```
import pandas as pd
import numpy as np
import matplotlib.pyplot as plt
import seaborn as sns
from sklearn.model_selection import train_test_split , cross_val_score , GridSearchCV
from sklearn.preprocessing import StandardScaler
from sklearn.metrics import r2_score , accuracy_score
from sklearn.ensemble import AdaBoostClassifier
from sklearn.tree import DecisionTreeClassifier
data = pd.read_csv('data.csv')
data.describe()
     Show hidden output
data.drop(['id', 'Unnamed: 32'], axis = 1, inplace = True)
data.head()
data['diagnosis'].unique()
⇒ array(['M', 'B'], dtype=object)
data['diagnosis'] = data['diagnosis'].apply(lambda val: 1 if val == 'M' else 0)
data.head()
data.isnull().sum()
```

```
data.dtypes

fig, ax = plt.subplots(16,2, figsize=(12,12))
axes_ = [axes_row for axes in ax for axes_row in axes]
```

```
fig, ax = plt.subplots(16,2, figsize=(12,12))
axes_ = [axes_row for axes in ax for axes_row in axes]

for i, j in enumerate(data.columns):
    g = sns.boxplot(x = data[j], ax = axes_[i])
    g.set_title(j)
    plt.tight_layout()

plt.figure(figsize = (20, 15))
plotnumber = 1
```

```
plt.figure(figsize = (20, 15))
plotnumber = 1

for column in data:
    if plotnumber <= 30:
        ax = plt.subplot(5, 6, plotnumber)
        sns.distplot(data[column])
        plt.xlabel(column)

    plotnumber += 1

plt.tight_layout()
plt.show()</pre>
```

```
plt.figure(figsize = (20, 12))

corr = data.corr()
mask = np.triu(np.ones_like(corr, dtype = bool))

sns.heatmap(corr, mask = mask, linewidths = 1, annot = True, fmt = ".2f")
plt.show()
```

```
diagnosis -
          radius_mean - 0.73
         texture_mean - 0.42 0.32
       perimeter_mean - 0.74 1.00 0.33
            area_mean - 0.71 0.99 0.32 0.99
     smoothness_mean - 0.36 0.17 -0.02 0.21 0.18
    compactness_mean - 0.60 0.51 0.24
       concavity_mean - 0.70
                                   0.30 0.72
                                                   0.52 0.88
  concave points_mean - 0.78 0.82 0.29 0.85 0.82
                                                    0.55 0.83 0.92
       symmetry_mean - 0.33 0.15 0.07 0.18 0.15
                                                              0.50 0.46
fractal_dimension_mean --0.01 -0.31 -0.08 -0.26 -0.28
                                                         0.57 0.34 0.17
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              radius_se - 0.57
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          perimeter_se - 0.56
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               area_se - 0.55 0.74 0.26 0.74 0.80
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        smoothness_se --0.07 -0.22 0.01 -0.20 -0.17
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       compactness_se - 0.29 0.21
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          concavity_se - 0.25 0.19 0.14 0.23 0.21
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          symmetry_se --0.01 -0.10 0.01 -0.08 -0.07
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   fractal dimension se - 0.08 -0.04 0.05 -0.01 -0.02
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       perimeter worst - 0.78 0.97 0.36 0.97 0.96 0.24
                                                          0.59 0.73 0.86 0.22 -0.21 0.72 -0.10
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            area worst - 0.73 0.94 0.34 0.94 0.96 0.21
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     smoothness_worst - 0.42 0.12
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```

```
corr_matrix = data.corr().abs()
mask = np.triu(np.ones_like(corr_matrix, dtype = bool))
tri_data = corr_matrix.mask(mask)
to_drop = [x for x in tri_data.columns if any(tri_data[x] > 0.92)]
data = data.drop(to_drop, axis = 1)
print(f"The reduced dataframe has {df.shape[1]} columns.")
    The reduced dataframe has 23 columns.
X = data.drop('diagnosis', axis = 1)
y = data['diagnosis']
X.shape
→ (569, 22)
base = DecisionTreeClassifier()
```

model = AdaBoostClassifier(estimator=base)

```
param_grid = {
    'n_estimators': [50, 100, 180 , 200],
    'learning_rate': [0.01, 0.1, 0.5, 1.0],
grid_search = GridSearchCV(estimator=model, param_grid=param_grid,
                          cv=5, scoring='accuracy', n_jobs=-1)
grid_search.fit(X, y)
print("Best Parameters:", grid_search.best_params_)
Best Parameters: {'learning_rate': 0.1, 'n_estimators': 200}
X_train , X_test , y_train , y_test = train_test_split(X , y , test_size=0.3 , random_state=0)
sc = StandardScaler()
sc.fit(X_train)
X train = sc.transform(X train)
X_test = sc.transform(X_test)
ada = AdaBoostClassifier(base, n_estimators = 180)
ada.fit(X_train, y_train)
```

```
AdaBoostClassifier

y_pred = ada.predict(X_test)

print(accuracy_score(y_test, y_pred))

0.9298245614035088

print(accuracy_score(y_train, ada.predict(X_train)))

ada_acc = accuracy_score(y_test, y_pred)
print(ada_acc)

1.0
0.9298245614035088
```