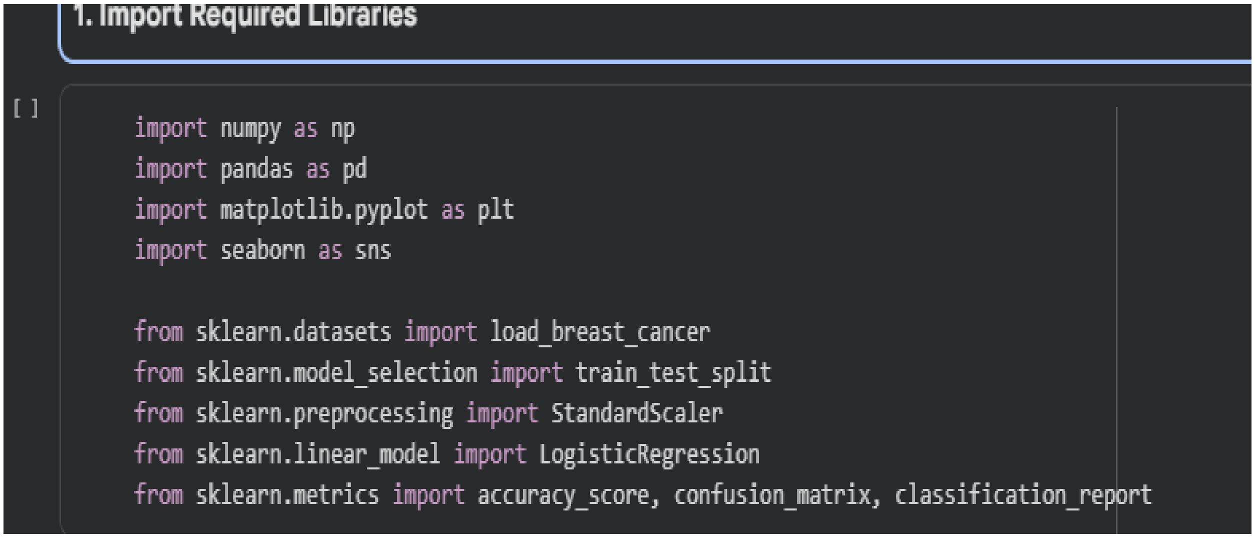
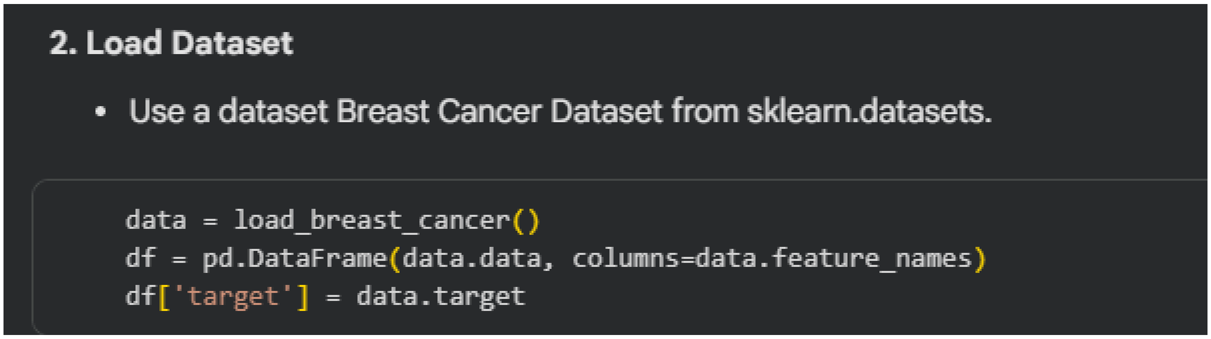
LAB NO 03



1. Import Required Libraries

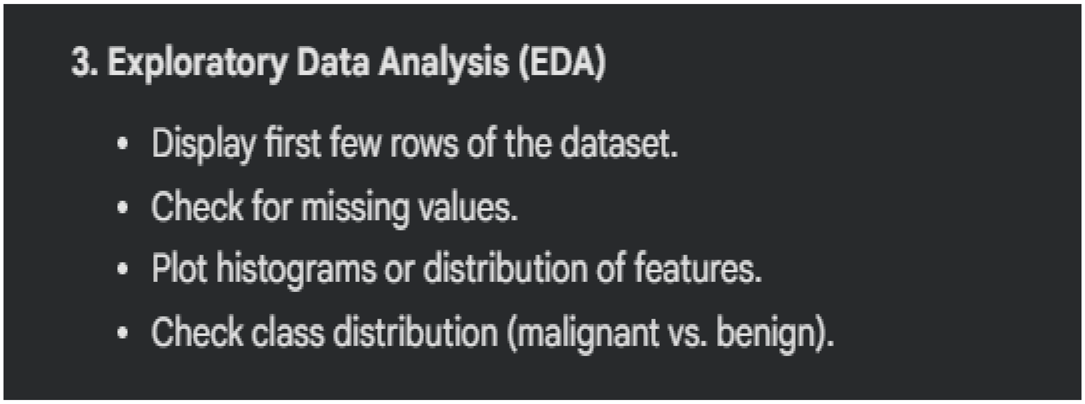
```
import numpy as np
import pandas as pd
import matplotlib.pyplot as plt
import seaborn as sns

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 accuracy_score, confusion_matrix, classification_report
```



2. Load Dataset

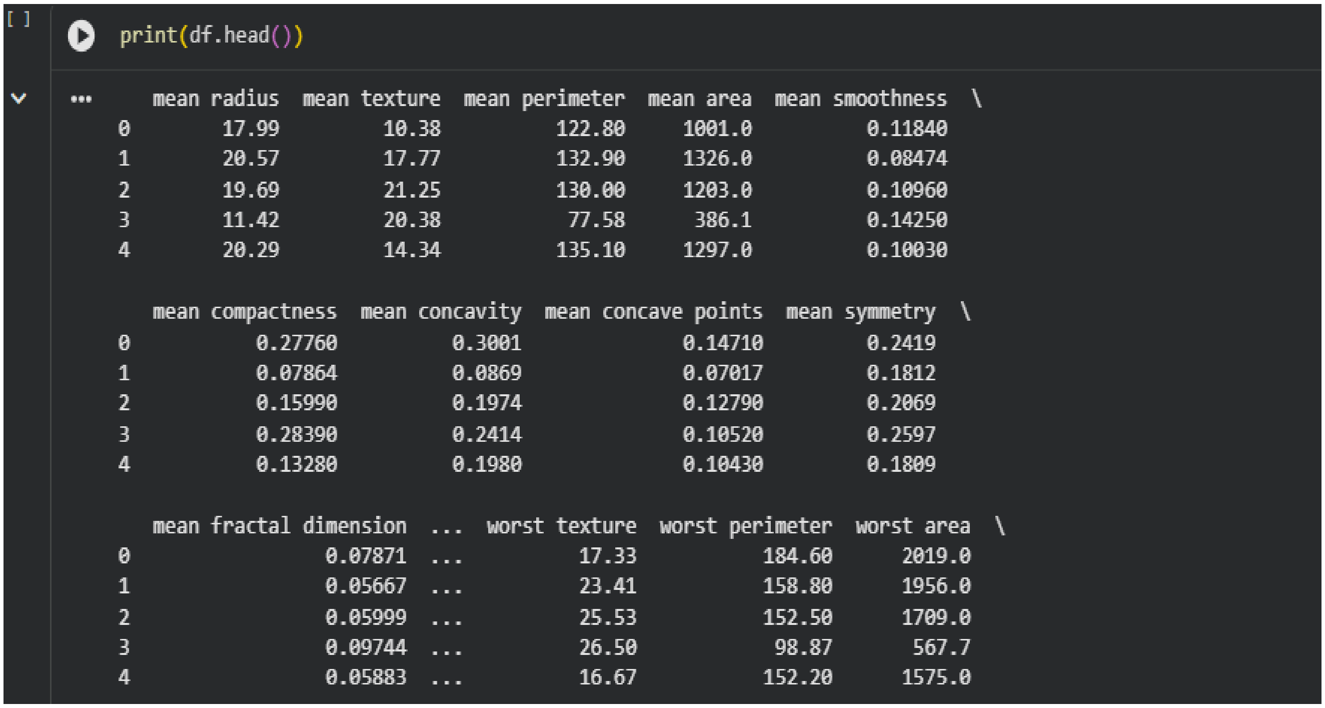
- Use a dataset Breast Cancer Dataset from sklearn.datasets.

```
data = load_breast_cancer()
df = pd.DataFrame(data.data, columns=data.feature_names)
df['target'] = data.target
```



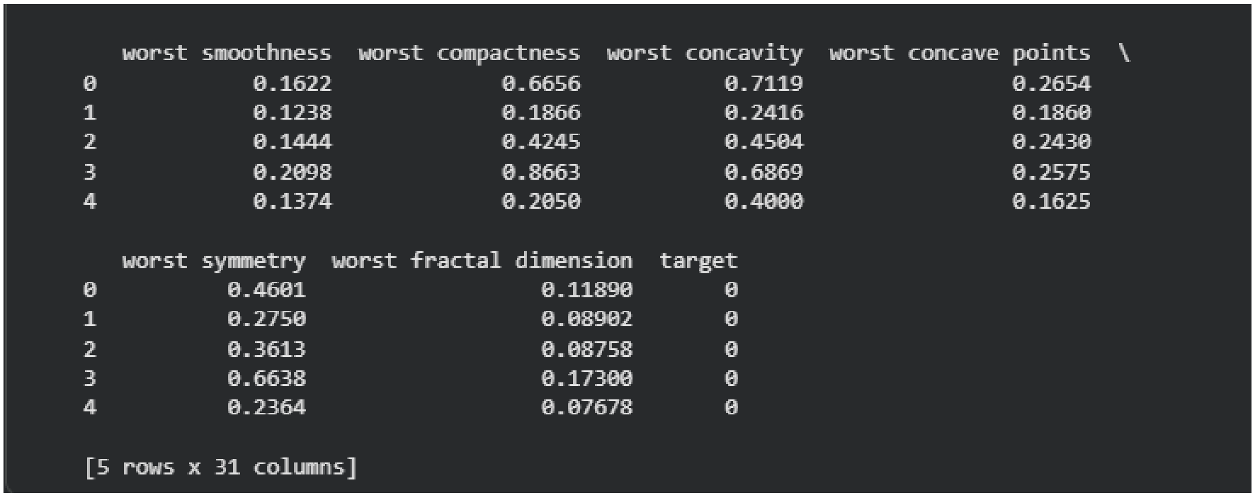
3. Exploratory Data Analysis (EDA)

- Display first few rows of the dataset.
- Check for missing values.
- Plot histograms or distribution of features.
- Check class distribution (malignant vs. benign).

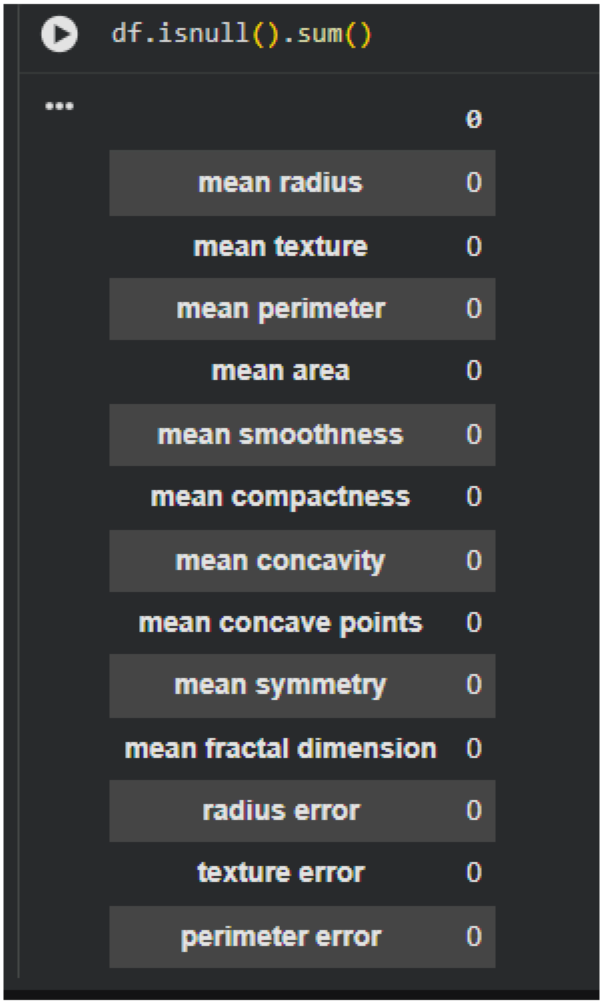


```
print(df.head())
```

```
   mean radius  mean texture  mean perimeter  mean area  mean smoothness  \
0        17.99         10.38          122.80     1001.0          0.11840   
1        20.57         17.77          132.90     1326.0          0.08474   
2        19.69         21.25          130.00     1203.0          0.10960   
3        11.42         20.38           77.58      386.1          0.14250   
4        20.29         14.34          135.10     1297.0          0.10030   

   mean compactness  mean concavity  mean concave points  mean symmetry  \
0           0.27760          0.3001              0.14710         0.2419   
1           0.07864          0.0869              0.07017         0.1812   
2           0.15990          0.1974              0.12790         0.2069   
3           0.28390          0.2414              0.10520         0.2597   
4           0.13280          0.1980              0.10430         0.1809   

   mean fractal dimension  ...  worst texture  worst perimeter  worst area  \
0                 0.07871  ...          17.33           184.60      2019.0   
1                 0.05667  ...          23.41           158.80      1956.0   
2                 0.05999  ...          25.53           152.50      1709.0   
3                 0.09744  ...          26.50            98.87       567.7   
4                 0.05883  ...          16.67           152.20      1575.0   
```

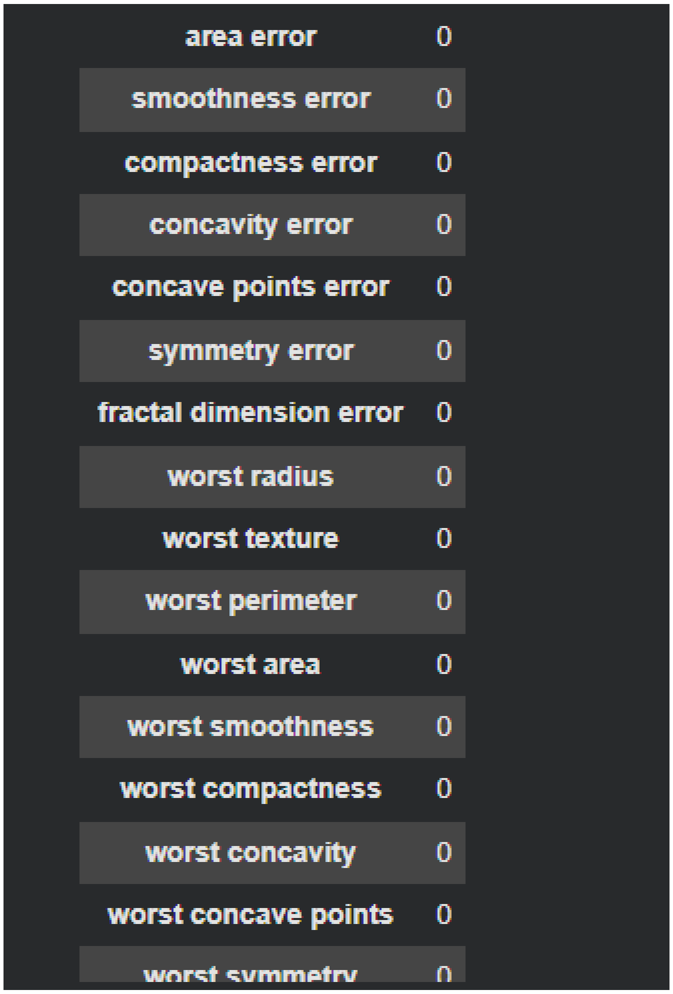


```
   worst smoothness  worst compactness  worst concavity  worst concave points  \
0            0.1622             0.6656           0.7119                0.2654   
1            0.1238             0.1866           0.2416                0.1860   
2            0.1444             0.4245           0.4504                0.2430   
3            0.2098             0.8663           0.6869                0.2575   
4            0.1374             0.2050           0.4000                0.1625   

   worst symmetry  worst fractal dimension  target  
0          0.4601                  0.11890       0  
1          0.2750                  0.08902       0  
2          0.3613                  0.08758       0  
3          0.6638                  0.17300       0  
4          0.2364                  0.07678       0  

[5 rows x 31 columns]
```

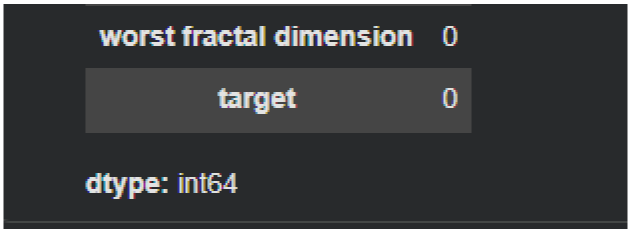


```
df.isnull().sum()
```

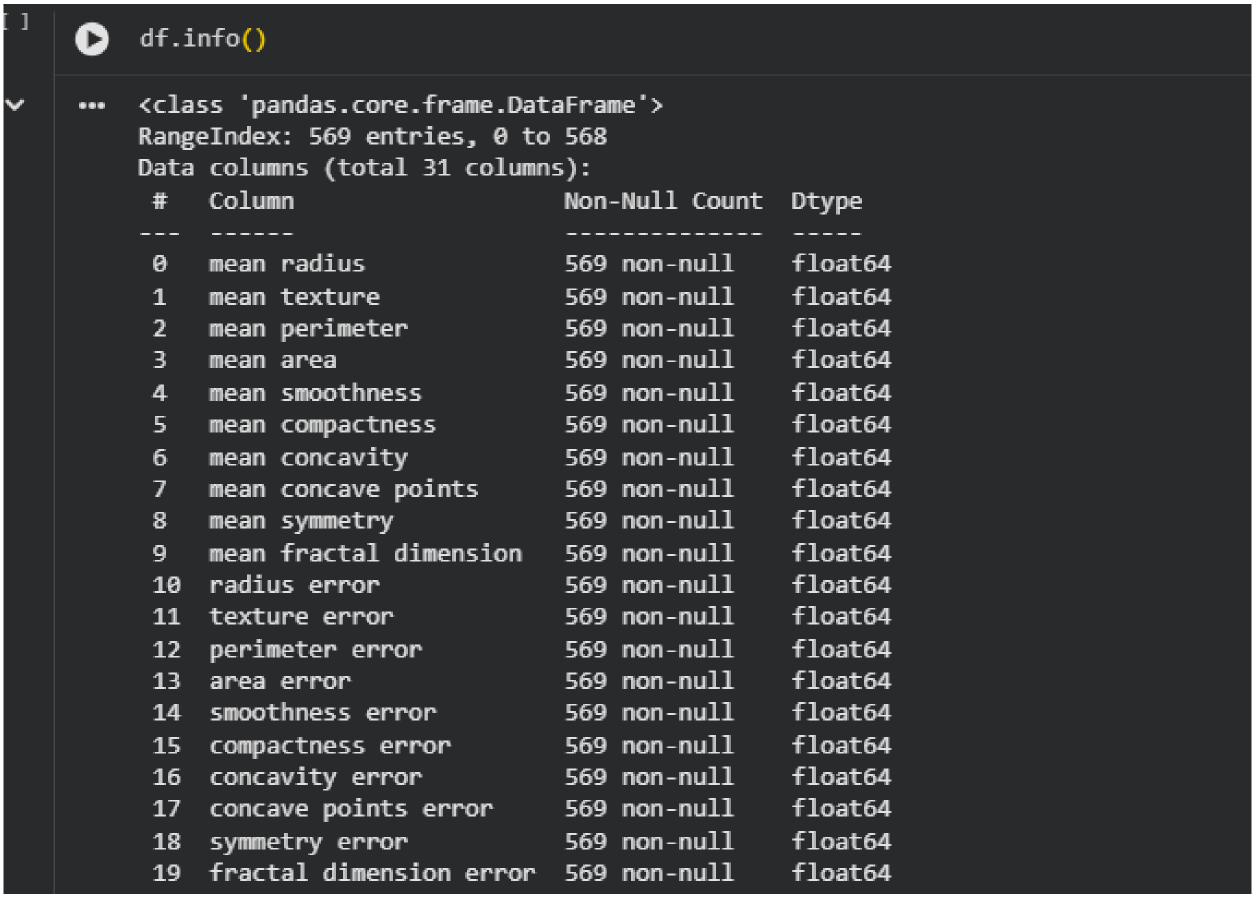
```
                             0
            mean radius      0
           mean texture      0
         mean perimeter      0
              mean area      0
        mean smoothness      0
       mean compactness      0
         mean concavity      0
    mean concave points      0
          mean symmetry      0
mean fractal dimension       0
           radius error      0
          texture error      0
        perimeter error      0
```



```
              area error  0
        smoothness error  0
       compactness error  0
         concavity error  0
    concave points error  0
          symmetry error  0
fractal dimension error  0
            worst radius  0
           worst texture  0
         worst perimeter  0
              worst area  0
        worst smoothness  0
       worst compactness  0
         worst concavity  0
    worst concave points  0
          worst symmetry  0
```

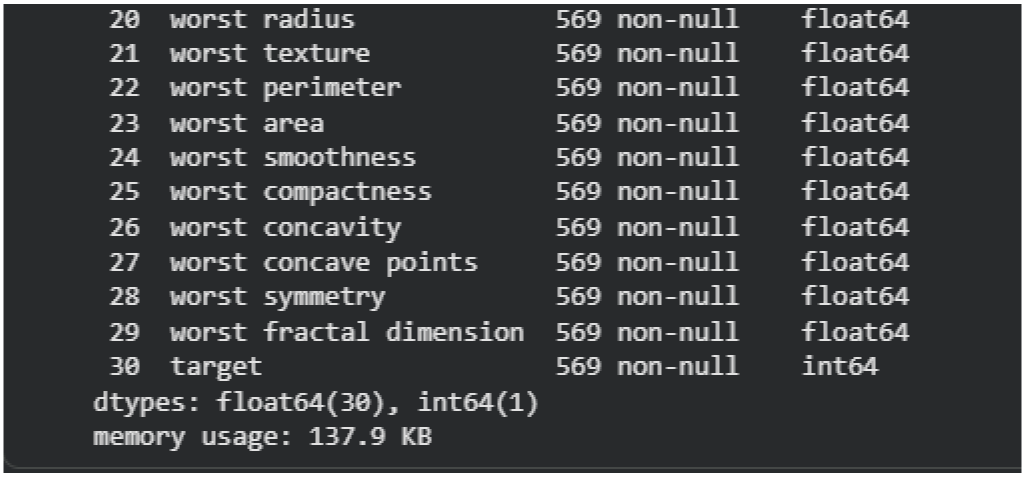


```
worst fractal dimension  0
                 target  0

dtype: int64
```

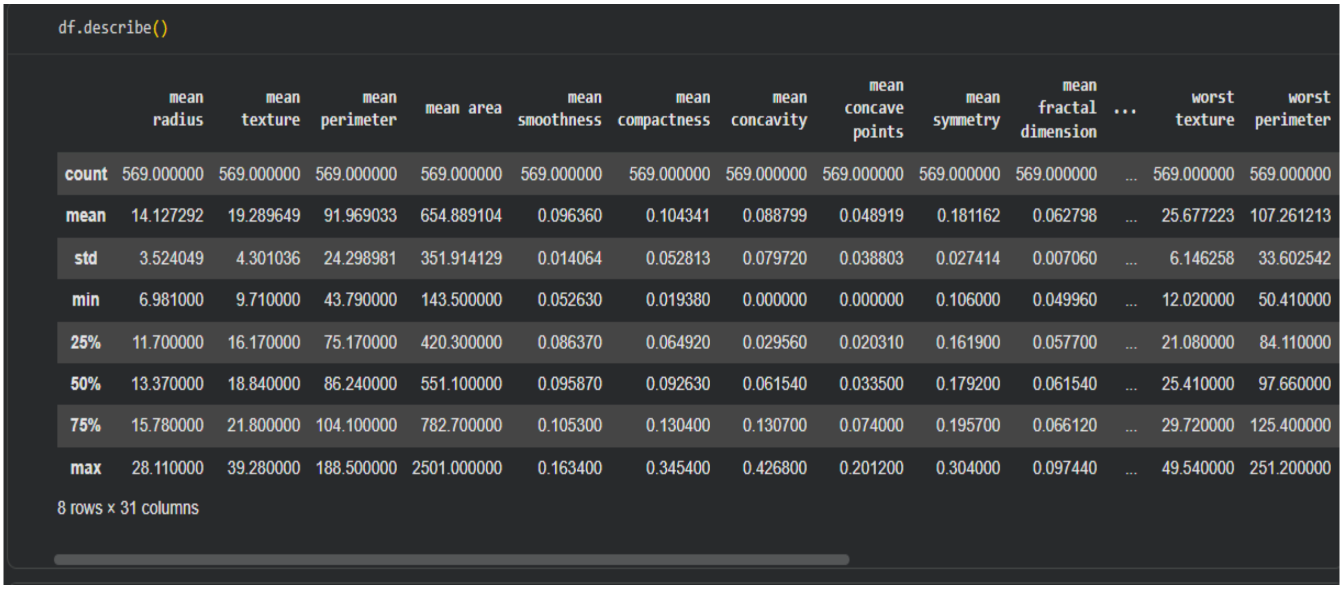


```
df.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 569 entries, 0 to 568
Data columns (total 31 columns):
 #   Column                   Non-Null Count  Dtype  
---  ------                   --------------  -----  
 0   mean radius              569 non-null    float64
 1   mean texture             569 non-null    float64
 2   mean perimeter           569 non-null    float64
 3   mean area                569 non-null    float64
 4   mean smoothness          569 non-null    float64
 5   mean compactness         569 non-null    float64
 6   mean concavity           569 non-null    float64
 7   mean concave points      569 non-null    float64
 8   mean symmetry            569 non-null    float64
 9   mean fractal dimension   569 non-null    float64
 10  radius error             569 non-null    float64
 11  texture error            569 non-null    float64
 12  perimeter error          569 non-null    float64
 13  area error               569 non-null    float64
 14  smoothness error         569 non-null    float64
 15  compactness error        569 non-null    float64
 16  concavity error          569 non-null    float64
 17  concave points error     569 non-null    float64
 18  symmetry error           569 non-null    float64
 19  fractal dimension error  569 non-null    float64
```

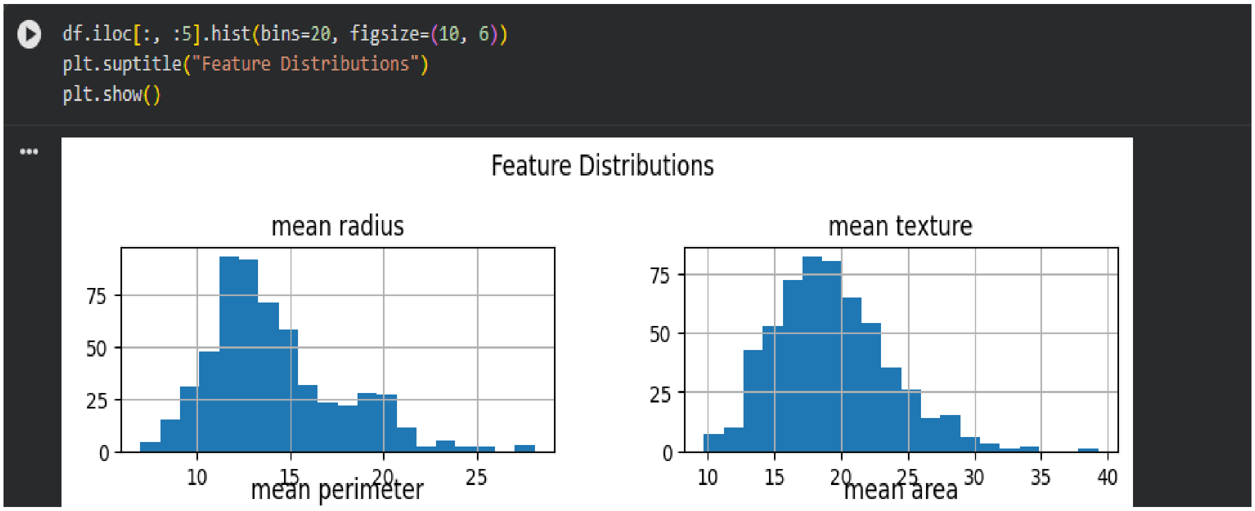


```
 20  worst radius             569 non-null    float64
 21  worst texture            569 non-null    float64
 22  worst perimeter          569 non-null    float64
 23  worst area               569 non-null    float64
 24  worst smoothness         569 non-null    float64
 25  worst compactness        569 non-null    float64
 26  worst concavity          569 non-null    float64
 27  worst concave points     569 non-null    float64
 28  worst symmetry           569 non-null    float64
 29  worst fractal dimension  569 non-null    float64
 30  target                   569 non-null    int64  
dtypes: float64(30), int64(1)
memory usage: 137.9 KB
```

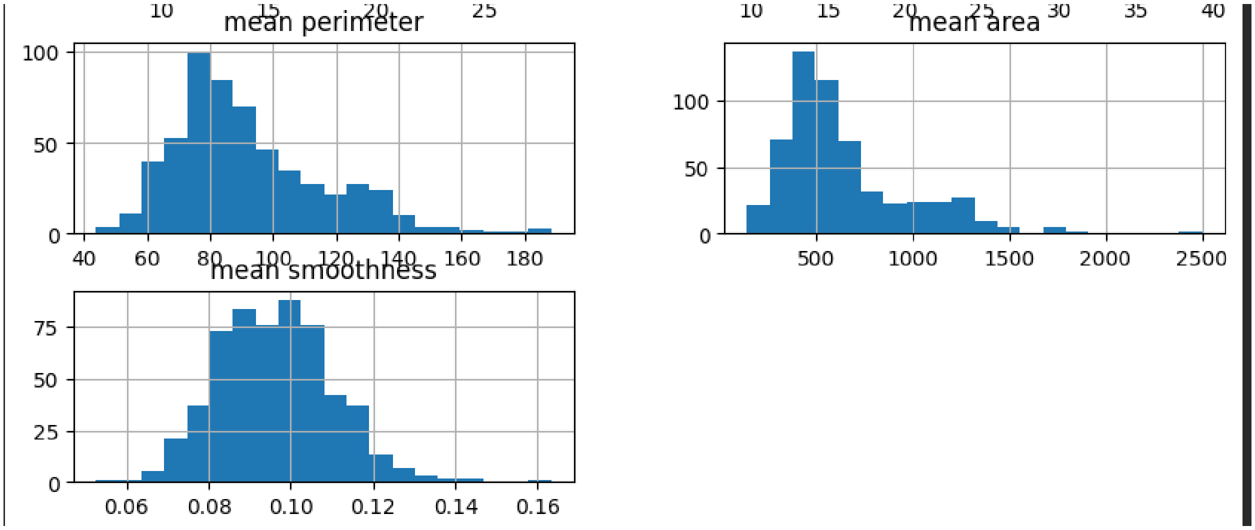


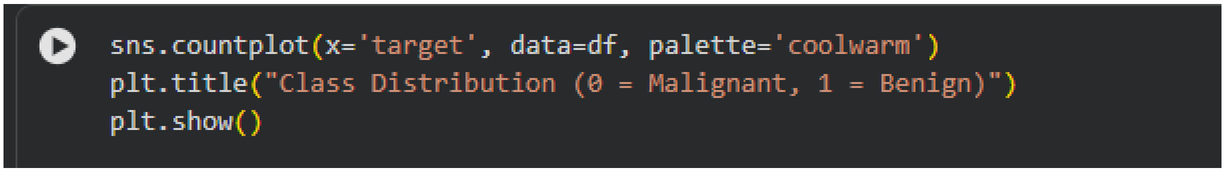
```
df.describe()
```

```
             mean        mean        mean    mean area        mean         mean        mean        mean        mean        mean  ...       worst       worst
           radius     texture   perimeter              smoothness  compactness   concavity     concave    symmetry     fractal  ...     texture   perimeter
                                                                                                points               dimension
count  569.000000  569.000000  569.000000   569.000000  569.000000   569.000000  569.000000  569.000000  569.000000  569.000000  ...  569.000000  569.000000
mean    14.127292   19.289649   91.969033   654.889104    0.096360     0.104341    0.088799    0.048919    0.181162    0.062798  ...   25.677223  107.261213
std      3.524049    4.301036   24.298981   351.914129    0.014064     0.052813    0.079720    0.038803    0.027414    0.007060  ...    6.146258   33.602542
min      6.981000    9.710000   43.790000   143.500000    0.052630     0.019380    0.000000    0.000000    0.106000    0.049960  ...   12.020000   50.410000
25%     11.700000   16.170000   75.170000   420.300000    0.086370     0.064920    0.029560    0.020310    0.161900    0.057700  ...   21.080000   84.110000
50%     13.370000   18.840000   86.240000   551.100000    0.095870     0.092630    0.061540    0.033500    0.179200    0.061540  ...   25.410000   97.660000
75%     15.780000   21.800000  104.100000   782.700000    0.105300     0.130400    0.130700    0.074000    0.195700    0.066120  ...   29.720000  125.400000
max     28.110000   39.280000  188.500000  2501.000000    0.163400     0.345400    0.426800    0.201200    0.304000    0.097440  ...   49.540000  251.200000

8 rows × 31 columns
```

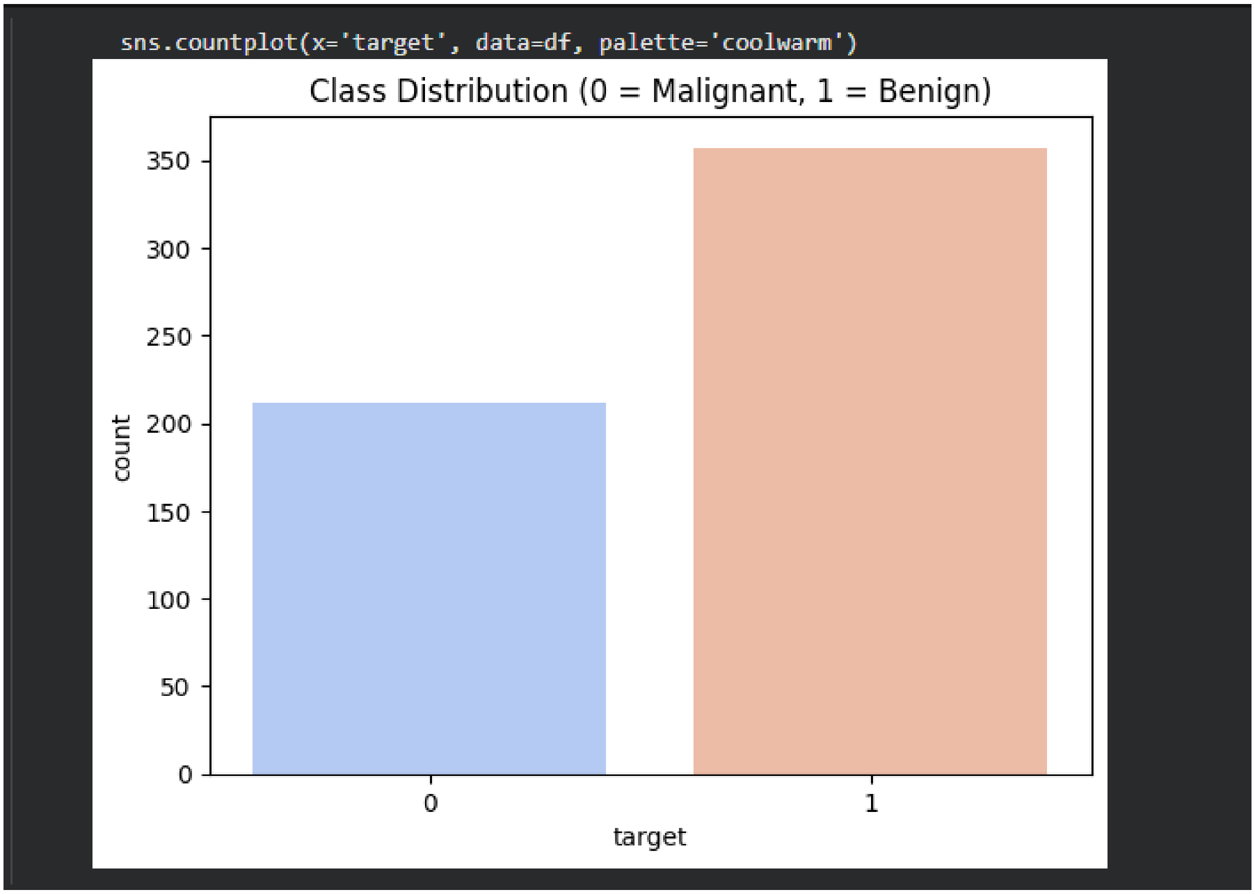


```
df.iloc[:, :5].hist(bins=20, figsize=(10, 6))
plt.suptitle("Feature Distributions")
plt.show()
```





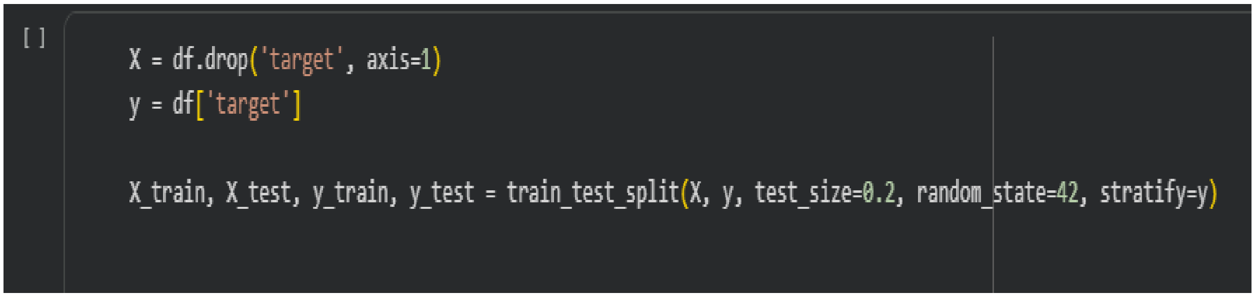
```python
sns.countplot(x='target', data=df, palette='coolwarm')
plt.title("Class Distribution (0 = Malignant, 1 = Benign)")
plt.show()
```



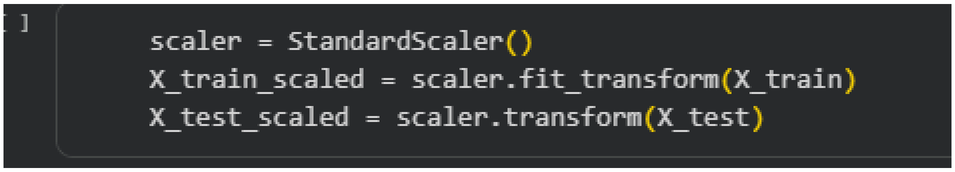
```
sns.countplot(x='target', data=df, palette='coolwarm')
```

4. Data Preprocessing

- Split features and labels.
- Standardize features using StandardScaler.
- Train-test split.



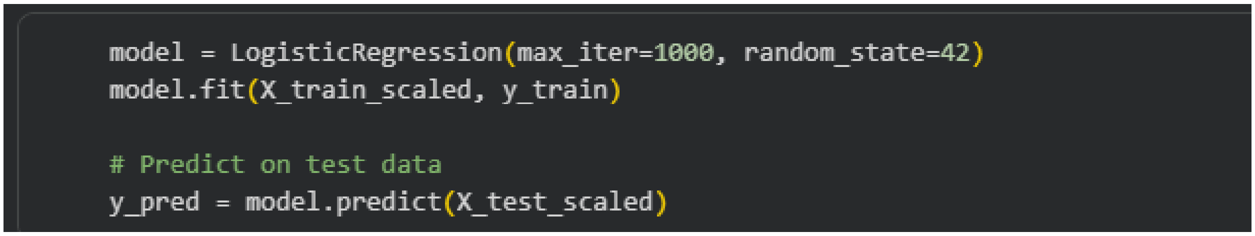
```python
X = df.drop('target', axis=1)
y = df['target']

X_train, X_test, y_train, y_test = train_test_split(X, y, test_size=0.2, random_state=42, stratify=y)
```



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

5. Model Implementation

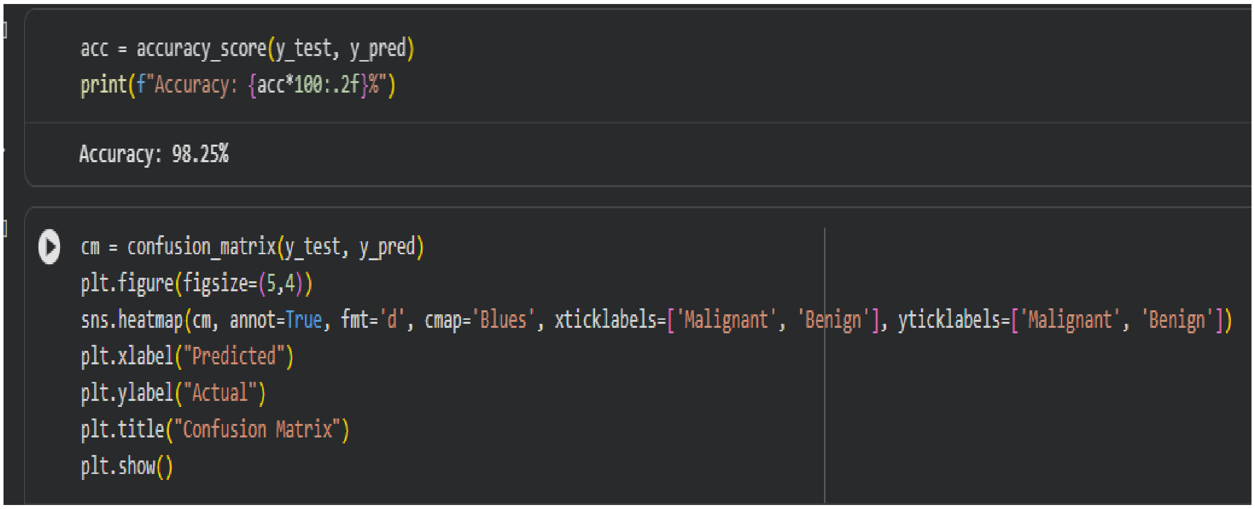
- Use sklearn.linear_model.LogisticRegression.
- Train the model on the training data.
- Predict on the test data.



```
model = LogisticRegression(max_iter=1000, random_state=42)
model.fit(X_train_scaled, y_train)

# Predict on test data
y_pred = model.predict(X_test_scaled)
```

6. Evaluation

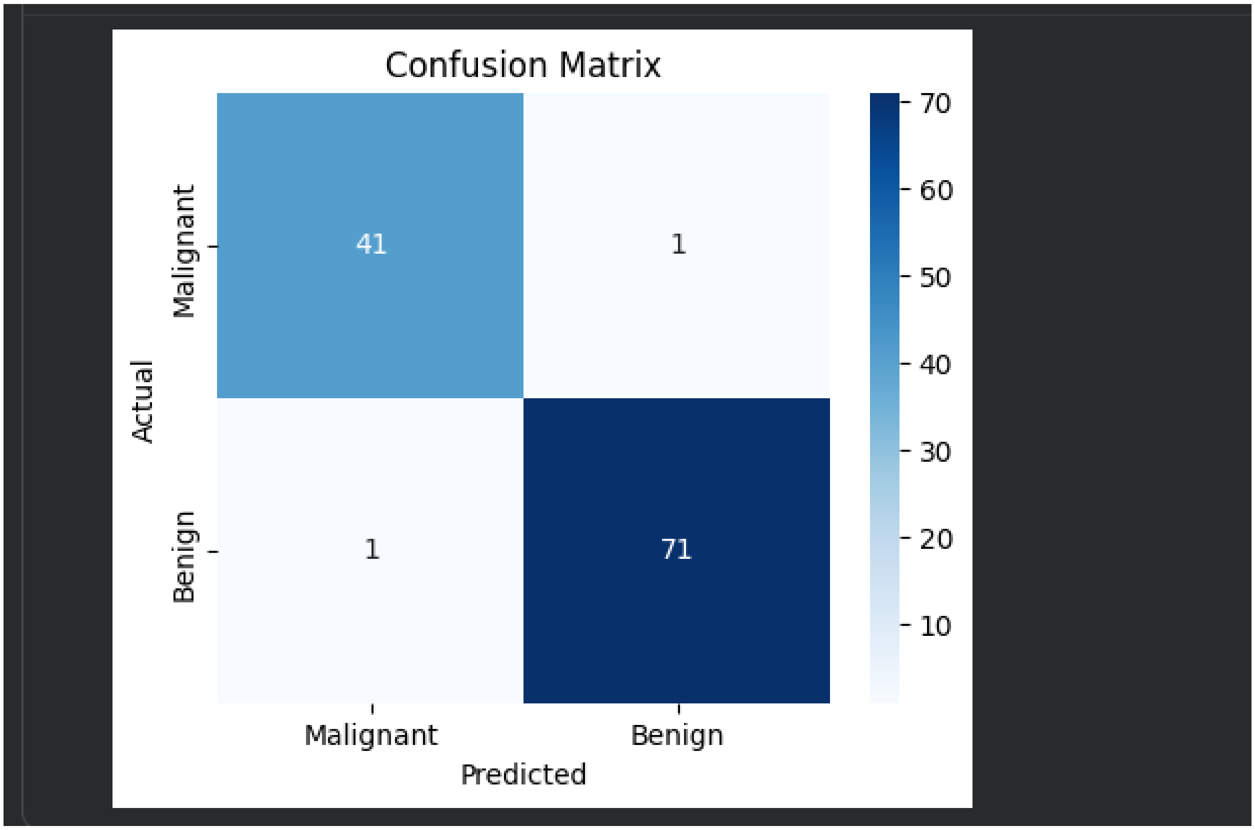
- Accuracy score.
- Confusion matrix.
- Precision, Recall, F1-score

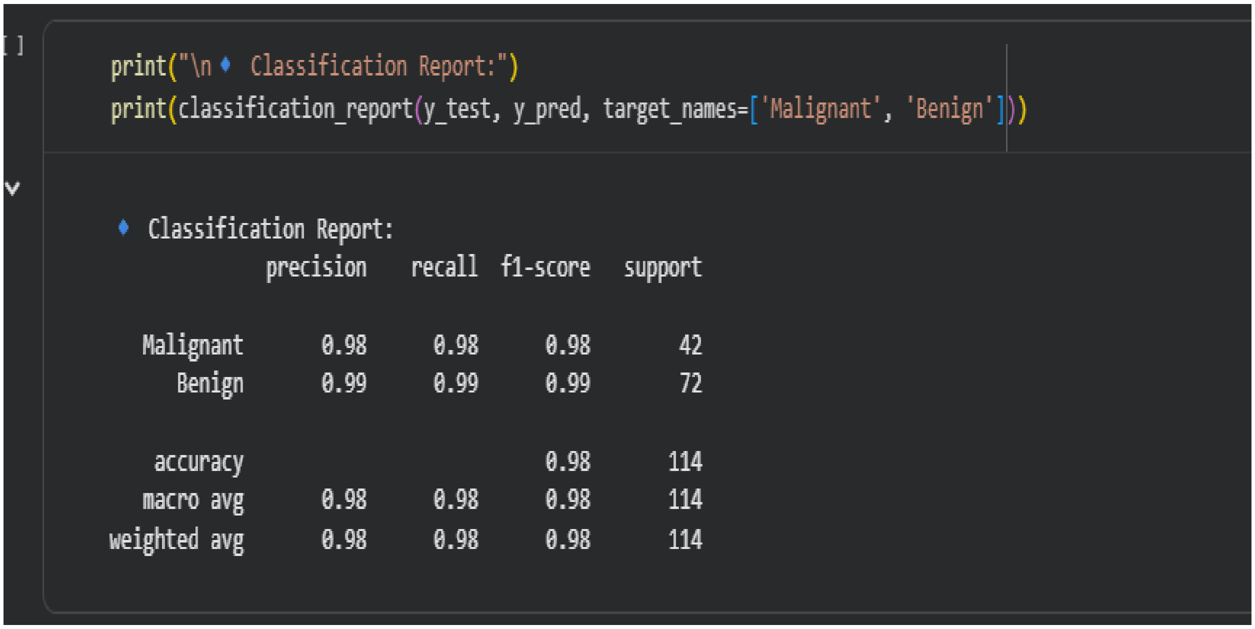


```
acc = accuracy_score(y_test, y_pred)
print(f"Accuracy: {acc*100:.2f}%")
```

```
Accuracy: 98.25%
```

```
cm = confusion_matrix(y_test, y_pred)
plt.figure(figsize=(5,4))
sns.heatmap(cm, annot=True, fmt='d', cmap='Blues', xticklabels=['Malignant', 'Benign'], yticklabels=['Malignant', 'Benign'])
plt.xlabel("Predicted")
plt.ylabel("Actual")
plt.title("Confusion Matrix")
plt.show()
```





```
print("\n🔹 Classification Report:")
print(classification_report(y_test, y_pred, target_names=['Malignant', 'Benign']))
```

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

   Malignant       0.98      0.98      0.98        42
      Benign       0.99      0.99      0.99        72

    accuracy                           0.98       114
   macro avg       0.98      0.98      0.98       114
weighted avg       0.98      0.98      0.98       114
```