krishna-chaitanya-aasgn-4

September 27, 2023

```python
[ ]: # This Python 3 environment comes with many helpful analytics libraries␣
     ↪installed
     # It is defined by the kaggle/python Docker image: https://github.com/kaggle/
     ↪docker-python
     # For example, here's several helpful packages to load

     import numpy as np # linear algebra
     import pandas as pd # data processing, CSV file I/O (e.g. pd.read_csv)

     # Input data files are available in the read-only "../input/" directory
     # For example, running this (by clicking run or pressing Shift+Enter) will list␣
     ↪all files under the input directory

     import os
     for dirname, _, filenames in os.walk('/kaggle/input'):
         for filename in filenames:
             print(os.path.join(dirname, filename))

     # You can write up to 20GB to the current directory (/kaggle/working/) that␣
     ↪gets preserved as output when you create a version using "Save & Run All"
     # You can also write temporary files to /kaggle/temp/, but they won't be saved␣
     ↪outside of the current session
```

```python
[1]: import pandas as pd
     import numpy as np
     import matplotlib.pyplot as plt
     import seaborn as sns
```

```python
[7]: df=pd.read_csv("/kaggle/input/employee-attrition/
     ↪WA_Fn-UseC_-HR-Employee-Attrition.csv",sep=",",encoding="utf-8")
     df
```

```
[7]:      Age Attrition     BusinessTravel  DailyRate              Department  \
     0     41       Yes      Travel_Rarely       1102                   Sales
     1     49        No  Travel_Frequently        279  Research & Development
     2     37       Yes      Travel_Rarely       1373  Research & Development
     3     33        No  Travel_Frequently       1392  Research & Development
```

```
4       27      No         Travel_Rarely       591  Research & Development
...     ...          ...                   ...    ...                   ...
1465    36      No   Travel_Frequently       884  Research & Development
1466    39      No         Travel_Rarely     613  Research & Development
1467    27      No         Travel_Rarely     155  Research & Development
1468    49      No   Travel_Frequently      1023                    Sales
1469    34      No         Travel_Rarely     628  Research & Development


      DistanceFromHome   Education EducationField  EmployeeCount  \
0                    1           2  Life Sciences              1
1                    8           1  Life Sciences              1
2                    2           2          Other              1
3                    3           4  Life Sciences              1
4                    2           1        Medical              1
...                 ...         ...            ...            ...
1465                23           2        Medical              1
1466                 6           1        Medical              1
1467                 4           3  Life Sciences              1
1468                 2           3        Medical              1
1469                 8           3        Medical              1


      EmployeeNumber  …  RelationshipSatisfaction  StandardHours  \
0                  1  …                         1             80
1                  2  …                         4             80
2                  4  …                         2             80
3                  5  …                         3             80
4                  7  …                         4             80
...              ...  …                       ...            ...
1465            2061  …                         3             80
1466            2062  …                         1             80
1467            2064  …                         2             80
1468            2065  …                         4             80
1469            2068  …                         1             80


      StockOptionLevel  TotalWorkingYears  TrainingTimesLastYear  \
0                    0                  8                      0
1                    1                 10                      3
2                    0                  7                      3
3                    0                  8                      3
4                    1                  6                      3
...                ...                ...                    ...
1465                 1                 17                      3
1466                 1                  9                      5
1467                 1                  6                      0
1468                 0                 17                      3
1469                 0                  6                      3
```

```
     WorkLifeBalance  YearsAtCompany YearsInCurrentRole  \
0                  1               6                  4
1                  3              10                  7
2                  3               0                  0
3                  3               8                  7
4                  3               2                  2
...              ...             ...                ...
1465               3               5                  2
1466               3               7                  7
1467               3               6                  2
1468               2               9                  6
1469               4               4                  3

     YearsSinceLastPromotion  YearsWithCurrManager
0                          0                     5
1                          1                     7
2                          0                     0
3                          3                     0
4                          2                     2
...                      ...                   ...
1465                       0                     3
1466                       1                     7
1467                       0                     3
1468                       0                     8
1469                       1                     2

[1470 rows x 35 columns]
```

[8]: `df.shape`

[8]: (1470, 35)

[9]: `df.sample(10)`

[9]:
```
      Age Attrition     BusinessTravel  DailyRate              Department  \
278    26        No  Travel_Frequently       1479  Research & Development
927    36        No      Travel_Rarely        429  Research & Development
768    40        No      Travel_Rarely        300                   Sales
472    37        No      Travel_Rarely        446  Research & Development
1284   39        No      Travel_Rarely       1253  Research & Development
487    20        No      Travel_Rarely        959  Research & Development
1210   33        No      Travel_Rarely        267  Research & Development
1019   36        No      Travel_Rarely        329                   Sales
543    44        No         Non-Travel        381  Research & Development
1229   40        No      Travel_Rarely        369  Research & Development

      DistanceFromHome  Education EducationField  EmployeeCount  \
```

```
278                     1       3  Life Sciences               1
927                     2       4  Life Sciences               1
768                    26       3      Marketing               1
472                     1       4  Life Sciences               1
1284                   10       1        Medical               1
487                     1       3  Life Sciences               1
1210                   21       3        Medical               1
1019                   16       4      Marketing               1
543                    24       3        Medical               1
1229                    8       2  Life Sciences               1

       EmployeeNumber  …  RelationshipSatisfaction  StandardHours  \
278               384  …                         1             80
927              1294  …                         4             80
768              1066  …                         2             80
472               635  …                         2             80
1284             1800  …                         3             80
487               657  …                         4             80
1210             1698  …                         4             80
1019             1436  …                         1             80
543               744  …                         3             80
1229             1724  …                         2             80

       StockOptionLevel  TotalWorkingYears  TrainingTimesLastYear  \
278                   1                  6                      6
927                   0                 18                      2
768                   1                  8                      3
472                   1                  8                      2
1284                  0                  9                      3
487                   0                  1                      0
1210                  3                 14                      6
1019                  2                 11                      3
543                   0                  9                      5
1229                  1                 18                      3

       WorkLifeBalance  YearsAtCompany  YearsInCurrentRole  \
278                  1               6                   5
927                  3              16                  14
768                  2               7                   7
472                  2               6                   5
1284                 3               4                   3
487                  4               1                   0
1210                 3              14                  11
1019                 2               3                   2
543                  3               5                   2
1229                 3               1                   0
```

```
     YearsSinceLastPromotion  YearsWithCurrManager
278                        1                     4
927                        5                    12
768                        7                     5
472                        4                     3
1284                       2                     2
487                        0                     0
1210                       2                    13
1019                       0                     2
543                        1                     4
1229                       0                     0

[10 rows x 35 columns]
```

[10]: `df.info()`

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 1470 entries, 0 to 1469
Data columns (total 35 columns):
 #   Column                   Non-Null Count  Dtype
---  ------                   --------------  -----
 0   Age                      1470 non-null   int64
 1   Attrition                1470 non-null   object
 2   BusinessTravel           1470 non-null   object
 3   DailyRate                1470 non-null   int64
 4   Department               1470 non-null   object
 5   DistanceFromHome         1470 non-null   int64
 6   Education                1470 non-null   int64
 7   EducationField           1470 non-null   object
 8   EmployeeCount            1470 non-null   int64
 9   EmployeeNumber           1470 non-null   int64
 10  EnvironmentSatisfaction  1470 non-null   int64
 11  Gender                   1470 non-null   object
 12  HourlyRate               1470 non-null   int64
 13  JobInvolvement           1470 non-null   int64
 14  JobLevel                 1470 non-null   int64
 15  JobRole                  1470 non-null   object
 16  JobSatisfaction          1470 non-null   int64
 17  MaritalStatus            1470 non-null   object
 18  MonthlyIncome            1470 non-null   int64
 19  MonthlyRate              1470 non-null   int64
 20  NumCompaniesWorked       1470 non-null   int64
 21  Over18                   1470 non-null   object
 22  OverTime                 1470 non-null   object
 23  PercentSalaryHike        1470 non-null   int64
 24  PerformanceRating        1470 non-null   int64
 25  RelationshipSatisfaction 1470 non-null   int64
```

```
26  StandardHours           1470 non-null   int64
27  StockOptionLevel        1470 non-null   int64
28  TotalWorkingYears       1470 non-null   int64
29  TrainingTimesLastYear   1470 non-null   int64
30  WorkLifeBalance         1470 non-null   int64
31  YearsAtCompany          1470 non-null   int64
32  YearsInCurrentRole      1470 non-null   int64
33  YearsSinceLastPromotion 1470 non-null   int64
34  YearsWithCurrManager    1470 non-null   int64
dtypes: int64(26), object(9)
memory usage: 402.1+ KB
```

[11]: `df.nunique()`

[11]:
```
Age                        43
Attrition                   2
BusinessTravel              3
DailyRate                 886
Department                  3
DistanceFromHome           29
Education                   5
EducationField              6
EmployeeCount               1
EmployeeNumber           1470
EnvironmentSatisfaction     4
Gender                      2
HourlyRate                 71
JobInvolvement              4
JobLevel                    5
JobRole                     9
JobSatisfaction             4
MaritalStatus               3
MonthlyIncome            1349
MonthlyRate              1427
NumCompaniesWorked         10
Over18                      1
OverTime                    2
PercentSalaryHike          15
PerformanceRating           2
RelationshipSatisfaction    4
StandardHours               1
StockOptionLevel            4
TotalWorkingYears          40
TrainingTimesLastYear       7
WorkLifeBalance             4
YearsAtCompany             37
YearsInCurrentRole         19
```

```
YearsSinceLastPromotion        16
YearsWithCurrManager           18
dtype: int64
```

[14]: `df.describe()`

[14]:
	Age	DailyRate	DistanceFromHome	Education	EmployeeCount \
count	1470.000000	1470.000000	1470.000000	1470.000000	1470.0
mean	36.923810	802.485714	9.192517	2.912925	1.0
std	9.135373	403.509100	8.106864	1.024165	0.0
min	18.000000	102.000000	1.000000	1.000000	1.0
25%	30.000000	465.000000	2.000000	2.000000	1.0
50%	36.000000	802.000000	7.000000	3.000000	1.0
75%	43.000000	1157.000000	14.000000	4.000000	1.0
max	60.000000	1499.000000	29.000000	5.000000	1.0

	EmployeeNumber	EnvironmentSatisfaction	HourlyRate	JobInvolvement \
count	1470.000000	1470.000000	1470.000000	1470.000000
mean	1024.865306	2.721769	65.891156	2.729932
std	602.024335	1.093082	20.329428	0.711561
min	1.000000	1.000000	30.000000	1.000000
25%	491.250000	2.000000	48.000000	2.000000
50%	1020.500000	3.000000	66.000000	3.000000
75%	1555.750000	4.000000	83.750000	3.000000
max	2068.000000	4.000000	100.000000	4.000000

	JobLevel	…	RelationshipSatisfaction	StandardHours \
count	1470.000000	…	1470.000000	1470.0
mean	2.063946	…	2.712245	80.0
std	1.106940	…	1.081209	0.0
min	1.000000	…	1.000000	80.0
25%	1.000000	…	2.000000	80.0
50%	2.000000	…	3.000000	80.0
75%	3.000000	…	4.000000	80.0
max	5.000000	…	4.000000	80.0

	StockOptionLevel	TotalWorkingYears	TrainingTimesLastYear \
count	1470.000000	1470.000000	1470.000000
mean	0.793878	11.279592	2.799320
std	0.852077	7.780782	1.289271
min	0.000000	0.000000	0.000000
25%	0.000000	6.000000	2.000000
50%	1.000000	10.000000	3.000000
75%	1.000000	15.000000	3.000000
max	3.000000	40.000000	6.000000

	WorkLifeBalance	YearsAtCompany	YearsInCurrentRole \

```
count      1470.000000      1470.000000              1470.000000
mean          2.761224         7.008163                 4.229252
std           0.706476         6.126525                 3.623137
min           1.000000         0.000000                 0.000000
25%           2.000000         3.000000                 2.000000
50%           3.000000         5.000000                 3.000000
75%           3.000000         9.000000                 7.000000
max           4.000000        40.000000                18.000000

       YearsSinceLastPromotion  YearsWithCurrManager
count              1470.000000           1470.000000
mean                  2.187755              4.123129
std                   3.222430              3.568136
min                   0.000000              0.000000
25%                   0.000000              2.000000
50%                   1.000000              3.000000
75%                   3.000000              7.000000
max                  15.000000             17.000000

[8 rows x 26 columns]
```

[15]: `df.isnull().sum()`

```
[15]: Age                        0
      Attrition                  0
      BusinessTravel             0
      DailyRate                  0
      Department                 0
      DistanceFromHome           0
      Education                  0
      EducationField             0
      EmployeeCount              0
      EmployeeNumber             0
      EnvironmentSatisfaction    0
      Gender                     0
      HourlyRate                 0
      JobInvolvement             0
      JobLevel                   0
      JobRole                    0
      JobSatisfaction            0
      MaritalStatus              0
      MonthlyIncome              0
      MonthlyRate                0
      NumCompaniesWorked         0
      Over18                     0
      OverTime                   0
      PercentSalaryHike          0
```

```
PerformanceRating              0
RelationshipSatisfaction       0
StandardHours                  0
StockOptionLevel               0
TotalWorkingYears              0
TrainingTimesLastYear          0
WorkLifeBalance                0
YearsAtCompany                 0
YearsInCurrentRole             0
YearsSinceLastPromotion        0
YearsWithCurrManager           0
dtype: int64
```

[19]:
```python
# Select only numeric columns in your DataFrame
numeric_df = df.select_dtypes(include=['number'])

# Calculate the correlation matrix for numeric columns
correlation_matrix = numeric_df.corr()

# Create a heatmap
fig, ax = plt.subplots(figsize=(25, 25))
sns.heatmap(correlation_matrix, annot=True, cmap='coolwarm', fmt=".2f",
 ↪linewidths=0.5)
plt.show()
```
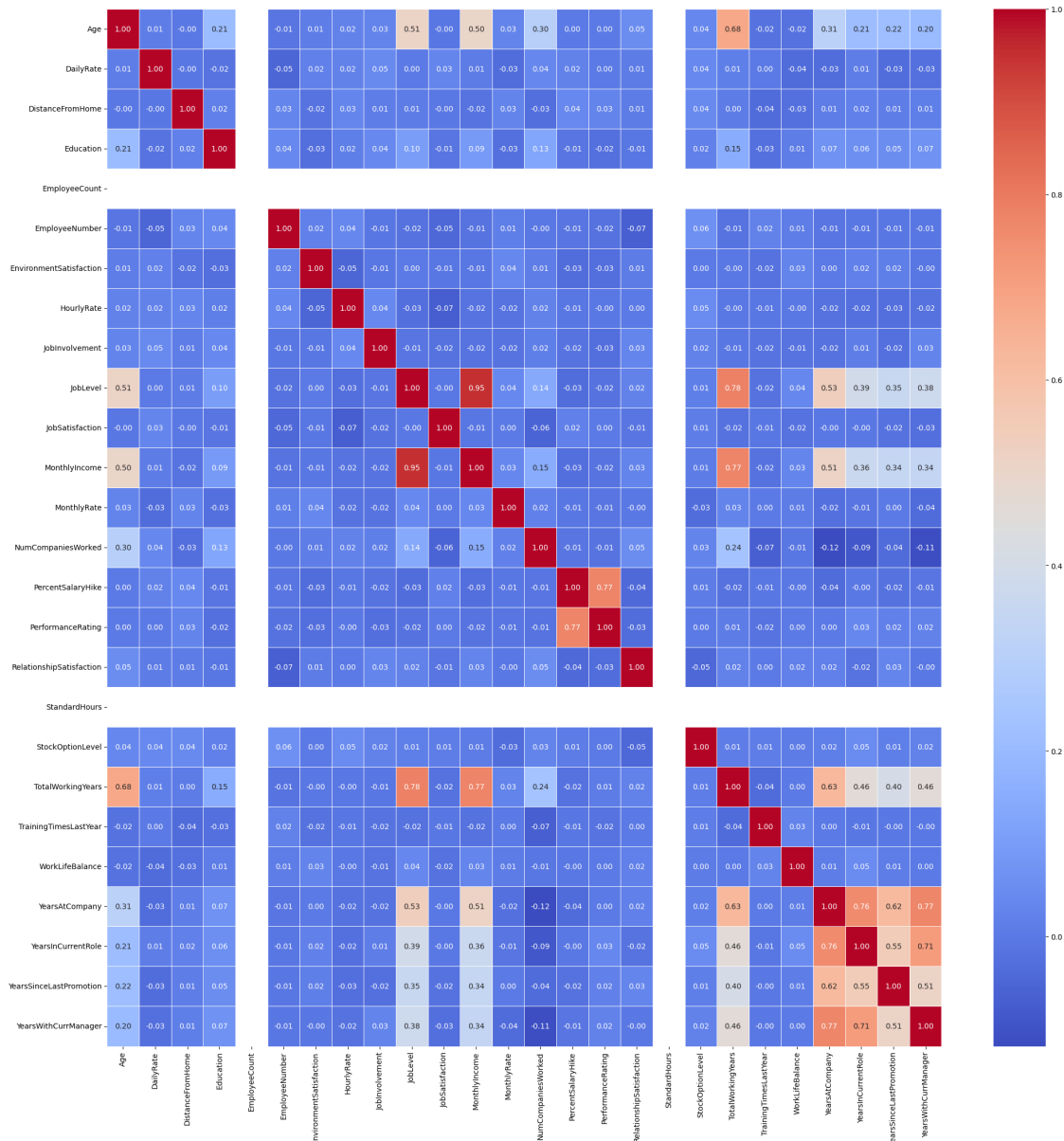
```
[ ]: sns.pairplot(data)
```

```
[23]: from sklearn.preprocessing import LabelEncoder
```

```
[25]: le=LabelEncoder()
```

```
[27]: df["BusinessTravel"]=le.fit_transform(df["BusinessTravel"])
      df["Department"]=le.fit_transform(df["Department"])
      df["EducationField"]=le.fit_transform(df["EducationField"])
      df["Gender"]=le.fit_transform(df["Gender"])
```

```python
df["JobRole"]=le.fit_transform(df["JobRole"])
df["MaritalStatus"]=le.fit_transform(df["MaritalStatus"])
df["Over18"]=le.fit_transform(df["Over18"])
df["OverTime"]=le.fit_transform(df["OverTime"])
df.head()
```

[27]:

	Age	Attrition	BusinessTravel	DailyRate	Department	DistanceFromHome \
0	41	Yes	2	1102	2	1
1	49	No	1	279	1	8
2	37	Yes	2	1373	1	2
3	33	No	1	1392	1	3
4	27	No	2	591	1	2

	Education	EducationField	EmployeeCount	EmployeeNumber	… \
0	2	1	1	1	…
1	1	1	1	2	…
2	2	4	1	4	…
3	4	1	1	5	…
4	1	3	1	7	…

	RelationshipSatisfaction	StandardHours	StockOptionLevel \
0	1	80	0
1	4	80	1
2	2	80	0
3	3	80	0
4	4	80	1

	TotalWorkingYears	TrainingTimesLastYear	WorkLifeBalance	YearsAtCompany \
0	8	0	1	6
1	10	3	3	10
2	7	3	3	0
3	8	3	3	8
4	6	3	3	2

	YearsInCurrentRole	YearsSinceLastPromotion	YearsWithCurrManager
0	4	0	5
1	7	1	7
2	0	0	0
3	7	3	0
4	2	2	2

[5 rows x 35 columns]

[28]:
```python
df.tail()
```

[28]:

	Age	Attrition	BusinessTravel	DailyRate	Department	DistanceFromHome \
1465	36	No	1	884	1	23

```
        1466  39        No                 2       613              1                  6
        1467  27        No                 2       155              1                  4
        1468  49        No                 1      1023              2                  2
        1469  34        No                 2       628              1                  8

              Education  EducationField  EmployeeCount  EmployeeNumber  …  \
        1465          2               3              1            2061  …
        1466          1               3              1            2062  …
        1467          3               1              1            2064  …
        1468          3               3              1            2065  …
        1469          3               3              1            2068  …

              RelationshipSatisfaction  StandardHours  StockOptionLevel  \
        1465                         3             80                 1
        1466                         1             80                 1
        1467                         2             80                 1
        1468                         4             80                 0
        1469                         1             80                 0

              TotalWorkingYears  TrainingTimesLastYear  WorkLifeBalance  \
        1465                 17                      3                3
        1466                  9                      5                3
        1467                  6                      0                3
        1468                 17                      3                2
        1469                  6                      3                4

              YearsAtCompany  YearsInCurrentRole  YearsSinceLastPromotion  \
        1465               5                   2                        0
        1466               7                   7                        1
        1467               6                   2                        0
        1468               9                   6                        0
        1469               4                   3                        1

              YearsWithCurrManager
        1465                     3
        1466                     7
        1467                     3
        1468                     8
        1469                     2

        [5 rows x 35 columns]
```

```python
[47]:  from sklearn.preprocessing import LabelEncoder

       # Assuming df is your DataFrame
       # Drop non-numeric columns and target variable
```

```python
X = df.drop(columns=["EmployeeNumber", "EmployeeCount", "StandardHours",
 ↪"Attrition"])
y = df["Attrition"]

# Encode categorical columns
label_encoder = LabelEncoder()
for column in X.select_dtypes(include=['object']).columns:
    X[column] = label_encoder.fit_transform(X[column])
```

```python
[36]: from sklearn.preprocessing import StandardScaler

# Exclude non-numeric columns (assuming you have already dealt with categorical
 ↪data)
numeric_df = X.select_dtypes(include=['number'])

# Scale the numeric features
ms = StandardScaler()
X_scaled = ms.fit_transform(numeric_df)

# Calculate the correlation matrix for the scaled numeric features
correlation_matrix = pd.DataFrame(X_scaled, columns=numeric_df.columns).corr()

# Create a heatmap
fig, ax = plt.subplots(figsize=(30, 30))
sns.heatmap(correlation_matrix, annot=True)
plt.show()
```
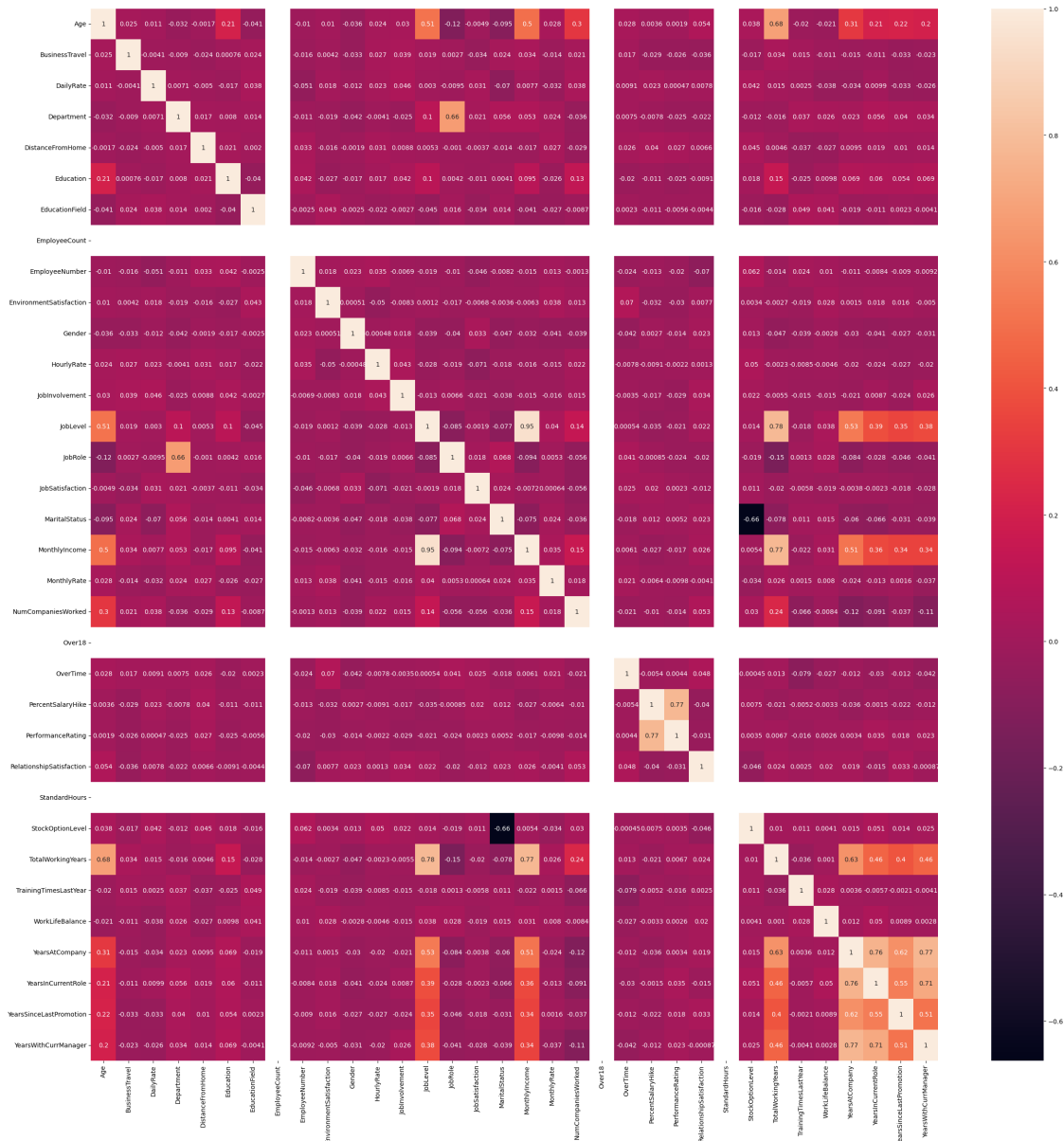
```python
[39]: from sklearn.model_selection import train_test_split

      # Define the features (X) and the target variable (y)
      X = df.drop('Attrition', axis=1)  # Features, excluding the 'Attrition' column
      y = df['Attrition']  # Target variable, 'Attrition'

      # Split the data into training and testing sets (e.g., 80% train, 20% test)
      x_train, x_test, y_train, y_test = train_test_split(X, y, test_size=0.2,
       random_state=42)
```

```python
# Now, you have X_train, X_test, y_train, and y_test for model training and
 ↪evaluation
```

```python
[40]: from sklearn.linear_model import LogisticRegression
      classifier = LogisticRegression(random_state=0)
      classifier.fit(x_train,y_train)
```

/opt/conda/lib/python3.10/site-packages/sklearn/linear_model/_logistic.py:458:
ConvergenceWarning: lbfgs failed to converge (status=1):
STOP: TOTAL NO. of ITERATIONS REACHED LIMIT.

Increase the number of iterations (max_iter) or scale the data as shown in:
    https://scikit-learn.org/stable/modules/preprocessing.html
Please also refer to the documentation for alternative solver options:
    https://scikit-learn.org/stable/modules/linear_model.html#logistic-
regression
  n_iter_i = _check_optimize_result(

[40]: LogisticRegression(random_state=0)

```python
[41]: from sklearn.metrics import accuracy_score,confusion_matrix
      y_pred = classifier.predict(x_test)
      cm = confusion_matrix(y_test, y_pred)
      print(cm)
      accuracy_score(y_test, y_pred)*100
```

```
[[255    0]
 [ 39    0]]
```

[41]: 86.73469387755102

```python
[42]: from sklearn.metrics import accuracy_score, confusion_matrix,
      ↪classification_report

      # Assuming you have actual target values (y_test) and predicted values (y_pred)
      # For example, if you have predictions from a model named 'model':
      # y_pred = model.predict(X_test)

      # Calculate accuracy
      accuracy = accuracy_score(y_test, y_pred)

      # Create a confusion matrix
      cm = confusion_matrix(y_test, y_pred)

      # Generate a classification report
      class_report = classification_report(y_test, y_pred)
```

```python
# Display the accuracy, confusion matrix, and classification report
print("Accuracy:", accuracy)
print("\nConfusion Matrix:\n", cm)
print("\nClassification Report:\n", class_report)
```

Accuracy: 0.8673469387755102

Confusion Matrix:
 [[255   0]
 [39   0]]

Classification Report:
              precision   recall f1-score   support

          No   0.87   1.00   0.93   255
         Yes   0.00   0.00   0.00   39

    accuracy   0.87   294
   macro avg   0.43   0.50   0.46   294
weighted avg   0.75   0.87   0.81   294

/opt/conda/lib/python3.10/site-packages/sklearn/metrics/_classification.py:1344:
UndefinedMetricWarning: Precision and F-score are ill-defined and being set to
0.0 in labels with no predicted samples. Use `zero_division` parameter to
control this behavior.
  _warn_prf(average, modifier, msg_start, len(result))
/opt/conda/lib/python3.10/site-packages/sklearn/metrics/_classification.py:1344:
UndefinedMetricWarning: Precision and F-score are ill-defined and being set to
0.0 in labels with no predicted samples. Use `zero_division` parameter to
control this behavior.
  _warn_prf(average, modifier, msg_start, len(result))
/opt/conda/lib/python3.10/site-packages/sklearn/metrics/_classification.py:1344:
UndefinedMetricWarning: Precision and F-score are ill-defined and being set to
0.0 in labels with no predicted samples. Use `zero_division` parameter to
control this behavior.
  _warn_prf(average, modifier, msg_start, len(result))
```

[48]:
```python
from sklearn.tree import DecisionTreeClassifier
dtc=DecisionTreeClassifier()
dtc.fit(x_train,y_train)
```

[48]: DecisionTreeClassifier()

[49]:
```python
from sklearn.metrics import accuracy_score,confusion_matrix
y_pred = dtc.predict(x_test)
cm = confusion_matrix(y_test, y_pred)
print(cm)
```

```
accuracy_score(y_test, y_pred)*100
```

```
[[221  34]
 [ 32   7]]
```

[49]: 77.55102040816327

[50]:
```python
from sklearn import tree
plt.figure(figsize=(25,15))
tree.plot_tree(dtc,filled=True)
```

[50]: [Text(0.4617713004484305, 0.9705882352941176, 'x[21] <= 0.5\ngini =
0.28\nsamples = 1176\nvalue = [978, 198]'),
 Text(0.19966367713004485, 0.9117647058823529, 'x[27] <= 1.5\ngini =
0.182\nsamples = 837\nvalue = [752, 85]'),
 Text(0.04663677130044843, 0.8529411764705882, 'x[11] <= 58.5\ngini =
0.473\nsamples = 52\nvalue = [32, 20]'),
 Text(0.021524663677130046, 0.7941176470588235, 'x[28] <= 3.5\ngini =
0.43\nsamples = 16\nvalue = [5, 11]'),
 Text(0.014349775784753363, 0.7352941176470589, 'x[1] <= 0.5\ngini =
0.26\nsamples = 13\nvalue = [2, 11]'),
 Text(0.007174887892376682, 0.6764705882352942, 'gini = 0.0\nsamples = 1\nvalue
= [1, 0]'),
 Text(0.021524663677130046, 0.6764705882352942, 'x[33] <= 0.5\ngini =
0.153\nsamples = 12\nvalue = [1, 11]'),
 Text(0.014349775784753363, 0.6176470588235294, 'gini = 0.0\nsamples = 10\nvalue
= [0, 10]'),
 Text(0.028699551569506727, 0.6176470588235294, 'x[17] <= 1758.0\ngini =
0.5\nsamples = 2\nvalue = [1, 1]'),
 Text(0.021524663677130046, 0.5588235294117647, 'gini = 0.0\nsamples = 1\nvalue
= [1, 0]'),
 Text(0.03587443946188341, 0.5588235294117647, 'gini = 0.0\nsamples = 1\nvalue =
[0, 1]'),
 Text(0.028699551569506727, 0.7352941176470589, 'gini = 0.0\nsamples = 3\nvalue
= [3, 0]'),
 Text(0.07174887892376682, 0.7941176470588235, 'x[2] <= 158.0\ngini =
0.375\nsamples = 36\nvalue = [27, 9]'),
 Text(0.06457399103139014, 0.7352941176470589, 'gini = 0.0\nsamples = 2\nvalue =
[0, 2]'),
 Text(0.07892376681614349, 0.7352941176470589, 'x[24] <= 1.5\ngini =
0.327\nsamples = 34\nvalue = [27, 7]'),
 Text(0.06457399103139014, 0.6764705882352942, 'x[2] <= 898.0\ngini =
0.49\nsamples = 7\nvalue = [3, 4]'),
 Text(0.05739910313901345, 0.6176470588235294, 'x[29] <= 3.5\ngini =
0.375\nsamples = 4\nvalue = [3, 1]'),
 Text(0.05022421524663677, 0.5588235294117647, 'gini = 0.0\nsamples = 3\nvalue =
[3, 0]'),
```

Text(0.06457399103139014, 0.5588235294117647, 'gini = 0.0\nsamples = 1\nvalue =
[0, 1]'),
 Text(0.07174887892376682, 0.6176470588235294, 'gini = 0.0\nsamples = 3\nvalue =
[0, 3]'),
 Text(0.09327354260089686, 0.6764705882352942, 'x[4] <= 7.5\ngini =
0.198\nsamples = 27\nvalue = [24, 3]'),
 Text(0.08609865470852018, 0.6176470588235294, 'gini = 0.0\nsamples = 16\nvalue
= [16, 0]'),
 Text(0.10044843049327354, 0.6176470588235294, 'x[2] <= 491.0\ngini =
0.397\nsamples = 11\nvalue = [8, 3]'),
 Text(0.09327354260089686, 0.5588235294117647, 'gini = 0.0\nsamples = 2\nvalue =
[0, 2]'),
 Text(0.10762331838565023, 0.5588235294117647, 'x[29] <= 2.5\ngini =
0.198\nsamples = 9\nvalue = [8, 1]'),
 Text(0.10044843049327354, 0.5, 'gini = 0.0\nsamples = 1\nvalue = [0, 1]'),
 Text(0.1147982062780269, 0.5, 'gini = 0.0\nsamples = 8\nvalue = [8, 0]'),
 Text(0.35269058295964123, 0.8529411764705882, 'x[26] <= 0.5\ngini =
0.152\nsamples = 785\nvalue = [720, 65]'),
 Text(0.2140134529147982, 0.7941176470588235, 'x[15] <= 1.5\ngini =
0.236\nsamples = 308\nvalue = [266, 42]'),
 Text(0.16860986547085202, 0.7352941176470589, 'x[4] <= 8.5\ngini =
0.419\nsamples = 57\nvalue = [40, 17]'),
 Text(0.15067264573991032, 0.6764705882352942, 'x[17] <= 3263.0\ngini =
0.245\nsamples = 35\nvalue = [30, 5]'),
 Text(0.14349775784753363, 0.6176470588235294, 'x[17] <= 2955.0\ngini =
0.444\nsamples = 15\nvalue = [10, 5]'),
 Text(0.13632286995515694, 0.5588235294117647, 'x[19] <= 3.5\ngini =
0.355\nsamples = 13\nvalue = [10, 3]'),
 Text(0.12914798206278028, 0.5, 'gini = 0.0\nsamples = 7\nvalue = [7, 0]'),
 Text(0.14349775784753363, 0.5, 'x[17] <= 2709.5\ngini = 0.5\nsamples = 6\nvalue
= [3, 3]'),
 Text(0.13632286995515694, 0.4411764705882353, 'x[9] <= 3.5\ngini =
0.375\nsamples = 4\nvalue = [1, 3]'),
 Text(0.12914798206278028, 0.38235294117647056, 'gini = 0.0\nsamples = 3\nvalue
= [0, 3]'),
 Text(0.14349775784753363, 0.38235294117647056, 'gini = 0.0\nsamples = 1\nvalue
= [1, 0]'),
 Text(0.15067264573991032, 0.4411764705882353, 'gini = 0.0\nsamples = 2\nvalue =
[2, 0]'),
 Text(0.15067264573991032, 0.5588235294117647, 'gini = 0.0\nsamples = 2\nvalue =
[0, 2]'),
 Text(0.15784753363228698, 0.6176470588235294, 'gini = 0.0\nsamples = 20\nvalue
= [20, 0]'),
 Text(0.18654708520179372, 0.6764705882352942, 'x[19] <= 2.5\ngini =
0.496\nsamples = 22\nvalue = [10, 12]'),
 Text(0.17219730941704037, 0.6176470588235294, 'x[2] <= 419.0\ngini =
0.426\nsamples = 13\nvalue = [9, 4]'),

Text(0.16502242152466368, 0.5588235294117647, 'gini = 0.0\nsamples = 3\nvalue = [0, 3]'),
Text(0.17937219730941703, 0.5588235294117647, 'x[1] <= 1.0\ngini = 0.18\nsamples = 10\nvalue = [9, 1]'),
Text(0.17219730941704037, 0.5, 'gini = 0.0\nsamples = 1\nvalue = [0, 1]'),
Text(0.18654708520179372, 0.5, 'gini = 0.0\nsamples = 9\nvalue = [9, 0]'),
Text(0.20089686098654708, 0.6176470588235294, 'x[28] <= 1.5\ngini = 0.198\nsamples = 9\nvalue = [1, 8]'),
Text(0.1937219730941704, 0.5588235294117647, 'gini = 0.0\nsamples = 1\nvalue = [1, 0]'),
Text(0.20807174887892377, 0.5588235294117647, 'gini = 0.0\nsamples = 8\nvalue = [0, 8]'),
Text(0.2594170403587444, 0.7352941176470589, 'x[12] <= 1.5\ngini = 0.179\nsamples = 251\nvalue = [226, 25]'),
Text(0.22242152466367712, 0.6764705882352942, 'x[24] <= 1.5\ngini = 0.497\nsamples = 13\nvalue = [7, 6]'),
Text(0.21524663677130046, 0.6176470588235294, 'gini = 0.0\nsamples = 4\nvalue = [4, 0]'),
Text(0.2295964125560538, 0.6176470588235294, 'x[22] <= 17.5\ngini = 0.444\nsamples = 9\nvalue = [3, 6]'),
Text(0.22242152466367712, 0.5588235294117647, 'x[31] <= 9.5\ngini = 0.245\nsamples = 7\nvalue = [1, 6]'),
Text(0.21524663677130046, 0.5, 'gini = 0.0\nsamples = 6\nvalue = [0, 6]'),
Text(0.2295964125560538, 0.5, 'gini = 0.0\nsamples = 1\nvalue = [1, 0]'),
Text(0.2367713004484305, 0.5588235294117647, 'gini = 0.0\nsamples = 2\nvalue = [2, 0]'),
Text(0.29641255605381167, 0.6764705882352942, 'x[32] <= 14.0\ngini = 0.147\nsamples = 238\nvalue = [219, 19]'),
Text(0.289237668161435, 0.6176470588235294, 'x[31] <= 2.5\ngini = 0.14\nsamples = 237\nvalue = [219, 18]'),
Text(0.2645739910313901, 0.5588235294117647, 'x[32] <= 5.5\ngini = 0.236\nsamples = 110\nvalue = [95, 15]'),
Text(0.24394618834080717, 0.5, 'x[6] <= 4.5\ngini = 0.201\nsamples = 106\nvalue = [94, 12]'),
Text(0.2242152466367713, 0.4411764705882353, 'x[27] <= 5.5\ngini = 0.15\nsamples = 98\nvalue = [90, 8]'),
Text(0.2062780269058296, 0.38235294117647056, 'x[19] <= 4.5\ngini = 0.327\nsamples = 34\nvalue = [27, 7]'),
Text(0.19192825112107623, 0.3235294117647059, 'x[0] <= 51.5\ngini = 0.231\nsamples = 30\nvalue = [26, 4]'),
Text(0.18475336322869956, 0.2647058823529412, 'x[2] <= 120.5\ngini = 0.185\nsamples = 29\nvalue = [26, 3]'),
Text(0.17757847533632287, 0.20588235294117646, 'gini = 0.0\nsamples = 1\nvalue = [0, 1]'),
Text(0.19192825112107623, 0.20588235294117646, 'x[28] <= 4.0\ngini = 0.133\nsamples = 28\nvalue = [26, 2]'),
Text(0.17757847533632287, 0.14705882352941177, 'x[17] <= 2044.5\ngini =

0.074\nsamples = 26\nvalue = [25, 1]'),
 Text(0.17040358744394618, 0.08823529411764706, 'x[16] <= 1.5\ngini =
0.5\nsamples = 2\nvalue = [1, 1]'),
 Text(0.16322869955156952, 0.029411764705882353, 'gini = 0.0\nsamples = 1\nvalue
= [1, 0]'),
 Text(0.17757847533632287, 0.029411764705882353, 'gini = 0.0\nsamples = 1\nvalue
= [0, 1]'),
 Text(0.18475336322869956, 0.08823529411764706, 'gini = 0.0\nsamples = 24\nvalue
= [24, 0]'),
 Text(0.2062780269058296, 0.14705882352941177, 'x[32] <= 0.5\ngini =
0.5\nsamples = 2\nvalue = [1, 1]'),
 Text(0.19910313901345292, 0.08823529411764706, 'gini = 0.0\nsamples = 1\nvalue
= [0, 1]'),
 Text(0.21345291479820627, 0.08823529411764706, 'gini = 0.0\nsamples = 1\nvalue
= [1, 0]'),
 Text(0.19910313901345292, 0.2647058823529412, 'gini = 0.0\nsamples = 1\nvalue =
[0, 1]'),
 Text(0.22062780269058296, 0.3235294117647059, 'x[33] <= 1.5\ngini =
0.375\nsamples = 4\nvalue = [1, 3]'),
 Text(0.21345291479820627, 0.2647058823529412, 'gini = 0.0\nsamples = 3\nvalue =
[0, 3]'),
 Text(0.22780269058295965, 0.2647058823529412, 'gini = 0.0\nsamples = 1\nvalue =
[1, 0]'),
 Text(0.242152466367713, 0.38235294117647056, 'x[2] <= 1468.0\ngini =
0.031\nsamples = 64\nvalue = [63, 1]'),
 Text(0.23497757847533632, 0.3235294117647059, 'gini = 0.0\nsamples = 62\nvalue
= [62, 0]'),
 Text(0.24932735426008967, 0.3235294117647059, 'x[14] <= 5.0\ngini =
0.5\nsamples = 2\nvalue = [1, 1]'),
 Text(0.242152466367713, 0.2647058823529412, 'gini = 0.0\nsamples = 1\nvalue =
[1, 0]'),
 Text(0.25650224215246636, 0.2647058823529412, 'gini = 0.0\nsamples = 1\nvalue =
[0, 1]'),
 Text(0.26367713004484306, 0.4411764705882353, 'x[18] <= 20700.0\ngini =
0.5\nsamples = 8\nvalue = [4, 4]'),
 Text(0.25650224215246636, 0.38235294117647056, 'gini = 0.0\nsamples = 4\nvalue
= [0, 4]'),
 Text(0.27085201793721975, 0.38235294117647056, 'gini = 0.0\nsamples = 4\nvalue
= [4, 0]'),
 Text(0.2852017937219731, 0.5, 'x[29] <= 2.5\ngini = 0.375\nsamples = 4\nvalue =
[1, 3]'),
 Text(0.27802690582959644, 0.4411764705882353, 'gini = 0.0\nsamples = 3\nvalue =
[0, 3]'),
 Text(0.29237668161434976, 0.4411764705882353, 'gini = 0.0\nsamples = 1\nvalue =
[1, 0]'),
 Text(0.31390134529147984, 0.5588235294117647, 'x[14] <= 6.5\ngini =
0.046\nsamples = 127\nvalue = [124, 3]'),

```
Text(0.30672645739910315, 0.5, 'gini = 0.0\nsamples = 95\nvalue = [95, 0]'),
 Text(0.32107623318385653, 0.5, 'x[0] <= 45.5\ngini = 0.17\nsamples = 32\nvalue
= [29, 3]'),
 Text(0.30672645739910315, 0.4411764705882353, 'x[15] <= 2.5\ngini =
0.067\nsamples = 29\nvalue = [28, 1]'),
 Text(0.29955156950672646, 0.38235294117647056, 'x[17] <= 7251.0\ngini =
0.5\nsamples = 2\nvalue = [1, 1]'),
 Text(0.29237668161434976, 0.3235294117647059, 'gini = 0.0\nsamples = 1\nvalue =
[1, 0]'),
 Text(0.30672645739910315, 0.3235294117647059, 'gini = 0.0\nsamples = 1\nvalue =
[0, 1]'),
 Text(0.31390134529147984, 0.38235294117647056, 'gini = 0.0\nsamples = 27\nvalue
= [27, 0]'),
 Text(0.33542600896860986, 0.4411764705882353, 'x[9] <= 3.5\ngini =
0.444\nsamples = 3\nvalue = [1, 2]'),
 Text(0.32825112107623317, 0.38235294117647056, 'gini = 0.0\nsamples = 2\nvalue
= [0, 2]'),
 Text(0.34260089686098655, 0.38235294117647056, 'gini = 0.0\nsamples = 1\nvalue
= [1, 0]'),
 Text(0.30358744394618836, 0.6176470588235294, 'gini = 0.0\nsamples = 1\nvalue =
[0, 1]'),
 Text(0.4913677130044843, 0.7941176470588235, 'x[30] <= 31.5\ngini =
0.092\nsamples = 477\nvalue = [454, 23]'),
 Text(0.45986547085201795, 0.7352941176470589, 'x[2] <= 1495.5\ngini =
0.081\nsamples = 472\nvalue = [452, 20]'),
 Text(0.41838565022421526, 0.6764705882352942, 'x[30] <= 1.5\ngini =
0.078\nsamples = 470\nvalue = [451, 19]'),
 Text(0.35695067264573993, 0.6176470588235294, 'x[8] <= 74.0\ngini =
0.229\nsamples = 38\nvalue = [33, 5]'),
 Text(0.34977578475336324, 0.5588235294117647, 'gini = 0.0\nsamples = 1\nvalue =
[0, 1]'),
 Text(0.36412556053811657, 0.5588235294117647, 'x[9] <= 1.5\ngini =
0.193\nsamples = 37\nvalue = [33, 4]'),
 Text(0.35695067264573993, 0.5, 'x[4] <= 7.0\ngini = 0.408\nsamples = 14\nvalue
= [10, 4]'),
 Text(0.34977578475336324, 0.4411764705882353, 'gini = 0.0\nsamples = 6\nvalue =
[6, 0]'),
 Text(0.36412556053811657, 0.4411764705882353, 'x[4] <= 27.5\ngini =
0.5\nsamples = 8\nvalue = [4, 4]'),
 Text(0.35695067264573993, 0.38235294117647056, 'x[12] <= 2.5\ngini =
0.32\nsamples = 5\nvalue = [1, 4]'),
 Text(0.34977578475336324, 0.3235294117647059, 'gini = 0.0\nsamples = 1\nvalue =
[1, 0]'),
 Text(0.36412556053811657, 0.3235294117647059, 'gini = 0.0\nsamples = 4\nvalue =
[0, 4]'),
 Text(0.37130044843049326, 0.38235294117647056, 'gini = 0.0\nsamples = 3\nvalue
= [3, 0]'),
```

Text(0.37130044843049326, 0.5, 'gini = 0.0\nsamples = 23\nvalue = [23, 0]'),
 Text(0.47982062780269066, 0.6176470588235294, 'x[14] <= 2.5\ngini =
0.063\nsamples = 432\nvalue = [418, 14]'),
 Text(0.41973094170403585, 0.5588235294117647, 'x[0] <= 55.0\ngini =
0.129\nsamples = 130\nvalue = [121, 9]'),
 Text(0.4125560538116592, 0.5, 'x[18] <= 6717.0\ngini = 0.116\nsamples =
129\nvalue = [121, 8]'),
 Text(0.39282511210762333, 0.4411764705882353, 'x[19] <= 6.5\ngini =
0.26\nsamples = 26\nvalue = [22, 4]'),
 Text(0.38565022421524664, 0.38235294117647056, 'x[27] <= 2.5\ngini =
0.153\nsamples = 24\nvalue = [22, 2]'),
 Text(0.37847533632286995, 0.3235294117647059, 'gini = 0.0\nsamples = 1\nvalue =
[0, 1]'),
 Text(0.39282511210762333, 0.3235294117647059, 'x[31] <= 1.5\ngini =
0.083\nsamples = 23\nvalue = [22, 1]'),
 Text(0.38565022421524664, 0.2647058823529412, 'gini = 0.0\nsamples = 1\nvalue =
[0, 1]'),
 Text(0.4, 0.2647058823529412, 'gini = 0.0\nsamples = 22\nvalue = [22, 0]'),
 Text(0.4, 0.38235294117647056, 'gini = 0.0\nsamples = 2\nvalue = [0, 2]'),
 Text(0.43228699551569505, 0.4411764705882353, 'x[11] <= 32.5\ngini =
0.075\nsamples = 103\nvalue = [99, 4]'),
 Text(0.41434977578475335, 0.38235294117647056, 'x[17] <= 4938.5\ngini =
0.5\nsamples = 2\nvalue = [1, 1]'),
 Text(0.40717488789237666, 0.3235294117647059, 'gini = 0.0\nsamples = 1\nvalue =
[0, 1]'),
 Text(0.42152466367713004, 0.3235294117647059, 'gini = 0.0\nsamples = 1\nvalue =
[1, 0]'),
 Text(0.45022421524663675, 0.38235294117647056, 'x[22] <= 11.5\ngini =
0.058\nsamples = 101\nvalue = [98, 3]'),
 Text(0.4358744394618834, 0.3235294117647059, 'x[14] <= 1.5\ngini =
0.245\nsamples = 14\nvalue = [12, 2]'),
 Text(0.42869955156950673, 0.2647058823529412, 'x[26] <= 1.5\ngini =
0.444\nsamples = 3\nvalue = [1, 2]'),
 Text(0.42152466367713004, 0.20588235294117646, 'gini = 0.0\nsamples = 2\nvalue
= [0, 2]'),
 Text(0.4358744394618834, 0.20588235294117646, 'gini = 0.0\nsamples = 1\nvalue =
[1, 0]'),
 Text(0.4430493273542601, 0.2647058823529412, 'gini = 0.0\nsamples = 11\nvalue =
[11, 0]'),
 Text(0.46457399103139013, 0.3235294117647059, 'x[33] <= 1.5\ngini =
0.023\nsamples = 87\nvalue = [86, 1]'),
 Text(0.45739910313901344, 0.2647058823529412, 'x[8] <= 1200.5\ngini =
0.278\nsamples = 6\nvalue = [5, 1]'),
 Text(0.45022421524663675, 0.20588235294117646, 'gini = 0.0\nsamples = 5\nvalue
= [5, 0]'),
 Text(0.46457399103139013, 0.20588235294117646, 'gini = 0.0\nsamples = 1\nvalue
= [0, 1]'),

```
 Text(0.4717488789237668, 0.2647058823529412, 'gini = 0.0\nsamples = 81\nvalue =
[81, 0]'),
 Text(0.42690582959641254, 0.5, 'gini = 0.0\nsamples = 1\nvalue = [0, 1]'),
 Text(0.53991031390013453, 0.5588235294117647, 'x[8] <= 2042.5\ngini =
0.033\nsamples = 302\nvalue = [297, 5]'),
 Text(0.5219730941704036, 0.5, 'x[26] <= 2.5\ngini = 0.026\nsamples = 298\nvalue
= [294, 4]'),
 Text(0.5076233183856502, 0.4411764705882353, 'x[22] <= 11.5\ngini =
0.014\nsamples = 278\nvalue = [276, 2]'),
 Text(0.5004484304932736, 0.38235294117647056, 'x[15] <= 1.5\ngini =
0.097\nsamples = 39\nvalue = [37, 2]'),
 Text(0.49327354260089684, 0.3235294117647059, 'x[27] <= 14.0\ngini =
0.408\nsamples = 7\nvalue = [5, 2]'),
 Text(0.4860986547085202, 0.2647058823529412, 'x[28] <= 1.5\ngini =
0.444\nsamples = 3\nvalue = [1, 2]'),
 Text(0.4789237668161435, 0.20588235294117646, 'gini = 0.0\nsamples = 1\nvalue =
[1, 0]'),
 Text(0.49327354260089684, 0.20588235294117646, 'gini = 0.0\nsamples = 2\nvalue
= [0, 2]'),
 Text(0.5004484304932736, 0.2647058823529412, 'gini = 0.0\nsamples = 4\nvalue =
[4, 0]'),
 Text(0.5076233183856502, 0.3235294117647059, 'gini = 0.0\nsamples = 32\nvalue =
[32, 0]'),
 Text(0.5147982062780269, 0.38235294117647056, 'gini = 0.0\nsamples = 239\nvalue
= [239, 0]'),
 Text(0.536322869955157, 0.4411764705882353, 'x[2] <= 323.5\ngini =
0.18\nsamples = 20\nvalue = [18, 2]'),
 Text(0.5291479820627802, 0.38235294117647056, 'gini = 0.0\nsamples = 1\nvalue =
[0, 1]'),
 Text(0.5434977578475336, 0.38235294117647056, 'x[8] <= 1772.5\ngini =
0.1\nsamples = 19\nvalue = [18, 1]'),
 Text(0.536322869955157, 0.3235294117647059, 'gini = 0.0\nsamples = 17\nvalue =
[17, 0]'),
 Text(0.5506726457399103, 0.3235294117647059, 'x[31] <= 4.5\ngini = 0.5\nsamples
= 2\nvalue = [1, 1]'),
 Text(0.5434977578475336, 0.2647058823529412, 'gini = 0.0\nsamples = 1\nvalue =
[1, 0]'),
 Text(0.557847533632287, 0.2647058823529412, 'gini = 0.0\nsamples = 1\nvalue =
[0, 1]'),
 Text(0.557847533632287, 0.5, 'x[16] <= 0.5\ngini = 0.375\nsamples = 4\nvalue =
[3, 1]'),
 Text(0.5506726457399103, 0.4411764705882353, 'gini = 0.0\nsamples = 1\nvalue =
[0, 1]'),
 Text(0.5650224215246636, 0.4411764705882353, 'gini = 0.0\nsamples = 3\nvalue =
[3, 0]'),
 Text(0.5013452914798207, 0.6764705882352942, 'x[19] <= 2.0\ngini = 0.5\nsamples
= 2\nvalue = [1, 1]'),
```

Text(0.49417040358744396, 0.6176470588235294, 'gini = 0.0\nsamples = 1\nvalue =
[1, 0]'),
 Text(0.5085201793721973, 0.6176470588235294, 'gini = 0.0\nsamples = 1\nvalue =
[0, 1]'),
 Text(0.5228699551569507, 0.7352941176470589, 'x[10] <= 0.5\ngini =
0.48\nsamples = 5\nvalue = [2, 3]'),
 Text(0.515695067264574, 0.6764705882352942, 'gini = 0.0\nsamples = 3\nvalue =
[0, 3]'),
 Text(0.5300448430493273, 0.6764705882352942, 'gini = 0.0\nsamples = 2\nvalue =
[2, 0]'),
 Text(0.7238789237668162, 0.9117647058823529, 'x[17] <= 2475.0\ngini =
0.444\nsamples = 339\nvalue = [226, 113]'),
 Text(0.6017937219730942, 0.8529411764705882, 'x[2] <= 931.0\ngini =
0.379\nsamples = 63\nvalue = [16, 47]'),
 Text(0.5659192825112107, 0.7941176470588235, 'x[0] <= 36.0\ngini =
0.184\nsamples = 39\nvalue = [4, 35]'),
 Text(0.5515695067264574, 0.7352941176470589, 'x[28] <= 5.5\ngini =
0.061\nsamples = 32\nvalue = [1, 31]'),
 Text(0.5443946188340807, 0.6764705882352942, 'gini = 0.0\nsamples = 31\nvalue =
[0, 31]'),
 Text(0.5587443946188341, 0.6764705882352942, 'gini = 0.0\nsamples = 1\nvalue =
[1, 0]'),
 Text(0.5802690582959641, 0.7352941176470589, 'x[16] <= 0.5\ngini =
0.49\nsamples = 7\nvalue = [3, 4]'),
 Text(0.5730941704035875, 0.6764705882352942, 'gini = 0.0\nsamples = 3\nvalue =
[0, 3]'),
 Text(0.5874439461883408, 0.6764705882352942, 'x[17] <= 2404.5\ngini =
0.375\nsamples = 4\nvalue = [3, 1]'),
 Text(0.5802690582959641, 0.6176470588235294, 'gini = 0.0\nsamples = 3\nvalue =
[3, 0]'),
 Text(0.5946188340807175, 0.6176470588235294, 'gini = 0.0\nsamples = 1\nvalue =
[0, 1]'),
 Text(0.6376681614349776, 0.7941176470588235, 'x[31] <= 2.5\ngini = 0.5\nsamples
= 24\nvalue = [12, 12]'),
 Text(0.6304932735426009, 0.7352941176470589, 'x[18] <= 16767.5\ngini =
0.415\nsamples = 17\nvalue = [5, 12]'),
 Text(0.6161434977578475, 0.6764705882352942, 'x[24] <= 1.5\ngini =
0.26\nsamples = 13\nvalue = [2, 11]'),
 Text(0.6089686098654709, 0.6176470588235294, 'x[1] <= 1.5\ngini =
0.444\nsamples = 3\nvalue = [2, 1]'),
 Text(0.6017937219730942, 0.5588235294117647, 'gini = 0.0\nsamples = 1\nvalue =
[0, 1]'),
 Text(0.6161434977578475, 0.5588235294117647, 'gini = 0.0\nsamples = 2\nvalue =
[2, 0]'),
 Text(0.6233183856502242, 0.6176470588235294, 'gini = 0.0\nsamples = 10\nvalue =
[0, 10]'),
 Text(0.6448430493273543, 0.6764705882352942, 'x[8] <= 878.0\ngini =

0.375\nsamples = 4\nvalue = [3, 1]'),
 Text(0.6376681614349776, 0.6176470588235294, 'gini = 0.0\nsamples = 1\nvalue =
[0, 1]'),
 Text(0.6520179372197309, 0.6176470588235294, 'gini = 0.0\nsamples = 3\nvalue =
[3, 0]'),
 Text(0.6448430493273543, 0.7352941176470589, 'gini = 0.0\nsamples = 7\nvalue =
[7, 0]'),
 Text(0.8459641255605381, 0.8529411764705882, 'x[16] <= 1.5\ngini =
0.364\nsamples = 276\nvalue = [210, 66]'),
 Text(0.7582959641255606, 0.7941176470588235, 'x[13] <= 1.5\ngini =
0.264\nsamples = 198\nvalue = [167, 31]'),
 Text(0.6986547085201794, 0.7352941176470589, 'x[18] <= 16643.5\ngini =
0.431\nsamples = 51\nvalue = [35, 16]'),
 Text(0.673542600896861, 0.6764705882352942, 'x[3] <= 1.5\ngini = 0.278\nsamples
= 30\nvalue = [25, 5]'),
 Text(0.6663677130044843, 0.6176470588235294, 'x[30] <= 0.5\ngini =
0.191\nsamples = 28\nvalue = [25, 3]'),
 Text(0.6591928251121076, 0.5588235294117647, 'gini = 0.0\nsamples = 1\nvalue =
[0, 1]'),
 Text(0.673542600896861, 0.5588235294117647, 'x[17] <= 4864.5\ngini =
0.137\nsamples = 27\nvalue = [25, 2]'),
 Text(0.6663677130044843, 0.5, 'x[22] <= 23.5\ngini = 0.074\nsamples = 26\nvalue
= [25, 1]'),
 Text(0.6591928251121076, 0.4411764705882353, 'gini = 0.0\nsamples = 24\nvalue =
[24, 0]'),
 Text(0.673542600896861, 0.4411764705882353, 'x[19] <= 1.5\ngini = 0.5\nsamples
= 2\nvalue = [1, 1]'),
 Text(0.6663677130044843, 0.38235294117647056, 'gini = 0.0\nsamples = 1\nvalue =
[0, 1]'),
 Text(0.6807174887892377, 0.38235294117647056, 'gini = 0.0\nsamples = 1\nvalue =
[1, 0]'),
 Text(0.6807174887892377, 0.5, 'gini = 0.0\nsamples = 1\nvalue = [0, 1]'),
 Text(0.6807174887892377, 0.6176470588235294, 'gini = 0.0\nsamples = 2\nvalue =
[0, 2]'),
 Text(0.7237668161434978, 0.6764705882352942, 'x[19] <= 2.0\ngini =
0.499\nsamples = 21\nvalue = [10, 11]'),
 Text(0.7094170403587444, 0.6176470588235294, 'x[33] <= 0.5\ngini =
0.397\nsamples = 11\nvalue = [8, 3]'),
 Text(0.7022421524663677, 0.5588235294117647, 'x[18] <= 23057.0\ngini =
0.375\nsamples = 4\nvalue = [1, 3]'),
 Text(0.695067264573991, 0.5, 'gini = 0.0\nsamples = 3\nvalue = [0, 3]'),
 Text(0.7094170403587444, 0.5, 'gini = 0.0\nsamples = 1\nvalue = [1, 0]'),
 Text(0.7165919282511211, 0.5588235294117647, 'gini = 0.0\nsamples = 7\nvalue =
[7, 0]'),
 Text(0.7381165919282511, 0.6176470588235294, 'x[2] <= 304.5\ngini =
0.32\nsamples = 10\nvalue = [2, 8]'),
 Text(0.7309417040358744, 0.5588235294117647, 'gini = 0.0\nsamples = 1\nvalue =

[1, 0]'),
 Text(0.7452914798206278, 0.5588235294117647, 'x[0] <= 44.5\ngini =
0.198\nsamples = 9\nvalue = [1, 8]'),
 Text(0.7381165919282511, 0.5, 'gini = 0.0\nsamples = 8\nvalue = [0, 8]'),
 Text(0.7524663677130045, 0.5, 'gini = 0.0\nsamples = 1\nvalue = [1, 0]'),
 Text(0.8179372197309417, 0.7352941176470589, 'x[4] <= 21.5\ngini =
0.183\nsamples = 147\nvalue = [132, 15]'),
 Text(0.7865470852017937, 0.6764705882352942, 'x[0] <= 23.0\ngini =
0.131\nsamples = 128\nvalue = [119, 9]'),
 Text(0.7793721973094171, 0.6176470588235294, 'gini = 0.0\nsamples = 1\nvalue =
[0, 1]'),
 Text(0.7937219730941704, 0.6176470588235294, 'x[17] <= 19853.0\ngini =
0.118\nsamples = 127\nvalue = [119, 8]'),
 Text(0.7865470852017937, 0.5588235294117647, 'x[28] <= 0.5\ngini =
0.105\nsamples = 126\nvalue = [119, 7]'),
 Text(0.7668161434977578, 0.5, 'x[29] <= 2.5\ngini = 0.48\nsamples = 5\nvalue =
[3, 2]'),
 Text(0.7596412556053812, 0.4411764705882353, 'gini = 0.0\nsamples = 2\nvalue =
[0, 2]'),
 Text(0.7739910313901345, 0.4411764705882353, 'gini = 0.0\nsamples = 3\nvalue =
[3, 0]'),
 Text(0.8062780269058296, 0.5, 'x[18] <= 24606.5\ngini = 0.079\nsamples =
121\nvalue = [116, 5]'),
 Text(0.7883408071748879, 0.4411764705882353, 'x[28] <= 5.5\ngini =
0.051\nsamples = 114\nvalue = [111, 3]'),
 Text(0.7739910313901345, 0.38235294117647056, 'x[26] <= 0.5\ngini =
0.035\nsamples = 111\nvalue = [109, 2]'),
 Text(0.7668161434977578, 0.3235294117647059, 'x[12] <= 1.5\ngini =
0.159\nsamples = 23\nvalue = [21, 2]'),
 Text(0.7596412556053812, 0.2647058823529412, 'gini = 0.0\nsamples = 1\nvalue =
[0, 1]'),
 Text(0.7739910313901345, 0.2647058823529412, 'x[31] <= 1.0\ngini =
0.087\nsamples = 22\nvalue = [21, 1]'),
 Text(0.7668161434977578, 0.20588235294117646, 'x[30] <= 0.5\ngini =
0.5\nsamples = 2\nvalue = [1, 1]'),
 Text(0.7596412556053812, 0.14705882352941177, 'gini = 0.0\nsamples = 1\nvalue =
[1, 0]'),
 Text(0.7739910313901345, 0.14705882352941177, 'gini = 0.0\nsamples = 1\nvalue =
[0, 1]'),
 Text(0.7811659192825112, 0.20588235294117646, 'gini = 0.0\nsamples = 20\nvalue
= [20, 0]'),
 Text(0.7811659192825112, 0.3235294117647059, 'gini = 0.0\nsamples = 88\nvalue =
[88, 0]'),
 Text(0.8026905829596412, 0.38235294117647056, 'x[18] <= 9858.5\ngini =
0.444\nsamples = 3\nvalue = [2, 1]'),
 Text(0.7955156950672646, 0.3235294117647059, 'gini = 0.0\nsamples = 1\nvalue =
[0, 1]'),

```
Text(0.809865470852018, 0.3235294117647059, 'gini = 0.0\nsamples = 2\nvalue =
[2, 0]'),
 Text(0.8242152466367713, 0.4411764705882353, 'x[9] <= 2.5\ngini =
0.408\nsamples = 7\nvalue = [5, 2]'),
 Text(0.8170403587443946, 0.38235294117647056, 'gini = 0.0\nsamples = 2\nvalue =
[0, 2]'),
 Text(0.831390134529148, 0.38235294117647056, 'gini = 0.0\nsamples = 5\nvalue =
[5, 0]'),
 Text(0.8008968609865471, 0.5588235294117647, 'gini = 0.0\nsamples = 1\nvalue =
[0, 1]'),
 Text(0.8493273542600897, 0.6764705882352942, 'x[31] <= 7.5\ngini =
0.432\nsamples = 19\nvalue = [13, 6]'),
 Text(0.842152466367713, 0.6176470588235294, 'x[10] <= 0.5\ngini = 0.5\nsamples
= 12\nvalue = [6, 6]'),
 Text(0.8278026905829596, 0.5588235294117647, 'x[11] <= 45.0\ngini =
0.278\nsamples = 6\nvalue = [5, 1]'),
 Text(0.820627802690583, 0.5, 'gini = 0.0\nsamples = 1\nvalue = [0, 1]'),
 Text(0.8349775784753363, 0.5, 'gini = 0.0\nsamples = 5\nvalue = [5, 0]'),
 Text(0.8565022421524664, 0.5588235294117647, 'x[29] <= 3.5\ngini =
0.278\nsamples = 6\nvalue = [1, 5]'),
 Text(0.8493273542600897, 0.5, 'gini = 0.0\nsamples = 5\nvalue = [0, 5]'),
 Text(0.863677130044843, 0.5, 'gini = 0.0\nsamples = 1\nvalue = [1, 0]'),
 Text(0.8565022421524664, 0.6176470588235294, 'gini = 0.0\nsamples = 7\nvalue =
[7, 0]'),
 Text(0.9336322869955157, 0.7941176470588235, 'x[32] <= 5.5\ngini =
0.495\nsamples = 78\nvalue = [43, 35]'),
 Text(0.9192825112107623, 0.7352941176470589, 'x[11] <= 53.5\ngini =
0.466\nsamples = 65\nvalue = [41, 24]'),
 Text(0.9121076233183857, 0.6764705882352942, 'gini = 0.0\nsamples = 14\nvalue =
[14, 0]'),
 Text(0.9264573991031391, 0.6764705882352942, 'x[30] <= 2.5\ngini =
0.498\nsamples = 51\nvalue = [27, 24]'),
 Text(0.885201793721973, 0.6176470588235294, 'x[15] <= 2.5\ngini =
0.415\nsamples = 17\nvalue = [5, 12]'),
 Text(0.8780269058295964, 0.5588235294117647, 'gini = 0.0\nsamples = 7\nvalue =
[0, 7]'),
 Text(0.8923766816143498, 0.5588235294117647, 'x[27] <= 8.0\ngini = 0.5\nsamples
= 10\nvalue = [5, 5]'),
 Text(0.8780269058295964, 0.5, 'x[12] <= 3.5\ngini = 0.32\nsamples = 5\nvalue =
[1, 4]'),
 Text(0.8708520179372198, 0.4411764705882353, 'gini = 0.0\nsamples = 4\nvalue =
[0, 4]'),
 Text(0.885201793721973, 0.4411764705882353, 'gini = 0.0\nsamples = 1\nvalue =
[1, 0]'),
 Text(0.9067264573991032, 0.5, 'x[19] <= 7.0\ngini = 0.32\nsamples = 5\nvalue =
[4, 1]'),
 Text(0.8995515695067264, 0.4411764705882353, 'gini = 0.0\nsamples = 4\nvalue =
```

```
[4, 0]'),
 Text(0.9139013452914798, 0.4411764705882353, 'gini = 0.0\nsamples = 1\nvalue =
[0, 1]'),
 Text(0.967713004484305, 0.6176470588235294, 'x[28] <= 3.5\ngini =
0.457\nsamples = 34\nvalue = [22, 12]'),
 Text(0.9497757847533632, 0.5588235294117647, 'x[24] <= 1.5\ngini = 0.4\nsamples
= 29\nvalue = [21, 8]'),
 Text(0.9354260089686098, 0.5, 'x[11] <= 75.5\ngini = 0.469\nsamples = 8\nvalue
= [3, 5]'),
 Text(0.9282511210762332, 0.4411764705882353, 'gini = 0.0\nsamples = 3\nvalue =
[3, 0]'),
 Text(0.9426008968609866, 0.4411764705882353, 'gini = 0.0\nsamples = 5\nvalue =
[0, 5]'),
 Text(0.9641255605381166, 0.5, 'x[12] <= 3.5\ngini = 0.245\nsamples = 21\nvalue
= [18, 3]'),
 Text(0.95695067264574, 0.4411764705882353, 'gini = 0.0\nsamples = 17\nvalue =
[17, 0]'),
 Text(0.9713004484304932, 0.4411764705882353, 'x[3] <= 1.5\ngini =
0.375\nsamples = 4\nvalue = [1, 3]'),
 Text(0.9641255605381166, 0.38235294117647056, 'gini = 0.0\nsamples = 1\nvalue =
[1, 0]'),
 Text(0.97847533632287, 0.38235294117647056, 'gini = 0.0\nsamples = 3\nvalue =
[0, 3]'),
 Text(0.9856502242152466, 0.5588235294117647, 'x[0] <= 45.0\ngini =
0.32\nsamples = 5\nvalue = [1, 4]'),
 Text(0.97847533632287, 0.5, 'gini = 0.0\nsamples = 4\nvalue = [0, 4]'),
 Text(0.9928251121076234, 0.5, 'gini = 0.0\nsamples = 1\nvalue = [1, 0]'),
 Text(0.9479820627802691, 0.7352941176470589, 'x[11] <= 86.0\ngini =
0.26\nsamples = 13\nvalue = [2, 11]'),
 Text(0.9408071748878923, 0.6764705882352942, 'gini = 0.0\nsamples = 11\nvalue =
[0, 11]'),
 Text(0.9551569506726457, 0.6764705882352942, 'gini = 0.0\nsamples = 2\nvalue =
[2, 0]')]
```

```
[51]: from sklearn.model_selection import GridSearchCV
      parameter={
      'criterion':['gini','entropy'],
       'splitter':['best','random'],
       'max_depth':[1,2,3,4,5,6,7,8,9,10],
       'max_features':['auto', 'sqrt', 'log2']
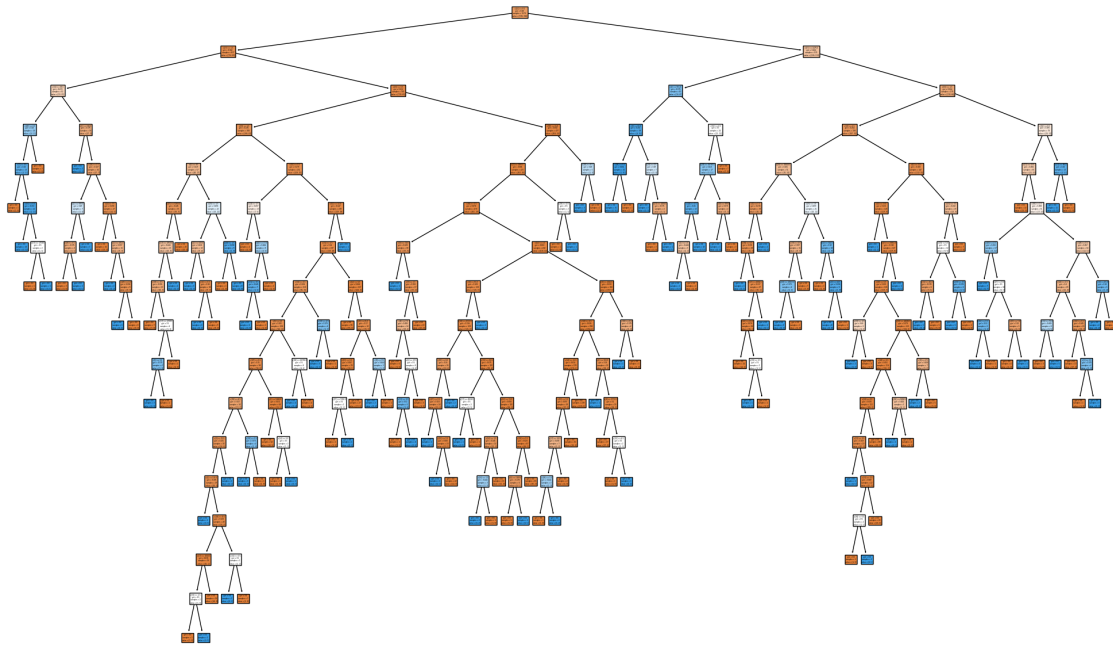
      }
```

```
[55]: grid_search=GridSearchCV(estimator=dtc,param_grid=parameter,cv=5,scoring="accuracy")
      grid_search.fit(x_train,y_train)
```

/opt/conda/lib/python3.10/site-packages/sklearn/tree/_classes.py:269:
FutureWarning: `max_features='auto'` has been deprecated in 1.1 and will be
removed in 1.3. To keep the past behaviour, explicitly set
`max_features='sqrt'`.
  warnings.warn(
/opt/conda/lib/python3.10/site-packages/sklearn/tree/_classes.py:269:
FutureWarning: `max_features='auto'` has been deprecated in 1.1 and will be
removed in 1.3. To keep the past behaviour, explicitly set
`max_features='sqrt'`.
  warnings.warn(
/opt/conda/lib/python3.10/site-packages/sklearn/tree/_classes.py:269:
FutureWarning: `max_features='auto'` has been deprecated in 1.1 and will be
removed in 1.3. To keep the past behaviour, explicitly set
`max_features='sqrt'`.

```
  warnings.warn(
/opt/conda/lib/python3.10/site-packages/sklearn/tree/_classes.py:269:
FutureWarning: `max_features='auto'` has been deprecated in 1.1 and will be
removed in 1.3. To keep the past behaviour, explicitly set
`max_features='sqrt'`.
  warnings.warn(
/opt/conda/lib/python3.10/site-packages/sklearn/tree/_classes.py:269:
FutureWarning: `max_features='auto'` has been deprecated in 1.1 and will be
removed in 1.3. To keep the past behaviour, explicitly set
`max_features='sqrt'`.
  warnings.warn(
/opt/conda/lib/python3.10/site-packages/sklearn/tree/_classes.py:269:
FutureWarning: `max_features='auto'` has been deprecated in 1.1 and will be
removed in 1.3. To keep the past behaviour, explicitly set
`max_features='sqrt'`.
  warnings.warn(
/opt/conda/lib/python3.10/site-packages/sklearn/tree/_classes.py:269:
FutureWarning: `max_features='auto'` has been deprecated in 1.1 and will be
removed in 1.3. To keep the past behaviour, explicitly set
`max_features='sqrt'`.
  warnings.warn(
/opt/conda/lib/python3.10/site-packages/sklearn/tree/_classes.py:269:
FutureWarning: `max_features='auto'` has been deprecated in 1.1 and will be
removed in 1.3. To keep the past behaviour, explicitly set
`max_features='sqrt'`.
  warnings.warn(
/opt/conda/lib/python3.10/site-packages/sklearn/tree/_classes.py:269:
FutureWarning: `max_features='auto'` has been deprecated in 1.1 and will be
removed in 1.3. To keep the past behaviour, explicitly set
`max_features='sqrt'`.
  warnings.warn(
/opt/conda/lib/python3.10/site-packages/sklearn/tree/_classes.py:269:
FutureWarning: `max_features='auto'` has been deprecated in 1.1 and will be
removed in 1.3. To keep the past behaviour, explicitly set
`max_features='sqrt'`.
  warnings.warn(
/opt/conda/lib/python3.10/site-packages/sklearn/tree/_classes.py:269:
FutureWarning: `max_features='auto'` has been deprecated in 1.1 and will be
removed in 1.3. To keep the past behaviour, explicitly set
`max_features='sqrt'`.
  warnings.warn(
/opt/conda/lib/python3.10/site-packages/sklearn/tree/_classes.py:269:
FutureWarning: `max_features='auto'` has been deprecated in 1.1 and will be
```

```
removed in 1.3. To keep the past behaviour, explicitly set
`max_features='sqrt'`.
  warnings.warn(
/opt/conda/lib/python3.10/site-packages/sklearn/tree/_classes.py:269:
FutureWarning: `max_features='auto'` has been deprecated in 1.1 and will be
removed in 1.3. To keep the past behaviour, explicitly set
`max_features='sqrt'`.
  warnings.warn(
/opt/conda/lib/python3.10/site-packages/sklearn/tree/_classes.py:269:
FutureWarning: `max_features='auto'` has been deprecated in 1.1 and will be
removed in 1.3. To keep the past behaviour, explicitly set
`max_features='sqrt'`.
  warnings.warn(
/opt/conda/lib/python3.10/site-packages/sklearn/tree/_classes.py:269:
FutureWarning: `max_features='auto'` has been deprecated in 1.1 and will be
removed in 1.3. To keep the past behaviour, explicitly set
`max_features='sqrt'`.
  warnings.warn(
/opt/conda/lib/python3.10/site-packages/sklearn/tree/_classes.py:269:
FutureWarning: `max_features='auto'` has been deprecated in 1.1 and will be
removed in 1.3. To keep the past behaviour, explicitly set
`max_features='sqrt'`.
  warnings.warn(
/opt/conda/lib/python3.10/site-packages/sklearn/tree/_classes.py:269:
FutureWarning: `max_features='auto'` has been deprecated in 1.1 and will be
removed in 1.3. To keep the past behaviour, explicitly set
`max_features='sqrt'`.
  warnings.warn(
/opt/conda/lib/python3.10/site-packages/sklearn/tree/_classes.py:269:
FutureWarning: `max_features='auto'` has been deprecated in 1.1 and will be
removed in 1.3. To keep the past behaviour, explicitly set
`max_features='sqrt'`.
  warnings.warn(
/opt/conda/lib/python3.10/site-packages/sklearn/tree/_classes.py:269:
FutureWarning: `max_features='auto'` has been deprecated in 1.1 and will be
removed in 1.3. To keep the past behaviour, explicitly set
`max_features='sqrt'`.
  warnings.warn(
/opt/conda/lib/python3.10/site-packages/sklearn/tree/_classes.py:269:
FutureWarning: `max_features='auto'` has been deprecated in 1.1 and will be
removed in 1.3. To keep the past behaviour, explicitly set
`max_features='sqrt'`.
  warnings.warn(
```

```
/opt/conda/lib/python3.10/site-packages/sklearn/tree/_classes.py:269:
FutureWarning: `max_features='auto'` has been deprecated in 1.1 and will be
removed in 1.3. To keep the past behaviour, explicitly set
`max_features='sqrt'`.
  warnings.warn(
/opt/conda/lib/python3.10/site-packages/sklearn/tree/_classes.py:269:
FutureWarning: `max_features='auto'` has been deprecated in 1.1 and will be
removed in 1.3. To keep the past behaviour, explicitly set
`max_features='sqrt'`.
  warnings.warn(
/opt/conda/lib/python3.10/site-packages/sklearn/tree/_classes.py:269:
FutureWarning: `max_features='auto'` has been deprecated in 1.1 and will be
removed in 1.3. To keep the past behaviour, explicitly set
`max_features='sqrt'`.
  warnings.warn(
/opt/conda/lib/python3.10/site-packages/sklearn/tree/_classes.py:269:
FutureWarning: `max_features='auto'` has been deprecated in 1.1 and will be
removed in 1.3. To keep the past behaviour, explicitly set
`max_features='sqrt'`.
  warnings.warn(
/opt/conda/lib/python3.10/site-packages/sklearn/tree/_classes.py:269:
FutureWarning: `max_features='auto'` has been deprecated in 1.1 and will be
removed in 1.3. To keep the past behaviour, explicitly set
`max_features='sqrt'`.
  warnings.warn(
/opt/conda/lib/python3.10/site-packages/sklearn/tree/_classes.py:269:
FutureWarning: `max_features='auto'` has been deprecated in 1.1 and will be
removed in 1.3. To keep the past behaviour, explicitly set
`max_features='sqrt'`.
  warnings.warn(
/opt/conda/lib/python3.10/site-packages/sklearn/tree/_classes.py:269:
FutureWarning: `max_features='auto'` has been deprecated in 1.1 and will be
removed in 1.3. To keep the past behaviour, explicitly set
`max_features='sqrt'`.
  warnings.warn(
/opt/conda/lib/python3.10/site-packages/sklearn/tree/_classes.py:269:
FutureWarning: `max_features='auto'` has been deprecated in 1.1 and will be
removed in 1.3. To keep the past behaviour, explicitly set
`max_features='sqrt'`.
  warnings.warn(
/opt/conda/lib/python3.10/site-packages/sklearn/tree/_classes.py:269:
FutureWarning: `max_features='auto'` has been deprecated in 1.1 and will be
removed in 1.3. To keep the past behaviour, explicitly set
```

```
`max_features='sqrt'`.
  warnings.warn(
/opt/conda/lib/python3.10/site-packages/sklearn/tree/_classes.py:269:
FutureWarning: `max_features='auto'` has been deprecated in 1.1 and will be
removed in 1.3. To keep the past behaviour, explicitly set
`max_features='sqrt'`.
  warnings.warn(
/opt/conda/lib/python3.10/site-packages/sklearn/tree/_classes.py:269:
FutureWarning: `max_features='auto'` has been deprecated in 1.1 and will be
removed in 1.3. To keep the past behaviour, explicitly set
`max_features='sqrt'`.
  warnings.warn(
/opt/conda/lib/python3.10/site-packages/sklearn/tree/_classes.py:269:
FutureWarning: `max_features='auto'` has been deprecated in 1.1 and will be
removed in 1.3. To keep the past behaviour, explicitly set
`max_features='sqrt'`.
  warnings.warn(
/opt/conda/lib/python3.10/site-packages/sklearn/tree/_classes.py:269:
FutureWarning: `max_features='auto'` has been deprecated in 1.1 and will be
removed in 1.3. To keep the past behaviour, explicitly set
`max_features='sqrt'`.
  warnings.warn(
/opt/conda/lib/python3.10/site-packages/sklearn/tree/_classes.py:269:
FutureWarning: `max_features='auto'` has been deprecated in 1.1 and will be
removed in 1.3. To keep the past behaviour, explicitly set
`max_features='sqrt'`.
  warnings.warn(
/opt/conda/lib/python3.10/site-packages/sklearn/tree/_classes.py:269:
FutureWarning: `max_features='auto'` has been deprecated in 1.1 and will be
removed in 1.3. To keep the past behaviour, explicitly set
`max_features='sqrt'`.
  warnings.warn(
/opt/conda/lib/python3.10/site-packages/sklearn/tree/_classes.py:269:
FutureWarning: `max_features='auto'` has been deprecated in 1.1 and will be
removed in 1.3. To keep the past behaviour, explicitly set
`max_features='sqrt'`.
  warnings.warn(
/opt/conda/lib/python3.10/site-packages/sklearn/tree/_classes.py:269:
FutureWarning: `max_features='auto'` has been deprecated in 1.1 and will be
removed in 1.3. To keep the past behaviour, explicitly set
`max_features='sqrt'`.
  warnings.warn(
/opt/conda/lib/python3.10/site-packages/sklearn/tree/_classes.py:269:
FutureWarning: `max_features='auto'` has been deprecated in 1.1 and will be
removed in 1.3. To keep the past behaviour, explicitly set
`max_features='sqrt'`.
  warnings.warn(
/opt/conda/lib/python3.10/site-packages/sklearn/tree/_classes.py:269:
```

```
FutureWarning: `max_features='auto'` has been deprecated in 1.1 and will be
removed in 1.3. To keep the past behaviour, explicitly set
`max_features='sqrt'`.
  warnings.warn(
/opt/conda/lib/python3.10/site-packages/sklearn/tree/_classes.py:269:
FutureWarning: `max_features='auto'` has been deprecated in 1.1 and will be
removed in 1.3. To keep the past behaviour, explicitly set
`max_features='sqrt'`.
  warnings.warn(
/opt/conda/lib/python3.10/site-packages/sklearn/tree/_classes.py:269:
FutureWarning: `max_features='auto'` has been deprecated in 1.1 and will be
removed in 1.3. To keep the past behaviour, explicitly set
`max_features='sqrt'`.
  warnings.warn(
/opt/conda/lib/python3.10/site-packages/sklearn/tree/_classes.py:269:
FutureWarning: `max_features='auto'` has been deprecated in 1.1 and will be
removed in 1.3. To keep the past behaviour, explicitly set
`max_features='sqrt'`.
  warnings.warn(
/opt/conda/lib/python3.10/site-packages/sklearn/tree/_classes.py:269:
FutureWarning: `max_features='auto'` has been deprecated in 1.1 and will be
removed in 1.3. To keep the past behaviour, explicitly set
`max_features='sqrt'`.
  warnings.warn(
/opt/conda/lib/python3.10/site-packages/sklearn/tree/_classes.py:269:
FutureWarning: `max_features='auto'` has been deprecated in 1.1 and will be
removed in 1.3. To keep the past behaviour, explicitly set
`max_features='sqrt'`.
  warnings.warn(
/opt/conda/lib/python3.10/site-packages/sklearn/tree/_classes.py:269:
FutureWarning: `max_features='auto'` has been deprecated in 1.1 and will be
removed in 1.3. To keep the past behaviour, explicitly set
`max_features='sqrt'`.
  warnings.warn(
/opt/conda/lib/python3.10/site-packages/sklearn/tree/_classes.py:269:
FutureWarning: `max_features='auto'` has been deprecated in 1.1 and will be
removed in 1.3. To keep the past behaviour, explicitly set
`max_features='sqrt'`.
  warnings.warn(
/opt/conda/lib/python3.10/site-packages/sklearn/tree/_classes.py:269:
FutureWarning: `max_features='auto'` has been deprecated in 1.1 and will be
removed in 1.3. To keep the past behaviour, explicitly set
`max_features='sqrt'`.
  warnings.warn(
/opt/conda/lib/python3.10/site-packages/sklearn/tree/_classes.py:269:
FutureWarning: `max_features='auto'` has been deprecated in 1.1 and will be
removed in 1.3. To keep the past behaviour, explicitly set
`max_features='sqrt'`.
  warnings.warn(
/opt/conda/lib/python3.10/site-packages/sklearn/tree/_classes.py:269:
FutureWarning: `max_features='auto'` has been deprecated in 1.1 and will be
removed in 1.3. To keep the past behaviour, explicitly set
`max_features='sqrt'`.
```

```
  warnings.warn(
/opt/conda/lib/python3.10/site-packages/sklearn/tree/_classes.py:269:
FutureWarning: `max_features='auto'` has been deprecated in 1.1 and will be
removed in 1.3. To keep the past behaviour, explicitly set
`max_features='sqrt'`.
  warnings.warn(
/opt/conda/lib/python3.10/site-packages/sklearn/tree/_classes.py:269:
FutureWarning: `max_features='auto'` has been deprecated in 1.1 and will be
removed in 1.3. To keep the past behaviour, explicitly set
`max_features='sqrt'`.
  warnings.warn(
/opt/conda/lib/python3.10/site-packages/sklearn/tree/_classes.py:269:
FutureWarning: `max_features='auto'` has been deprecated in 1.1 and will be
removed in 1.3. To keep the past behaviour, explicitly set
`max_features='sqrt'`.
  warnings.warn(
/opt/conda/lib/python3.10/site-packages/sklearn/tree/_classes.py:269:
FutureWarning: `max_features='auto'` has been deprecated in 1.1 and will be
removed in 1.3. To keep the past behaviour, explicitly set
`max_features='sqrt'`.
  warnings.warn(
/opt/conda/lib/python3.10/site-packages/sklearn/tree/_classes.py:269:
FutureWarning: `max_features='auto'` has been deprecated in 1.1 and will be
removed in 1.3. To keep the past behaviour, explicitly set
`max_features='sqrt'`.
  warnings.warn(
/opt/conda/lib/python3.10/site-packages/sklearn/tree/_classes.py:269:
FutureWarning: `max_features='auto'` has been deprecated in 1.1 and will be
removed in 1.3. To keep the past behaviour, explicitly set
`max_features='sqrt'`.
  warnings.warn(
/opt/conda/lib/python3.10/site-packages/sklearn/tree/_classes.py:269:
FutureWarning: `max_features='auto'` has been deprecated in 1.1 and will be
removed in 1.3. To keep the past behaviour, explicitly set
`max_features='sqrt'`.
  warnings.warn(
/opt/conda/lib/python3.10/site-packages/sklearn/tree/_classes.py:269:
FutureWarning: `max_features='auto'` has been deprecated in 1.1 and will be
removed in 1.3. To keep the past behaviour, explicitly set
`max_features='sqrt'`.
  warnings.warn(
/opt/conda/lib/python3.10/site-packages/sklearn/tree/_classes.py:269:
FutureWarning: `max_features='auto'` has been deprecated in 1.1 and will be
```

```
removed in 1.3. To keep the past behaviour, explicitly set
`max_features='sqrt'`.
  warnings.warn(
/opt/conda/lib/python3.10/site-packages/sklearn/tree/_classes.py:269:
FutureWarning: `max_features='auto'` has been deprecated in 1.1 and will be
removed in 1.3. To keep the past behaviour, explicitly set
`max_features='sqrt'`.
  warnings.warn(
/opt/conda/lib/python3.10/site-packages/sklearn/tree/_classes.py:269:
FutureWarning: `max_features='auto'` has been deprecated in 1.1 and will be
removed in 1.3. To keep the past behaviour, explicitly set
`max_features='sqrt'`.
  warnings.warn(
/opt/conda/lib/python3.10/site-packages/sklearn/tree/_classes.py:269:
FutureWarning: `max_features='auto'` has been deprecated in 1.1 and will be
removed in 1.3. To keep the past behaviour, explicitly set
`max_features='sqrt'`.
  warnings.warn(
/opt/conda/lib/python3.10/site-packages/sklearn/tree/_classes.py:269:
FutureWarning: `max_features='auto'` has been deprecated in 1.1 and will be
removed in 1.3. To keep the past behaviour, explicitly set
`max_features='sqrt'`.
  warnings.warn(
/opt/conda/lib/python3.10/site-packages/sklearn/tree/_classes.py:269:
FutureWarning: `max_features='auto'` has been deprecated in 1.1 and will be
removed in 1.3. To keep the past behaviour, explicitly set
`max_features='sqrt'`.
  warnings.warn(
/opt/conda/lib/python3.10/site-packages/sklearn/tree/_classes.py:269:
FutureWarning: `max_features='auto'` has been deprecated in 1.1 and will be
removed in 1.3. To keep the past behaviour, explicitly set
`max_features='sqrt'`.
  warnings.warn(
/opt/conda/lib/python3.10/site-packages/sklearn/tree/_classes.py:269:
FutureWarning: `max_features='auto'` has been deprecated in 1.1 and will be
removed in 1.3. To keep the past behaviour, explicitly set
`max_features='sqrt'`.
  warnings.warn(
/opt/conda/lib/python3.10/site-packages/sklearn/tree/_classes.py:269:
FutureWarning: `max_features='auto'` has been deprecated in 1.1 and will be
removed in 1.3. To keep the past behaviour, explicitly set
`max_features='sqrt'`.
  warnings.warn(
/opt/conda/lib/python3.10/site-packages/sklearn/tree/_classes.py:269:
FutureWarning: `max_features='auto'` has been deprecated in 1.1 and will be
removed in 1.3. To keep the past behaviour, explicitly set
`max_features='sqrt'`.
  warnings.warn(
```

```
/opt/conda/lib/python3.10/site-packages/sklearn/tree/_classes.py:269:
FutureWarning: `max_features='auto'` has been deprecated in 1.1 and will be
removed in 1.3. To keep the past behaviour, explicitly set
`max_features='sqrt'`.
  warnings.warn(
/opt/conda/lib/python3.10/site-packages/sklearn/tree/_classes.py:269:
FutureWarning: `max_features='auto'` has been deprecated in 1.1 and will be
removed in 1.3. To keep the past behaviour, explicitly set
`max_features='sqrt'`.
  warnings.warn(
/opt/conda/lib/python3.10/site-packages/sklearn/tree/_classes.py:269:
FutureWarning: `max_features='auto'` has been deprecated in 1.1 and will be
removed in 1.3. To keep the past behaviour, explicitly set
`max_features='sqrt'`.
  warnings.warn(
/opt/conda/lib/python3.10/site-packages/sklearn/tree/_classes.py:269:
FutureWarning: `max_features='auto'` has been deprecated in 1.1 and will be
removed in 1.3. To keep the past behaviour, explicitly set
`max_features='sqrt'`.
  warnings.warn(
/opt/conda/lib/python3.10/site-packages/sklearn/tree/_classes.py:269:
FutureWarning: `max_features='auto'` has been deprecated in 1.1 and will be
removed in 1.3. To keep the past behaviour, explicitly set
`max_features='sqrt'`.
  warnings.warn(
/opt/conda/lib/python3.10/site-packages/sklearn/tree/_classes.py:269:
FutureWarning: `max_features='auto'` has been deprecated in 1.1 and will be
removed in 1.3. To keep the past behaviour, explicitly set
`max_features='sqrt'`.
  warnings.warn(
/opt/conda/lib/python3.10/site-packages/sklearn/tree/_classes.py:269:
FutureWarning: `max_features='auto'` has been deprecated in 1.1 and will be
removed in 1.3. To keep the past behaviour, explicitly set
`max_features='sqrt'`.
  warnings.warn(
/opt/conda/lib/python3.10/site-packages/sklearn/tree/_classes.py:269:
FutureWarning: `max_features='auto'` has been deprecated in 1.1 and will be
removed in 1.3. To keep the past behaviour, explicitly set
`max_features='sqrt'`.
  warnings.warn(
/opt/conda/lib/python3.10/site-packages/sklearn/tree/_classes.py:269:
FutureWarning: `max_features='auto'` has been deprecated in 1.1 and will be
removed in 1.3. To keep the past behaviour, explicitly set
```

```
`max_features='sqrt'`.
  warnings.warn(
/opt/conda/lib/python3.10/site-packages/sklearn/tree/_classes.py:269:
FutureWarning: `max_features='auto'` has been deprecated in 1.1 and will be
removed in 1.3. To keep the past behaviour, explicitly set
`max_features='sqrt'`.
  warnings.warn(
/opt/conda/lib/python3.10/site-packages/sklearn/tree/_classes.py:269:
FutureWarning: `max_features='auto'` has been deprecated in 1.1 and will be
removed in 1.3. To keep the past behaviour, explicitly set
`max_features='sqrt'`.
  warnings.warn(
/opt/conda/lib/python3.10/site-packages/sklearn/tree/_classes.py:269:
FutureWarning: `max_features='auto'` has been deprecated in 1.1 and will be
removed in 1.3. To keep the past behaviour, explicitly set
`max_features='sqrt'`.
  warnings.warn(
/opt/conda/lib/python3.10/site-packages/sklearn/tree/_classes.py:269:
FutureWarning: `max_features='auto'` has been deprecated in 1.1 and will be
removed in 1.3. To keep the past behaviour, explicitly set
`max_features='sqrt'`.
  warnings.warn(
/opt/conda/lib/python3.10/site-packages/sklearn/tree/_classes.py:269:
FutureWarning: `max_features='auto'` has been deprecated in 1.1 and will be
removed in 1.3. To keep the past behaviour, explicitly set
`max_features='sqrt'`.
  warnings.warn(
/opt/conda/lib/python3.10/site-packages/sklearn/tree/_classes.py:269:
FutureWarning: `max_features='auto'` has been deprecated in 1.1 and will be
removed in 1.3. To keep the past behaviour, explicitly set
`max_features='sqrt'`.
  warnings.warn(
/opt/conda/lib/python3.10/site-packages/sklearn/tree/_classes.py:269:
FutureWarning: `max_features='auto'` has been deprecated in 1.1 and will be
removed in 1.3. To keep the past behaviour, explicitly set
`max_features='sqrt'`.
  warnings.warn(
/opt/conda/lib/python3.10/site-packages/sklearn/tree/_classes.py:269:
FutureWarning: `max_features='auto'` has been deprecated in 1.1 and will be
removed in 1.3. To keep the past behaviour, explicitly set
`max_features='sqrt'`.
  warnings.warn(
/opt/conda/lib/python3.10/site-packages/sklearn/tree/_classes.py:269:
FutureWarning: `max_features='auto'` has been deprecated in 1.1 and will be
removed in 1.3. To keep the past behaviour, explicitly set
`max_features='sqrt'`.
  warnings.warn(
/opt/conda/lib/python3.10/site-packages/sklearn/tree/_classes.py:269:
```

```
FutureWarning: `max_features='auto'` has been deprecated in 1.1 and will be
removed in 1.3. To keep the past behaviour, explicitly set
`max_features='sqrt'`.
  warnings.warn(
/opt/conda/lib/python3.10/site-packages/sklearn/tree/_classes.py:269:
FutureWarning: `max_features='auto'` has been deprecated in 1.1 and will be
removed in 1.3. To keep the past behaviour, explicitly set
`max_features='sqrt'`.
  warnings.warn(
/opt/conda/lib/python3.10/site-packages/sklearn/tree/_classes.py:269:
FutureWarning: `max_features='auto'` has been deprecated in 1.1 and will be
removed in 1.3. To keep the past behaviour, explicitly set
`max_features='sqrt'`.
  warnings.warn(
/opt/conda/lib/python3.10/site-packages/sklearn/tree/_classes.py:269:
FutureWarning: `max_features='auto'` has been deprecated in 1.1 and will be
removed in 1.3. To keep the past behaviour, explicitly set
`max_features='sqrt'`.
  warnings.warn(
/opt/conda/lib/python3.10/site-packages/sklearn/tree/_classes.py:269:
FutureWarning: `max_features='auto'` has been deprecated in 1.1 and will be
removed in 1.3. To keep the past behaviour, explicitly set
`max_features='sqrt'`.
  warnings.warn(
/opt/conda/lib/python3.10/site-packages/sklearn/tree/_classes.py:269:
FutureWarning: `max_features='auto'` has been deprecated in 1.1 and will be
removed in 1.3. To keep the past behaviour, explicitly set
`max_features='sqrt'`.
  warnings.warn(
/opt/conda/lib/python3.10/site-packages/sklearn/tree/_classes.py:269:
FutureWarning: `max_features='auto'` has been deprecated in 1.1 and will be
removed in 1.3. To keep the past behaviour, explicitly set
`max_features='sqrt'`.
  warnings.warn(
/opt/conda/lib/python3.10/site-packages/sklearn/tree/_classes.py:269:
FutureWarning: `max_features='auto'` has been deprecated in 1.1 and will be
removed in 1.3. To keep the past behaviour, explicitly set
`max_features='sqrt'`.
  warnings.warn(
/opt/conda/lib/python3.10/site-packages/sklearn/tree/_classes.py:269:
FutureWarning: `max_features='auto'` has been deprecated in 1.1 and will be
removed in 1.3. To keep the past behaviour, explicitly set
`max_features='sqrt'`.
  warnings.warn(
/opt/conda/lib/python3.10/site-packages/sklearn/tree/_classes.py:269:
FutureWarning: `max_features='auto'` has been deprecated in 1.1 and will be
removed in 1.3. To keep the past behaviour, explicitly set
`max_features='sqrt'`.
```

```
  warnings.warn(
/opt/conda/lib/python3.10/site-packages/sklearn/tree/_classes.py:269:
FutureWarning: `max_features='auto'` has been deprecated in 1.1 and will be
removed in 1.3. To keep the past behaviour, explicitly set
`max_features='sqrt'`.
  warnings.warn(
/opt/conda/lib/python3.10/site-packages/sklearn/tree/_classes.py:269:
FutureWarning: `max_features='auto'` has been deprecated in 1.1 and will be
removed in 1.3. To keep the past behaviour, explicitly set
`max_features='sqrt'`.
  warnings.warn(
/opt/conda/lib/python3.10/site-packages/sklearn/tree/_classes.py:269:
FutureWarning: `max_features='auto'` has been deprecated in 1.1 and will be
removed in 1.3. To keep the past behaviour, explicitly set
`max_features='sqrt'`.
  warnings.warn(
/opt/conda/lib/python3.10/site-packages/sklearn/tree/_classes.py:269:
FutureWarning: `max_features='auto'` has been deprecated in 1.1 and will be
removed in 1.3. To keep the past behaviour, explicitly set
`max_features='sqrt'`.
  warnings.warn(
/opt/conda/lib/python3.10/site-packages/sklearn/tree/_classes.py:269:
FutureWarning: `max_features='auto'` has been deprecated in 1.1 and will be
removed in 1.3. To keep the past behaviour, explicitly set
`max_features='sqrt'`.
  warnings.warn(
/opt/conda/lib/python3.10/site-packages/sklearn/tree/_classes.py:269:
FutureWarning: `max_features='auto'` has been deprecated in 1.1 and will be
removed in 1.3. To keep the past behaviour, explicitly set
`max_features='sqrt'`.
  warnings.warn(
/opt/conda/lib/python3.10/site-packages/sklearn/tree/_classes.py:269:
FutureWarning: `max_features='auto'` has been deprecated in 1.1 and will be
removed in 1.3. To keep the past behaviour, explicitly set
`max_features='sqrt'`.
  warnings.warn(
/opt/conda/lib/python3.10/site-packages/sklearn/tree/_classes.py:269:
FutureWarning: `max_features='auto'` has been deprecated in 1.1 and will be
removed in 1.3. To keep the past behaviour, explicitly set
`max_features='sqrt'`.
  warnings.warn(
/opt/conda/lib/python3.10/site-packages/sklearn/tree/_classes.py:269:
FutureWarning: `max_features='auto'` has been deprecated in 1.1 and will be
```

```
removed in 1.3. To keep the past behaviour, explicitly set
`max_features='sqrt'`.
  warnings.warn(
/opt/conda/lib/python3.10/site-packages/sklearn/tree/_classes.py:269:
FutureWarning: `max_features='auto'` has been deprecated in 1.1 and will be
removed in 1.3. To keep the past behaviour, explicitly set
`max_features='sqrt'`.
  warnings.warn(
/opt/conda/lib/python3.10/site-packages/sklearn/tree/_classes.py:269:
FutureWarning: `max_features='auto'` has been deprecated in 1.1 and will be
removed in 1.3. To keep the past behaviour, explicitly set
`max_features='sqrt'`.
  warnings.warn(
/opt/conda/lib/python3.10/site-packages/sklearn/tree/_classes.py:269:
FutureWarning: `max_features='auto'` has been deprecated in 1.1 and will be
removed in 1.3. To keep the past behaviour, explicitly set
`max_features='sqrt'`.
  warnings.warn(
/opt/conda/lib/python3.10/site-packages/sklearn/tree/_classes.py:269:
FutureWarning: `max_features='auto'` has been deprecated in 1.1 and will be
removed in 1.3. To keep the past behaviour, explicitly set
`max_features='sqrt'`.
  warnings.warn(
/opt/conda/lib/python3.10/site-packages/sklearn/tree/_classes.py:269:
FutureWarning: `max_features='auto'` has been deprecated in 1.1 and will be
removed in 1.3. To keep the past behaviour, explicitly set
`max_features='sqrt'`.
  warnings.warn(
/opt/conda/lib/python3.10/site-packages/sklearn/tree/_classes.py:269:
FutureWarning: `max_features='auto'` has been deprecated in 1.1 and will be
removed in 1.3. To keep the past behaviour, explicitly set
`max_features='sqrt'`.
  warnings.warn(
/opt/conda/lib/python3.10/site-packages/sklearn/tree/_classes.py:269:
FutureWarning: `max_features='auto'` has been deprecated in 1.1 and will be
removed in 1.3. To keep the past behaviour, explicitly set
`max_features='sqrt'`.
  warnings.warn(
/opt/conda/lib/python3.10/site-packages/sklearn/tree/_classes.py:269:
FutureWarning: `max_features='auto'` has been deprecated in 1.1 and will be
removed in 1.3. To keep the past behaviour, explicitly set
`max_features='sqrt'`.
  warnings.warn(
/opt/conda/lib/python3.10/site-packages/sklearn/tree/_classes.py:269:
FutureWarning: `max_features='auto'` has been deprecated in 1.1 and will be
removed in 1.3. To keep the past behaviour, explicitly set
`max_features='sqrt'`.
  warnings.warn(
```

```
/opt/conda/lib/python3.10/site-packages/sklearn/tree/_classes.py:269:
FutureWarning: `max_features='auto'` has been deprecated in 1.1 and will be
removed in 1.3. To keep the past behaviour, explicitly set
`max_features='sqrt'`.
  warnings.warn(
/opt/conda/lib/python3.10/site-packages/sklearn/tree/_classes.py:269:
FutureWarning: `max_features='auto'` has been deprecated in 1.1 and will be
removed in 1.3. To keep the past behaviour, explicitly set
`max_features='sqrt'`.
  warnings.warn(
/opt/conda/lib/python3.10/site-packages/sklearn/tree/_classes.py:269:
FutureWarning: `max_features='auto'` has been deprecated in 1.1 and will be
removed in 1.3. To keep the past behaviour, explicitly set
`max_features='sqrt'`.
  warnings.warn(
/opt/conda/lib/python3.10/site-packages/sklearn/tree/_classes.py:269:
FutureWarning: `max_features='auto'` has been deprecated in 1.1 and will be
removed in 1.3. To keep the past behaviour, explicitly set
`max_features='sqrt'`.
  warnings.warn(
/opt/conda/lib/python3.10/site-packages/sklearn/tree/_classes.py:269:
FutureWarning: `max_features='auto'` has been deprecated in 1.1 and will be
removed in 1.3. To keep the past behaviour, explicitly set
`max_features='sqrt'`.
  warnings.warn(
/opt/conda/lib/python3.10/site-packages/sklearn/tree/_classes.py:269:
FutureWarning: `max_features='auto'` has been deprecated in 1.1 and will be
removed in 1.3. To keep the past behaviour, explicitly set
`max_features='sqrt'`.
  warnings.warn(
/opt/conda/lib/python3.10/site-packages/sklearn/tree/_classes.py:269:
FutureWarning: `max_features='auto'` has been deprecated in 1.1 and will be
removed in 1.3. To keep the past behaviour, explicitly set
`max_features='sqrt'`.
  warnings.warn(
/opt/conda/lib/python3.10/site-packages/sklearn/tree/_classes.py:269:
FutureWarning: `max_features='auto'` has been deprecated in 1.1 and will be
removed in 1.3. To keep the past behaviour, explicitly set
`max_features='sqrt'`.
  warnings.warn(
/opt/conda/lib/python3.10/site-packages/sklearn/tree/_classes.py:269:
FutureWarning: `max_features='auto'` has been deprecated in 1.1 and will be
removed in 1.3. To keep the past behaviour, explicitly set
```

```
`max_features='sqrt'`.
  warnings.warn(
/opt/conda/lib/python3.10/site-packages/sklearn/tree/_classes.py:269:
FutureWarning: `max_features='auto'` has been deprecated in 1.1 and will be
removed in 1.3. To keep the past behaviour, explicitly set
`max_features='sqrt'`.
  warnings.warn(
/opt/conda/lib/python3.10/site-packages/sklearn/tree/_classes.py:269:
FutureWarning: `max_features='auto'` has been deprecated in 1.1 and will be
removed in 1.3. To keep the past behaviour, explicitly set
`max_features='sqrt'`.
  warnings.warn(
/opt/conda/lib/python3.10/site-packages/sklearn/tree/_classes.py:269:
FutureWarning: `max_features='auto'` has been deprecated in 1.1 and will be
removed in 1.3. To keep the past behaviour, explicitly set
`max_features='sqrt'`.
  warnings.warn(
/opt/conda/lib/python3.10/site-packages/sklearn/tree/_classes.py:269:
FutureWarning: `max_features='auto'` has been deprecated in 1.1 and will be
removed in 1.3. To keep the past behaviour, explicitly set
`max_features='sqrt'`.
  warnings.warn(
/opt/conda/lib/python3.10/site-packages/sklearn/tree/_classes.py:269:
FutureWarning: `max_features='auto'` has been deprecated in 1.1 and will be
removed in 1.3. To keep the past behaviour, explicitly set
`max_features='sqrt'`.
  warnings.warn(
/opt/conda/lib/python3.10/site-packages/sklearn/tree/_classes.py:269:
FutureWarning: `max_features='auto'` has been deprecated in 1.1 and will be
removed in 1.3. To keep the past behaviour, explicitly set
`max_features='sqrt'`.
  warnings.warn(
/opt/conda/lib/python3.10/site-packages/sklearn/tree/_classes.py:269:
FutureWarning: `max_features='auto'` has been deprecated in 1.1 and will be
removed in 1.3. To keep the past behaviour, explicitly set
`max_features='sqrt'`.
  warnings.warn(
/opt/conda/lib/python3.10/site-packages/sklearn/tree/_classes.py:269:
FutureWarning: `max_features='auto'` has been deprecated in 1.1 and will be
removed in 1.3. To keep the past behaviour, explicitly set
`max_features='sqrt'`.
  warnings.warn(
/opt/conda/lib/python3.10/site-packages/sklearn/tree/_classes.py:269:
```

```
FutureWarning: `max_features='auto'` has been deprecated in 1.1 and will be
removed in 1.3. To keep the past behaviour, explicitly set
`max_features='sqrt'`.
  warnings.warn(
/opt/conda/lib/python3.10/site-packages/sklearn/tree/_classes.py:269:
FutureWarning: `max_features='auto'` has been deprecated in 1.1 and will be
removed in 1.3. To keep the past behaviour, explicitly set
`max_features='sqrt'`.
  warnings.warn(
/opt/conda/lib/python3.10/site-packages/sklearn/tree/_classes.py:269:
FutureWarning: `max_features='auto'` has been deprecated in 1.1 and will be
removed in 1.3. To keep the past behaviour, explicitly set
`max_features='sqrt'`.
  warnings.warn(
/opt/conda/lib/python3.10/site-packages/sklearn/tree/_classes.py:269:
FutureWarning: `max_features='auto'` has been deprecated in 1.1 and will be
removed in 1.3. To keep the past behaviour, explicitly set
`max_features='sqrt'`.
  warnings.warn(
/opt/conda/lib/python3.10/site-packages/sklearn/tree/_classes.py:269:
FutureWarning: `max_features='auto'` has been deprecated in 1.1 and will be
removed in 1.3. To keep the past behaviour, explicitly set
`max_features='sqrt'`.
  warnings.warn(
/opt/conda/lib/python3.10/site-packages/sklearn/tree/_classes.py:269:
FutureWarning: `max_features='auto'` has been deprecated in 1.1 and will be
removed in 1.3. To keep the past behaviour, explicitly set
`max_features='sqrt'`.
  warnings.warn(
/opt/conda/lib/python3.10/site-packages/sklearn/tree/_classes.py:269:
FutureWarning: `max_features='auto'` has been deprecated in 1.1 and will be
removed in 1.3. To keep the past behaviour, explicitly set
`max_features='sqrt'`.
  warnings.warn(
/opt/conda/lib/python3.10/site-packages/sklearn/tree/_classes.py:269:
FutureWarning: `max_features='auto'` has been deprecated in 1.1 and will be
removed in 1.3. To keep the past behaviour, explicitly set
`max_features='sqrt'`.
  warnings.warn(
/opt/conda/lib/python3.10/site-packages/sklearn/tree/_classes.py:269:
FutureWarning: `max_features='auto'` has been deprecated in 1.1 and will be
removed in 1.3. To keep the past behaviour, explicitly set
`max_features='sqrt'`.
  warnings.warn(
/opt/conda/lib/python3.10/site-packages/sklearn/tree/_classes.py:269:
FutureWarning: `max_features='auto'` has been deprecated in 1.1 and will be
removed in 1.3. To keep the past behaviour, explicitly set
`max_features='sqrt'`.
```

```
    warnings.warn(
/opt/conda/lib/python3.10/site-packages/sklearn/tree/_classes.py:269:
FutureWarning: `max_features='auto'` has been deprecated in 1.1 and will be
removed in 1.3. To keep the past behaviour, explicitly set
`max_features='sqrt'`.
    warnings.warn(
/opt/conda/lib/python3.10/site-packages/sklearn/tree/_classes.py:269:
FutureWarning: `max_features='auto'` has been deprecated in 1.1 and will be
removed in 1.3. To keep the past behaviour, explicitly set
`max_features='sqrt'`.
    warnings.warn(
/opt/conda/lib/python3.10/site-packages/sklearn/tree/_classes.py:269:
FutureWarning: `max_features='auto'` has been deprecated in 1.1 and will be
removed in 1.3. To keep the past behaviour, explicitly set
`max_features='sqrt'`.
    warnings.warn(
/opt/conda/lib/python3.10/site-packages/sklearn/tree/_classes.py:269:
FutureWarning: `max_features='auto'` has been deprecated in 1.1 and will be
removed in 1.3. To keep the past behaviour, explicitly set
`max_features='sqrt'`.
    warnings.warn(
/opt/conda/lib/python3.10/site-packages/sklearn/tree/_classes.py:269:
FutureWarning: `max_features='auto'` has been deprecated in 1.1 and will be
removed in 1.3. To keep the past behaviour, explicitly set
`max_features='sqrt'`.
    warnings.warn(
/opt/conda/lib/python3.10/site-packages/sklearn/tree/_classes.py:269:
FutureWarning: `max_features='auto'` has been deprecated in 1.1 and will be
removed in 1.3. To keep the past behaviour, explicitly set
`max_features='sqrt'`.
    warnings.warn(
/opt/conda/lib/python3.10/site-packages/sklearn/tree/_classes.py:269:
FutureWarning: `max_features='auto'` has been deprecated in 1.1 and will be
removed in 1.3. To keep the past behaviour, explicitly set
`max_features='sqrt'`.
    warnings.warn(
/opt/conda/lib/python3.10/site-packages/sklearn/tree/_classes.py:269:
FutureWarning: `max_features='auto'` has been deprecated in 1.1 and will be
removed in 1.3. To keep the past behaviour, explicitly set
`max_features='sqrt'`.
    warnings.warn(
/opt/conda/lib/python3.10/site-packages/sklearn/tree/_classes.py:269:
FutureWarning: `max_features='auto'` has been deprecated in 1.1 and will be
```

```
removed in 1.3. To keep the past behaviour, explicitly set
`max_features='sqrt'`.
  warnings.warn(
/opt/conda/lib/python3.10/site-packages/sklearn/tree/_classes.py:269:
FutureWarning: `max_features='auto'` has been deprecated in 1.1 and will be
removed in 1.3. To keep the past behaviour, explicitly set
`max_features='sqrt'`.
  warnings.warn(
/opt/conda/lib/python3.10/site-packages/sklearn/tree/_classes.py:269:
FutureWarning: `max_features='auto'` has been deprecated in 1.1 and will be
removed in 1.3. To keep the past behaviour, explicitly set
`max_features='sqrt'`.
  warnings.warn(
/opt/conda/lib/python3.10/site-packages/sklearn/tree/_classes.py:269:
FutureWarning: `max_features='auto'` has been deprecated in 1.1 and will be
removed in 1.3. To keep the past behaviour, explicitly set
`max_features='sqrt'`.
  warnings.warn(
/opt/conda/lib/python3.10/site-packages/sklearn/tree/_classes.py:269:
FutureWarning: `max_features='auto'` has been deprecated in 1.1 and will be
removed in 1.3. To keep the past behaviour, explicitly set
`max_features='sqrt'`.
  warnings.warn(
/opt/conda/lib/python3.10/site-packages/sklearn/tree/_classes.py:269:
FutureWarning: `max_features='auto'` has been deprecated in 1.1 and will be
removed in 1.3. To keep the past behaviour, explicitly set
`max_features='sqrt'`.
  warnings.warn(
/opt/conda/lib/python3.10/site-packages/sklearn/tree/_classes.py:269:
FutureWarning: `max_features='auto'` has been deprecated in 1.1 and will be
removed in 1.3. To keep the past behaviour, explicitly set
`max_features='sqrt'`.
  warnings.warn(
/opt/conda/lib/python3.10/site-packages/sklearn/tree/_classes.py:269:
FutureWarning: `max_features='auto'` has been deprecated in 1.1 and will be
removed in 1.3. To keep the past behaviour, explicitly set
`max_features='sqrt'`.
  warnings.warn(
/opt/conda/lib/python3.10/site-packages/sklearn/tree/_classes.py:269:
FutureWarning: `max_features='auto'` has been deprecated in 1.1 and will be
removed in 1.3. To keep the past behaviour, explicitly set
`max_features='sqrt'`.
  warnings.warn(
/opt/conda/lib/python3.10/site-packages/sklearn/tree/_classes.py:269:
FutureWarning: `max_features='auto'` has been deprecated in 1.1 and will be
removed in 1.3. To keep the past behaviour, explicitly set
`max_features='sqrt'`.
  warnings.warn(
```

```
/opt/conda/lib/python3.10/site-packages/sklearn/tree/_classes.py:269:
FutureWarning: `max_features='auto'` has been deprecated in 1.1 and will be
removed in 1.3. To keep the past behaviour, explicitly set
`max_features='sqrt'`.
  warnings.warn(
/opt/conda/lib/python3.10/site-packages/sklearn/tree/_classes.py:269:
FutureWarning: `max_features='auto'` has been deprecated in 1.1 and will be
removed in 1.3. To keep the past behaviour, explicitly set
`max_features='sqrt'`.
  warnings.warn(
/opt/conda/lib/python3.10/site-packages/sklearn/tree/_classes.py:269:
FutureWarning: `max_features='auto'` has been deprecated in 1.1 and will be
removed in 1.3. To keep the past behaviour, explicitly set
`max_features='sqrt'`.
  warnings.warn(
/opt/conda/lib/python3.10/site-packages/sklearn/tree/_classes.py:269:
FutureWarning: `max_features='auto'` has been deprecated in 1.1 and will be
removed in 1.3. To keep the past behaviour, explicitly set
`max_features='sqrt'`.
  warnings.warn(
/opt/conda/lib/python3.10/site-packages/sklearn/tree/_classes.py:269:
FutureWarning: `max_features='auto'` has been deprecated in 1.1 and will be
removed in 1.3. To keep the past behaviour, explicitly set
`max_features='sqrt'`.
  warnings.warn(
/opt/conda/lib/python3.10/site-packages/sklearn/tree/_classes.py:269:
FutureWarning: `max_features='auto'` has been deprecated in 1.1 and will be
removed in 1.3. To keep the past behaviour, explicitly set
`max_features='sqrt'`.
  warnings.warn(
/opt/conda/lib/python3.10/site-packages/sklearn/tree/_classes.py:269:
FutureWarning: `max_features='auto'` has been deprecated in 1.1 and will be
removed in 1.3. To keep the past behaviour, explicitly set
`max_features='sqrt'`.
  warnings.warn(
/opt/conda/lib/python3.10/site-packages/sklearn/tree/_classes.py:269:
FutureWarning: `max_features='auto'` has been deprecated in 1.1 and will be
removed in 1.3. To keep the past behaviour, explicitly set
`max_features='sqrt'`.
  warnings.warn(
/opt/conda/lib/python3.10/site-packages/sklearn/tree/_classes.py:269:
FutureWarning: `max_features='auto'` has been deprecated in 1.1 and will be
removed in 1.3. To keep the past behaviour, explicitly set
```

```
`max_features='sqrt'`.
  warnings.warn(
/opt/conda/lib/python3.10/site-packages/sklearn/tree/_classes.py:269:
FutureWarning: `max_features='auto'` has been deprecated in 1.1 and will be
removed in 1.3. To keep the past behaviour, explicitly set
`max_features='sqrt'`.
  warnings.warn(
/opt/conda/lib/python3.10/site-packages/sklearn/tree/_classes.py:269:
FutureWarning: `max_features='auto'` has been deprecated in 1.1 and will be
removed in 1.3. To keep the past behaviour, explicitly set
`max_features='sqrt'`.
  warnings.warn(
/opt/conda/lib/python3.10/site-packages/sklearn/tree/_classes.py:269:
FutureWarning: `max_features='auto'` has been deprecated in 1.1 and will be
removed in 1.3. To keep the past behaviour, explicitly set
`max_features='sqrt'`.
  warnings.warn(
/opt/conda/lib/python3.10/site-packages/sklearn/tree/_classes.py:269:
FutureWarning: `max_features='auto'` has been deprecated in 1.1 and will be
removed in 1.3. To keep the past behaviour, explicitly set
`max_features='sqrt'`.
  warnings.warn(
/opt/conda/lib/python3.10/site-packages/sklearn/tree/_classes.py:269:
FutureWarning: `max_features='auto'` has been deprecated in 1.1 and will be
removed in 1.3. To keep the past behaviour, explicitly set
`max_features='sqrt'`.
  warnings.warn(
/opt/conda/lib/python3.10/site-packages/sklearn/tree/_classes.py:269:
FutureWarning: `max_features='auto'` has been deprecated in 1.1 and will be
removed in 1.3. To keep the past behaviour, explicitly set
`max_features='sqrt'`.
  warnings.warn(
/opt/conda/lib/python3.10/site-packages/sklearn/tree/_classes.py:269:
FutureWarning: `max_features='auto'` has been deprecated in 1.1 and will be
removed in 1.3. To keep the past behaviour, explicitly set
`max_features='sqrt'`.
  warnings.warn(
/opt/conda/lib/python3.10/site-packages/sklearn/tree/_classes.py:269:
FutureWarning: `max_features='auto'` has been deprecated in 1.1 and will be
removed in 1.3. To keep the past behaviour, explicitly set
`max_features='sqrt'`.
  warnings.warn(
/opt/conda/lib/python3.10/site-packages/sklearn/tree/_classes.py:269:
```

```
FutureWarning: `max_features='auto'` has been deprecated in 1.1 and will be
removed in 1.3. To keep the past behaviour, explicitly set
`max_features='sqrt'`.
  warnings.warn(
/opt/conda/lib/python3.10/site-packages/sklearn/tree/_classes.py:269:
FutureWarning: `max_features='auto'` has been deprecated in 1.1 and will be
removed in 1.3. To keep the past behaviour, explicitly set
`max_features='sqrt'`.
  warnings.warn(
/opt/conda/lib/python3.10/site-packages/sklearn/tree/_classes.py:269:
FutureWarning: `max_features='auto'` has been deprecated in 1.1 and will be
removed in 1.3. To keep the past behaviour, explicitly set
`max_features='sqrt'`.
  warnings.warn(
/opt/conda/lib/python3.10/site-packages/sklearn/tree/_classes.py:269:
FutureWarning: `max_features='auto'` has been deprecated in 1.1 and will be
removed in 1.3. To keep the past behaviour, explicitly set
`max_features='sqrt'`.
  warnings.warn(
/opt/conda/lib/python3.10/site-packages/sklearn/tree/_classes.py:269:
FutureWarning: `max_features='auto'` has been deprecated in 1.1 and will be
removed in 1.3. To keep the past behaviour, explicitly set
`max_features='sqrt'`.
  warnings.warn(
/opt/conda/lib/python3.10/site-packages/sklearn/tree/_classes.py:269:
FutureWarning: `max_features='auto'` has been deprecated in 1.1 and will be
removed in 1.3. To keep the past behaviour, explicitly set
`max_features='sqrt'`.
  warnings.warn(
/opt/conda/lib/python3.10/site-packages/sklearn/tree/_classes.py:269:
FutureWarning: `max_features='auto'` has been deprecated in 1.1 and will be
removed in 1.3. To keep the past behaviour, explicitly set
`max_features='sqrt'`.
  warnings.warn(
/opt/conda/lib/python3.10/site-packages/sklearn/tree/_classes.py:269:
FutureWarning: `max_features='auto'` has been deprecated in 1.1 and will be
removed in 1.3. To keep the past behaviour, explicitly set
`max_features='sqrt'`.
  warnings.warn(
/opt/conda/lib/python3.10/site-packages/sklearn/tree/_classes.py:269:
FutureWarning: `max_features='auto'` has been deprecated in 1.1 and will be
removed in 1.3. To keep the past behaviour, explicitly set
`max_features='sqrt'`.
  warnings.warn(
/opt/conda/lib/python3.10/site-packages/sklearn/tree/_classes.py:269:
FutureWarning: `max_features='auto'` has been deprecated in 1.1 and will be
removed in 1.3. To keep the past behaviour, explicitly set
`max_features='sqrt'`.
```

```
  warnings.warn(
/opt/conda/lib/python3.10/site-packages/sklearn/tree/_classes.py:269:
FutureWarning: `max_features='auto'` has been deprecated in 1.1 and will be
removed in 1.3. To keep the past behaviour, explicitly set
`max_features='sqrt'`.
  warnings.warn(
/opt/conda/lib/python3.10/site-packages/sklearn/tree/_classes.py:269:
FutureWarning: `max_features='auto'` has been deprecated in 1.1 and will be
removed in 1.3. To keep the past behaviour, explicitly set
`max_features='sqrt'`.
  warnings.warn(
/opt/conda/lib/python3.10/site-packages/sklearn/tree/_classes.py:269:
FutureWarning: `max_features='auto'` has been deprecated in 1.1 and will be
removed in 1.3. To keep the past behaviour, explicitly set
`max_features='sqrt'`.
  warnings.warn(
/opt/conda/lib/python3.10/site-packages/sklearn/tree/_classes.py:269:
FutureWarning: `max_features='auto'` has been deprecated in 1.1 and will be
removed in 1.3. To keep the past behaviour, explicitly set
`max_features='sqrt'`.
  warnings.warn(
/opt/conda/lib/python3.10/site-packages/sklearn/tree/_classes.py:269:
FutureWarning: `max_features='auto'` has been deprecated in 1.1 and will be
removed in 1.3. To keep the past behaviour, explicitly set
`max_features='sqrt'`.
  warnings.warn(
```

[55]:
```
GridSearchCV(cv=5, estimator=DecisionTreeClassifier(),
             param_grid={'criterion': ['gini', 'entropy'],
                         'max_depth': [1, 2, 3, 4, 5, 6, 7, 8, 9, 10],
                         'max_features': ['auto', 'sqrt', 'log2'],
                         'splitter': ['best', 'random']},
             scoring='accuracy')
```

[54]:

```
/opt/conda/lib/python3.10/site-packages/sklearn/tree/_classes.py:269:
FutureWarning: `max_features='auto'` has been deprecated in 1.1 and will be
removed in 1.3. To keep the past behaviour, explicitly set
`max_features='sqrt'`.
  warnings.warn(
/opt/conda/lib/python3.10/site-packages/sklearn/tree/_classes.py:269:
FutureWarning: `max_features='auto'` has been deprecated in 1.1 and will be
removed in 1.3. To keep the past behaviour, explicitly set
`max_features='sqrt'`.
  warnings.warn(
/opt/conda/lib/python3.10/site-packages/sklearn/tree/_classes.py:269:
FutureWarning: `max_features='auto'` has been deprecated in 1.1 and will be
```

```
removed in 1.3. To keep the past behaviour, explicitly set
`max_features='sqrt'`.
  warnings.warn(
/opt/conda/lib/python3.10/site-packages/sklearn/tree/_classes.py:269:
FutureWarning: `max_features='auto'` has been deprecated in 1.1 and will be
removed in 1.3. To keep the past behaviour, explicitly set
`max_features='sqrt'`.
  warnings.warn(
/opt/conda/lib/python3.10/site-packages/sklearn/tree/_classes.py:269:
FutureWarning: `max_features='auto'` has been deprecated in 1.1 and will be
removed in 1.3. To keep the past behaviour, explicitly set
`max_features='sqrt'`.
  warnings.warn(
/opt/conda/lib/python3.10/site-packages/sklearn/tree/_classes.py:269:
FutureWarning: `max_features='auto'` has been deprecated in 1.1 and will be
removed in 1.3. To keep the past behaviour, explicitly set
`max_features='sqrt'`.
  warnings.warn(
/opt/conda/lib/python3.10/site-packages/sklearn/tree/_classes.py:269:
FutureWarning: `max_features='auto'` has been deprecated in 1.1 and will be
removed in 1.3. To keep the past behaviour, explicitly set
`max_features='sqrt'`.
  warnings.warn(
/opt/conda/lib/python3.10/site-packages/sklearn/tree/_classes.py:269:
FutureWarning: `max_features='auto'` has been deprecated in 1.1 and will be
removed in 1.3. To keep the past behaviour, explicitly set
`max_features='sqrt'`.
  warnings.warn(
/opt/conda/lib/python3.10/site-packages/sklearn/tree/_classes.py:269:
FutureWarning: `max_features='auto'` has been deprecated in 1.1 and will be
removed in 1.3. To keep the past behaviour, explicitly set
`max_features='sqrt'`.
  warnings.warn(
/opt/conda/lib/python3.10/site-packages/sklearn/tree/_classes.py:269:
FutureWarning: `max_features='auto'` has been deprecated in 1.1 and will be
removed in 1.3. To keep the past behaviour, explicitly set
`max_features='sqrt'`.
  warnings.warn(
/opt/conda/lib/python3.10/site-packages/sklearn/tree/_classes.py:269:
FutureWarning: `max_features='auto'` has been deprecated in 1.1 and will be
removed in 1.3. To keep the past behaviour, explicitly set
`max_features='sqrt'`.
  warnings.warn(
/opt/conda/lib/python3.10/site-packages/sklearn/tree/_classes.py:269:
FutureWarning: `max_features='auto'` has been deprecated in 1.1 and will be
removed in 1.3. To keep the past behaviour, explicitly set
`max_features='sqrt'`.
  warnings.warn(
```

```
/opt/conda/lib/python3.10/site-packages/sklearn/tree/_classes.py:269:
FutureWarning: `max_features='auto'` has been deprecated in 1.1 and will be
removed in 1.3. To keep the past behaviour, explicitly set
`max_features='sqrt'`.
  warnings.warn(
/opt/conda/lib/python3.10/site-packages/sklearn/tree/_classes.py:269:
FutureWarning: `max_features='auto'` has been deprecated in 1.1 and will be
removed in 1.3. To keep the past behaviour, explicitly set
`max_features='sqrt'`.
  warnings.warn(
/opt/conda/lib/python3.10/site-packages/sklearn/tree/_classes.py:269:
FutureWarning: `max_features='auto'` has been deprecated in 1.1 and will be
removed in 1.3. To keep the past behaviour, explicitly set
`max_features='sqrt'`.
  warnings.warn(
/opt/conda/lib/python3.10/site-packages/sklearn/tree/_classes.py:269:
FutureWarning: `max_features='auto'` has been deprecated in 1.1 and will be
removed in 1.3. To keep the past behaviour, explicitly set
`max_features='sqrt'`.
  warnings.warn(
/opt/conda/lib/python3.10/site-packages/sklearn/tree/_classes.py:269:
FutureWarning: `max_features='auto'` has been deprecated in 1.1 and will be
removed in 1.3. To keep the past behaviour, explicitly set
`max_features='sqrt'`.
  warnings.warn(
/opt/conda/lib/python3.10/site-packages/sklearn/tree/_classes.py:269:
FutureWarning: `max_features='auto'` has been deprecated in 1.1 and will be
removed in 1.3. To keep the past behaviour, explicitly set
`max_features='sqrt'`.
  warnings.warn(
/opt/conda/lib/python3.10/site-packages/sklearn/tree/_classes.py:269:
FutureWarning: `max_features='auto'` has been deprecated in 1.1 and will be
removed in 1.3. To keep the past behaviour, explicitly set
`max_features='sqrt'`.
  warnings.warn(
/opt/conda/lib/python3.10/site-packages/sklearn/tree/_classes.py:269:
FutureWarning: `max_features='auto'` has been deprecated in 1.1 and will be
removed in 1.3. To keep the past behaviour, explicitly set
`max_features='sqrt'`.
  warnings.warn(
/opt/conda/lib/python3.10/site-packages/sklearn/tree/_classes.py:269:
FutureWarning: `max_features='auto'` has been deprecated in 1.1 and will be
removed in 1.3. To keep the past behaviour, explicitly set
`max_features='sqrt'`.
  warnings.warn(
/opt/conda/lib/python3.10/site-packages/sklearn/tree/_classes.py:269:
FutureWarning: `max_features='auto'` has been deprecated in 1.1 and will be
removed in 1.3. To keep the past behaviour, explicitly set
```

```
`max_features='sqrt'`.
  warnings.warn(
/opt/conda/lib/python3.10/site-packages/sklearn/tree/_classes.py:269:
FutureWarning: `max_features='auto'` has been deprecated in 1.1 and will be
removed in 1.3. To keep the past behaviour, explicitly set
`max_features='sqrt'`.
  warnings.warn(
/opt/conda/lib/python3.10/site-packages/sklearn/tree/_classes.py:269:
FutureWarning: `max_features='auto'` has been deprecated in 1.1 and will be
removed in 1.3. To keep the past behaviour, explicitly set
`max_features='sqrt'`.
  warnings.warn(
/opt/conda/lib/python3.10/site-packages/sklearn/tree/_classes.py:269:
FutureWarning: `max_features='auto'` has been deprecated in 1.1 and will be
removed in 1.3. To keep the past behaviour, explicitly set
`max_features='sqrt'`.
  warnings.warn(
/opt/conda/lib/python3.10/site-packages/sklearn/tree/_classes.py:269:
FutureWarning: `max_features='auto'` has been deprecated in 1.1 and will be
removed in 1.3. To keep the past behaviour, explicitly set
`max_features='sqrt'`.
  warnings.warn(
/opt/conda/lib/python3.10/site-packages/sklearn/tree/_classes.py:269:
FutureWarning: `max_features='auto'` has been deprecated in 1.1 and will be
removed in 1.3. To keep the past behaviour, explicitly set
`max_features='sqrt'`.
  warnings.warn(
/opt/conda/lib/python3.10/site-packages/sklearn/tree/_classes.py:269:
FutureWarning: `max_features='auto'` has been deprecated in 1.1 and will be
removed in 1.3. To keep the past behaviour, explicitly set
`max_features='sqrt'`.
  warnings.warn(
/opt/conda/lib/python3.10/site-packages/sklearn/tree/_classes.py:269:
FutureWarning: `max_features='auto'` has been deprecated in 1.1 and will be
removed in 1.3. To keep the past behaviour, explicitly set
`max_features='sqrt'`.
  warnings.warn(
/opt/conda/lib/python3.10/site-packages/sklearn/tree/_classes.py:269:
FutureWarning: `max_features='auto'` has been deprecated in 1.1 and will be
removed in 1.3. To keep the past behaviour, explicitly set
`max_features='sqrt'`.
  warnings.warn(
/opt/conda/lib/python3.10/site-packages/sklearn/tree/_classes.py:269:
```

```
FutureWarning: `max_features='auto'` has been deprecated in 1.1 and will be
removed in 1.3. To keep the past behaviour, explicitly set
`max_features='sqrt'`.
  warnings.warn(
/opt/conda/lib/python3.10/site-packages/sklearn/tree/_classes.py:269:
FutureWarning: `max_features='auto'` has been deprecated in 1.1 and will be
removed in 1.3. To keep the past behaviour, explicitly set
`max_features='sqrt'`.
  warnings.warn(
/opt/conda/lib/python3.10/site-packages/sklearn/tree/_classes.py:269:
FutureWarning: `max_features='auto'` has been deprecated in 1.1 and will be
removed in 1.3. To keep the past behaviour, explicitly set
`max_features='sqrt'`.
  warnings.warn(
/opt/conda/lib/python3.10/site-packages/sklearn/tree/_classes.py:269:
FutureWarning: `max_features='auto'` has been deprecated in 1.1 and will be
removed in 1.3. To keep the past behaviour, explicitly set
`max_features='sqrt'`.
  warnings.warn(
/opt/conda/lib/python3.10/site-packages/sklearn/tree/_classes.py:269:
FutureWarning: `max_features='auto'` has been deprecated in 1.1 and will be
removed in 1.3. To keep the past behaviour, explicitly set
`max_features='sqrt'`.
  warnings.warn(
/opt/conda/lib/python3.10/site-packages/sklearn/tree/_classes.py:269:
FutureWarning: `max_features='auto'` has been deprecated in 1.1 and will be
removed in 1.3. To keep the past behaviour, explicitly set
`max_features='sqrt'`.
  warnings.warn(
/opt/conda/lib/python3.10/site-packages/sklearn/tree/_classes.py:269:
FutureWarning: `max_features='auto'` has been deprecated in 1.1 and will be
removed in 1.3. To keep the past behaviour, explicitly set
`max_features='sqrt'`.
  warnings.warn(
/opt/conda/lib/python3.10/site-packages/sklearn/tree/_classes.py:269:
FutureWarning: `max_features='auto'` has been deprecated in 1.1 and will be
removed in 1.3. To keep the past behaviour, explicitly set
`max_features='sqrt'`.
  warnings.warn(
/opt/conda/lib/python3.10/site-packages/sklearn/tree/_classes.py:269:
FutureWarning: `max_features='auto'` has been deprecated in 1.1 and will be
removed in 1.3. To keep the past behaviour, explicitly set
`max_features='sqrt'`.
  warnings.warn(
/opt/conda/lib/python3.10/site-packages/sklearn/tree/_classes.py:269:
FutureWarning: `max_features='auto'` has been deprecated in 1.1 and will be
removed in 1.3. To keep the past behaviour, explicitly set
`max_features='sqrt'`.
```

```
  warnings.warn(
/opt/conda/lib/python3.10/site-packages/sklearn/tree/_classes.py:269:
FutureWarning: `max_features='auto'` has been deprecated in 1.1 and will be
removed in 1.3. To keep the past behaviour, explicitly set
`max_features='sqrt'`.
  warnings.warn(
/opt/conda/lib/python3.10/site-packages/sklearn/tree/_classes.py:269:
FutureWarning: `max_features='auto'` has been deprecated in 1.1 and will be
removed in 1.3. To keep the past behaviour, explicitly set
`max_features='sqrt'`.
  warnings.warn(
/opt/conda/lib/python3.10/site-packages/sklearn/tree/_classes.py:269:
FutureWarning: `max_features='auto'` has been deprecated in 1.1 and will be
removed in 1.3. To keep the past behaviour, explicitly set
`max_features='sqrt'`.
  warnings.warn(
/opt/conda/lib/python3.10/site-packages/sklearn/tree/_classes.py:269:
FutureWarning: `max_features='auto'` has been deprecated in 1.1 and will be
removed in 1.3. To keep the past behaviour, explicitly set
`max_features='sqrt'`.
  warnings.warn(
/opt/conda/lib/python3.10/site-packages/sklearn/tree/_classes.py:269:
FutureWarning: `max_features='auto'` has been deprecated in 1.1 and will be
removed in 1.3. To keep the past behaviour, explicitly set
`max_features='sqrt'`.
  warnings.warn(
/opt/conda/lib/python3.10/site-packages/sklearn/tree/_classes.py:269:
FutureWarning: `max_features='auto'` has been deprecated in 1.1 and will be
removed in 1.3. To keep the past behaviour, explicitly set
`max_features='sqrt'`.
  warnings.warn(
/opt/conda/lib/python3.10/site-packages/sklearn/tree/_classes.py:269:
FutureWarning: `max_features='auto'` has been deprecated in 1.1 and will be
removed in 1.3. To keep the past behaviour, explicitly set
`max_features='sqrt'`.
  warnings.warn(
/opt/conda/lib/python3.10/site-packages/sklearn/tree/_classes.py:269:
FutureWarning: `max_features='auto'` has been deprecated in 1.1 and will be
removed in 1.3. To keep the past behaviour, explicitly set
`max_features='sqrt'`.
  warnings.warn(
/opt/conda/lib/python3.10/site-packages/sklearn/tree/_classes.py:269:
FutureWarning: `max_features='auto'` has been deprecated in 1.1 and will be
```

```
removed in 1.3. To keep the past behaviour, explicitly set
`max_features='sqrt'`.
  warnings.warn(
/opt/conda/lib/python3.10/site-packages/sklearn/tree/_classes.py:269:
FutureWarning: `max_features='auto'` has been deprecated in 1.1 and will be
removed in 1.3. To keep the past behaviour, explicitly set
`max_features='sqrt'`.
  warnings.warn(
/opt/conda/lib/python3.10/site-packages/sklearn/tree/_classes.py:269:
FutureWarning: `max_features='auto'` has been deprecated in 1.1 and will be
removed in 1.3. To keep the past behaviour, explicitly set
`max_features='sqrt'`.
  warnings.warn(
/opt/conda/lib/python3.10/site-packages/sklearn/tree/_classes.py:269:
FutureWarning: `max_features='auto'` has been deprecated in 1.1 and will be
removed in 1.3. To keep the past behaviour, explicitly set
`max_features='sqrt'`.
  warnings.warn(
/opt/conda/lib/python3.10/site-packages/sklearn/tree/_classes.py:269:
FutureWarning: `max_features='auto'` has been deprecated in 1.1 and will be
removed in 1.3. To keep the past behaviour, explicitly set
`max_features='sqrt'`.
  warnings.warn(
/opt/conda/lib/python3.10/site-packages/sklearn/tree/_classes.py:269:
FutureWarning: `max_features='auto'` has been deprecated in 1.1 and will be
removed in 1.3. To keep the past behaviour, explicitly set
`max_features='sqrt'`.
  warnings.warn(
/opt/conda/lib/python3.10/site-packages/sklearn/tree/_classes.py:269:
FutureWarning: `max_features='auto'` has been deprecated in 1.1 and will be
removed in 1.3. To keep the past behaviour, explicitly set
`max_features='sqrt'`.
  warnings.warn(
/opt/conda/lib/python3.10/site-packages/sklearn/tree/_classes.py:269:
FutureWarning: `max_features='auto'` has been deprecated in 1.1 and will be
removed in 1.3. To keep the past behaviour, explicitly set
`max_features='sqrt'`.
  warnings.warn(
/opt/conda/lib/python3.10/site-packages/sklearn/tree/_classes.py:269:
FutureWarning: `max_features='auto'` has been deprecated in 1.1 and will be
removed in 1.3. To keep the past behaviour, explicitly set
`max_features='sqrt'`.
  warnings.warn(
```

```
/opt/conda/lib/python3.10/site-packages/sklearn/tree/_classes.py:269:
FutureWarning: `max_features='auto'` has been deprecated in 1.1 and will be
removed in 1.3. To keep the past behaviour, explicitly set
`max_features='sqrt'`.
  warnings.warn(
/opt/conda/lib/python3.10/site-packages/sklearn/tree/_classes.py:269:
FutureWarning: `max_features='auto'` has been deprecated in 1.1 and will be
removed in 1.3. To keep the past behaviour, explicitly set
`max_features='sqrt'`.
  warnings.warn(
/opt/conda/lib/python3.10/site-packages/sklearn/tree/_classes.py:269:
FutureWarning: `max_features='auto'` has been deprecated in 1.1 and will be
removed in 1.3. To keep the past behaviour, explicitly set
`max_features='sqrt'`.
  warnings.warn(
/opt/conda/lib/python3.10/site-packages/sklearn/tree/_classes.py:269:
FutureWarning: `max_features='auto'` has been deprecated in 1.1 and will be
removed in 1.3. To keep the past behaviour, explicitly set
`max_features='sqrt'`.
  warnings.warn(
/opt/conda/lib/python3.10/site-packages/sklearn/tree/_classes.py:269:
FutureWarning: `max_features='auto'` has been deprecated in 1.1 and will be
removed in 1.3. To keep the past behaviour, explicitly set
`max_features='sqrt'`.
  warnings.warn(
/opt/conda/lib/python3.10/site-packages/sklearn/tree/_classes.py:269:
FutureWarning: `max_features='auto'` has been deprecated in 1.1 and will be
removed in 1.3. To keep the past behaviour, explicitly set
`max_features='sqrt'`.
  warnings.warn(
/opt/conda/lib/python3.10/site-packages/sklearn/tree/_classes.py:269:
FutureWarning: `max_features='auto'` has been deprecated in 1.1 and will be
removed in 1.3. To keep the past behaviour, explicitly set
`max_features='sqrt'`.
  warnings.warn(
/opt/conda/lib/python3.10/site-packages/sklearn/tree/_classes.py:269:
FutureWarning: `max_features='auto'` has been deprecated in 1.1 and will be
removed in 1.3. To keep the past behaviour, explicitly set
`max_features='sqrt'`.
  warnings.warn(
/opt/conda/lib/python3.10/site-packages/sklearn/tree/_classes.py:269:
FutureWarning: `max_features='auto'` has been deprecated in 1.1 and will be
removed in 1.3. To keep the past behaviour, explicitly set
`max_features='sqrt'`.
  warnings.warn(
/opt/conda/lib/python3.10/site-packages/sklearn/tree/_classes.py:269:
FutureWarning: `max_features='auto'` has been deprecated in 1.1 and will be
removed in 1.3. To keep the past behaviour, explicitly set
```

```
`max_features='sqrt'`.
  warnings.warn(
/opt/conda/lib/python3.10/site-packages/sklearn/tree/_classes.py:269:
FutureWarning: `max_features='auto'` has been deprecated in 1.1 and will be
removed in 1.3. To keep the past behaviour, explicitly set
`max_features='sqrt'`.
  warnings.warn(
/opt/conda/lib/python3.10/site-packages/sklearn/tree/_classes.py:269:
FutureWarning: `max_features='auto'` has been deprecated in 1.1 and will be
removed in 1.3. To keep the past behaviour, explicitly set
`max_features='sqrt'`.
  warnings.warn(
/opt/conda/lib/python3.10/site-packages/sklearn/tree/_classes.py:269:
FutureWarning: `max_features='auto'` has been deprecated in 1.1 and will be
removed in 1.3. To keep the past behaviour, explicitly set
`max_features='sqrt'`.
  warnings.warn(
/opt/conda/lib/python3.10/site-packages/sklearn/tree/_classes.py:269:
FutureWarning: `max_features='auto'` has been deprecated in 1.1 and will be
removed in 1.3. To keep the past behaviour, explicitly set
`max_features='sqrt'`.
  warnings.warn(
/opt/conda/lib/python3.10/site-packages/sklearn/tree/_classes.py:269:
FutureWarning: `max_features='auto'` has been deprecated in 1.1 and will be
removed in 1.3. To keep the past behaviour, explicitly set
`max_features='sqrt'`.
  warnings.warn(
/opt/conda/lib/python3.10/site-packages/sklearn/tree/_classes.py:269:
FutureWarning: `max_features='auto'` has been deprecated in 1.1 and will be
removed in 1.3. To keep the past behaviour, explicitly set
`max_features='sqrt'`.
  warnings.warn(
/opt/conda/lib/python3.10/site-packages/sklearn/tree/_classes.py:269:
FutureWarning: `max_features='auto'` has been deprecated in 1.1 and will be
removed in 1.3. To keep the past behaviour, explicitly set
`max_features='sqrt'`.
  warnings.warn(
/opt/conda/lib/python3.10/site-packages/sklearn/tree/_classes.py:269:
FutureWarning: `max_features='auto'` has been deprecated in 1.1 and will be
removed in 1.3. To keep the past behaviour, explicitly set
`max_features='sqrt'`.
  warnings.warn(
/opt/conda/lib/python3.10/site-packages/sklearn/tree/_classes.py:269:
FutureWarning: `max_features='auto'` has been deprecated in 1.1 and will be
removed in 1.3. To keep the past behaviour, explicitly set
`max_features='sqrt'`.
  warnings.warn(
/opt/conda/lib/python3.10/site-packages/sklearn/tree/_classes.py:269:
```

```
FutureWarning: `max_features='auto'` has been deprecated in 1.1 and will be
removed in 1.3. To keep the past behaviour, explicitly set
`max_features='sqrt'`.
  warnings.warn(
/opt/conda/lib/python3.10/site-packages/sklearn/tree/_classes.py:269:
FutureWarning: `max_features='auto'` has been deprecated in 1.1 and will be
removed in 1.3. To keep the past behaviour, explicitly set
`max_features='sqrt'`.
  warnings.warn(
/opt/conda/lib/python3.10/site-packages/sklearn/tree/_classes.py:269:
FutureWarning: `max_features='auto'` has been deprecated in 1.1 and will be
removed in 1.3. To keep the past behaviour, explicitly set
`max_features='sqrt'`.
  warnings.warn(
/opt/conda/lib/python3.10/site-packages/sklearn/tree/_classes.py:269:
FutureWarning: `max_features='auto'` has been deprecated in 1.1 and will be
removed in 1.3. To keep the past behaviour, explicitly set
`max_features='sqrt'`.
  warnings.warn(
/opt/conda/lib/python3.10/site-packages/sklearn/tree/_classes.py:269:
FutureWarning: `max_features='auto'` has been deprecated in 1.1 and will be
removed in 1.3. To keep the past behaviour, explicitly set
`max_features='sqrt'`.
  warnings.warn(
/opt/conda/lib/python3.10/site-packages/sklearn/tree/_classes.py:269:
FutureWarning: `max_features='auto'` has been deprecated in 1.1 and will be
removed in 1.3. To keep the past behaviour, explicitly set
`max_features='sqrt'`.
  warnings.warn(
/opt/conda/lib/python3.10/site-packages/sklearn/tree/_classes.py:269:
FutureWarning: `max_features='auto'` has been deprecated in 1.1 and will be
removed in 1.3. To keep the past behaviour, explicitly set
`max_features='sqrt'`.
  warnings.warn(
/opt/conda/lib/python3.10/site-packages/sklearn/tree/_classes.py:269:
FutureWarning: `max_features='auto'` has been deprecated in 1.1 and will be
removed in 1.3. To keep the past behaviour, explicitly set
`max_features='sqrt'`.
  warnings.warn(
/opt/conda/lib/python3.10/site-packages/sklearn/tree/_classes.py:269:
FutureWarning: `max_features='auto'` has been deprecated in 1.1 and will be
removed in 1.3. To keep the past behaviour, explicitly set
`max_features='sqrt'`.
  warnings.warn(
/opt/conda/lib/python3.10/site-packages/sklearn/tree/_classes.py:269:
FutureWarning: `max_features='auto'` has been deprecated in 1.1 and will be
removed in 1.3. To keep the past behaviour, explicitly set
`max_features='sqrt'`.
```

```
  warnings.warn(
/opt/conda/lib/python3.10/site-packages/sklearn/tree/_classes.py:269:
FutureWarning: `max_features='auto'` has been deprecated in 1.1 and will be
removed in 1.3. To keep the past behaviour, explicitly set
`max_features='sqrt'`.
  warnings.warn(
/opt/conda/lib/python3.10/site-packages/sklearn/tree/_classes.py:269:
FutureWarning: `max_features='auto'` has been deprecated in 1.1 and will be
removed in 1.3. To keep the past behaviour, explicitly set
`max_features='sqrt'`.
  warnings.warn(
/opt/conda/lib/python3.10/site-packages/sklearn/tree/_classes.py:269:
FutureWarning: `max_features='auto'` has been deprecated in 1.1 and will be
removed in 1.3. To keep the past behaviour, explicitly set
`max_features='sqrt'`.
  warnings.warn(
/opt/conda/lib/python3.10/site-packages/sklearn/tree/_classes.py:269:
FutureWarning: `max_features='auto'` has been deprecated in 1.1 and will be
removed in 1.3. To keep the past behaviour, explicitly set
`max_features='sqrt'`.
  warnings.warn(
/opt/conda/lib/python3.10/site-packages/sklearn/tree/_classes.py:269:
FutureWarning: `max_features='auto'` has been deprecated in 1.1 and will be
removed in 1.3. To keep the past behaviour, explicitly set
`max_features='sqrt'`.
  warnings.warn(
/opt/conda/lib/python3.10/site-packages/sklearn/tree/_classes.py:269:
FutureWarning: `max_features='auto'` has been deprecated in 1.1 and will be
removed in 1.3. To keep the past behaviour, explicitly set
`max_features='sqrt'`.
  warnings.warn(
/opt/conda/lib/python3.10/site-packages/sklearn/tree/_classes.py:269:
FutureWarning: `max_features='auto'` has been deprecated in 1.1 and will be
removed in 1.3. To keep the past behaviour, explicitly set
`max_features='sqrt'`.
  warnings.warn(
/opt/conda/lib/python3.10/site-packages/sklearn/tree/_classes.py:269:
FutureWarning: `max_features='auto'` has been deprecated in 1.1 and will be
removed in 1.3. To keep the past behaviour, explicitly set
`max_features='sqrt'`.
  warnings.warn(
/opt/conda/lib/python3.10/site-packages/sklearn/tree/_classes.py:269:
FutureWarning: `max_features='auto'` has been deprecated in 1.1 and will be
```

```
removed in 1.3. To keep the past behaviour, explicitly set
`max_features='sqrt'`.
  warnings.warn(
/opt/conda/lib/python3.10/site-packages/sklearn/tree/_classes.py:269:
FutureWarning: `max_features='auto'` has been deprecated in 1.1 and will be
removed in 1.3. To keep the past behaviour, explicitly set
`max_features='sqrt'`.
  warnings.warn(
/opt/conda/lib/python3.10/site-packages/sklearn/tree/_classes.py:269:
FutureWarning: `max_features='auto'` has been deprecated in 1.1 and will be
removed in 1.3. To keep the past behaviour, explicitly set
`max_features='sqrt'`.
  warnings.warn(
/opt/conda/lib/python3.10/site-packages/sklearn/tree/_classes.py:269:
FutureWarning: `max_features='auto'` has been deprecated in 1.1 and will be
removed in 1.3. To keep the past behaviour, explicitly set
`max_features='sqrt'`.
  warnings.warn(
/opt/conda/lib/python3.10/site-packages/sklearn/tree/_classes.py:269:
FutureWarning: `max_features='auto'` has been deprecated in 1.1 and will be
removed in 1.3. To keep the past behaviour, explicitly set
`max_features='sqrt'`.
  warnings.warn(
/opt/conda/lib/python3.10/site-packages/sklearn/tree/_classes.py:269:
FutureWarning: `max_features='auto'` has been deprecated in 1.1 and will be
removed in 1.3. To keep the past behaviour, explicitly set
`max_features='sqrt'`.
  warnings.warn(
/opt/conda/lib/python3.10/site-packages/sklearn/tree/_classes.py:269:
FutureWarning: `max_features='auto'` has been deprecated in 1.1 and will be
removed in 1.3. To keep the past behaviour, explicitly set
`max_features='sqrt'`.
  warnings.warn(
/opt/conda/lib/python3.10/site-packages/sklearn/tree/_classes.py:269:
FutureWarning: `max_features='auto'` has been deprecated in 1.1 and will be
removed in 1.3. To keep the past behaviour, explicitly set
`max_features='sqrt'`.
  warnings.warn(
/opt/conda/lib/python3.10/site-packages/sklearn/tree/_classes.py:269:
FutureWarning: `max_features='auto'` has been deprecated in 1.1 and will be
removed in 1.3. To keep the past behaviour, explicitly set
`max_features='sqrt'`.
  warnings.warn(
/opt/conda/lib/python3.10/site-packages/sklearn/tree/_classes.py:269:
FutureWarning: `max_features='auto'` has been deprecated in 1.1 and will be
removed in 1.3. To keep the past behaviour, explicitly set
`max_features='sqrt'`.
  warnings.warn(
```

```
/opt/conda/lib/python3.10/site-packages/sklearn/tree/_classes.py:269:
FutureWarning: `max_features='auto'` has been deprecated in 1.1 and will be
removed in 1.3. To keep the past behaviour, explicitly set
`max_features='sqrt'`.
  warnings.warn(
/opt/conda/lib/python3.10/site-packages/sklearn/tree/_classes.py:269:
FutureWarning: `max_features='auto'` has been deprecated in 1.1 and will be
removed in 1.3. To keep the past behaviour, explicitly set
`max_features='sqrt'`.
  warnings.warn(
/opt/conda/lib/python3.10/site-packages/sklearn/tree/_classes.py:269:
FutureWarning: `max_features='auto'` has been deprecated in 1.1 and will be
removed in 1.3. To keep the past behaviour, explicitly set
`max_features='sqrt'`.
  warnings.warn(
/opt/conda/lib/python3.10/site-packages/sklearn/tree/_classes.py:269:
FutureWarning: `max_features='auto'` has been deprecated in 1.1 and will be
removed in 1.3. To keep the past behaviour, explicitly set
`max_features='sqrt'`.
  warnings.warn(
/opt/conda/lib/python3.10/site-packages/sklearn/tree/_classes.py:269:
FutureWarning: `max_features='auto'` has been deprecated in 1.1 and will be
removed in 1.3. To keep the past behaviour, explicitly set
`max_features='sqrt'`.
  warnings.warn(
/opt/conda/lib/python3.10/site-packages/sklearn/tree/_classes.py:269:
FutureWarning: `max_features='auto'` has been deprecated in 1.1 and will be
removed in 1.3. To keep the past behaviour, explicitly set
`max_features='sqrt'`.
  warnings.warn(
/opt/conda/lib/python3.10/site-packages/sklearn/tree/_classes.py:269:
FutureWarning: `max_features='auto'` has been deprecated in 1.1 and will be
removed in 1.3. To keep the past behaviour, explicitly set
`max_features='sqrt'`.
  warnings.warn(
/opt/conda/lib/python3.10/site-packages/sklearn/tree/_classes.py:269:
FutureWarning: `max_features='auto'` has been deprecated in 1.1 and will be
removed in 1.3. To keep the past behaviour, explicitly set
`max_features='sqrt'`.
  warnings.warn(
/opt/conda/lib/python3.10/site-packages/sklearn/tree/_classes.py:269:
FutureWarning: `max_features='auto'` has been deprecated in 1.1 and will be
removed in 1.3. To keep the past behaviour, explicitly set
```

```
`max_features='sqrt'`.
  warnings.warn(
/opt/conda/lib/python3.10/site-packages/sklearn/tree/_classes.py:269:
FutureWarning: `max_features='auto'` has been deprecated in 1.1 and will be
removed in 1.3. To keep the past behaviour, explicitly set
`max_features='sqrt'`.
  warnings.warn(
/opt/conda/lib/python3.10/site-packages/sklearn/tree/_classes.py:269:
FutureWarning: `max_features='auto'` has been deprecated in 1.1 and will be
removed in 1.3. To keep the past behaviour, explicitly set
`max_features='sqrt'`.
  warnings.warn(
/opt/conda/lib/python3.10/site-packages/sklearn/tree/_classes.py:269:
FutureWarning: `max_features='auto'` has been deprecated in 1.1 and will be
removed in 1.3. To keep the past behaviour, explicitly set
`max_features='sqrt'`.
  warnings.warn(
/opt/conda/lib/python3.10/site-packages/sklearn/tree/_classes.py:269:
FutureWarning: `max_features='auto'` has been deprecated in 1.1 and will be
removed in 1.3. To keep the past behaviour, explicitly set
`max_features='sqrt'`.
  warnings.warn(
/opt/conda/lib/python3.10/site-packages/sklearn/tree/_classes.py:269:
FutureWarning: `max_features='auto'` has been deprecated in 1.1 and will be
removed in 1.3. To keep the past behaviour, explicitly set
`max_features='sqrt'`.
  warnings.warn(
/opt/conda/lib/python3.10/site-packages/sklearn/tree/_classes.py:269:
FutureWarning: `max_features='auto'` has been deprecated in 1.1 and will be
removed in 1.3. To keep the past behaviour, explicitly set
`max_features='sqrt'`.
  warnings.warn(
/opt/conda/lib/python3.10/site-packages/sklearn/tree/_classes.py:269:
FutureWarning: `max_features='auto'` has been deprecated in 1.1 and will be
removed in 1.3. To keep the past behaviour, explicitly set
`max_features='sqrt'`.
  warnings.warn(
/opt/conda/lib/python3.10/site-packages/sklearn/tree/_classes.py:269:
FutureWarning: `max_features='auto'` has been deprecated in 1.1 and will be
removed in 1.3. To keep the past behaviour, explicitly set
`max_features='sqrt'`.
  warnings.warn(
/opt/conda/lib/python3.10/site-packages/sklearn/tree/_classes.py:269:
FutureWarning: `max_features='auto'` has been deprecated in 1.1 and will be
removed in 1.3. To keep the past behaviour, explicitly set
`max_features='sqrt'`.
  warnings.warn(
/opt/conda/lib/python3.10/site-packages/sklearn/tree/_classes.py:269:
```

```
FutureWarning: `max_features='auto'` has been deprecated in 1.1 and will be
removed in 1.3. To keep the past behaviour, explicitly set
`max_features='sqrt'`.
  warnings.warn(
/opt/conda/lib/python3.10/site-packages/sklearn/tree/_classes.py:269:
FutureWarning: `max_features='auto'` has been deprecated in 1.1 and will be
removed in 1.3. To keep the past behaviour, explicitly set
`max_features='sqrt'`.
  warnings.warn(
/opt/conda/lib/python3.10/site-packages/sklearn/tree/_classes.py:269:
FutureWarning: `max_features='auto'` has been deprecated in 1.1 and will be
removed in 1.3. To keep the past behaviour, explicitly set
`max_features='sqrt'`.
  warnings.warn(
/opt/conda/lib/python3.10/site-packages/sklearn/tree/_classes.py:269:
FutureWarning: `max_features='auto'` has been deprecated in 1.1 and will be
removed in 1.3. To keep the past behaviour, explicitly set
`max_features='sqrt'`.
  warnings.warn(
/opt/conda/lib/python3.10/site-packages/sklearn/tree/_classes.py:269:
FutureWarning: `max_features='auto'` has been deprecated in 1.1 and will be
removed in 1.3. To keep the past behaviour, explicitly set
`max_features='sqrt'`.
  warnings.warn(
/opt/conda/lib/python3.10/site-packages/sklearn/tree/_classes.py:269:
FutureWarning: `max_features='auto'` has been deprecated in 1.1 and will be
removed in 1.3. To keep the past behaviour, explicitly set
`max_features='sqrt'`.
  warnings.warn(
/opt/conda/lib/python3.10/site-packages/sklearn/tree/_classes.py:269:
FutureWarning: `max_features='auto'` has been deprecated in 1.1 and will be
removed in 1.3. To keep the past behaviour, explicitly set
`max_features='sqrt'`.
  warnings.warn(
/opt/conda/lib/python3.10/site-packages/sklearn/tree/_classes.py:269:
FutureWarning: `max_features='auto'` has been deprecated in 1.1 and will be
removed in 1.3. To keep the past behaviour, explicitly set
`max_features='sqrt'`.
  warnings.warn(
/opt/conda/lib/python3.10/site-packages/sklearn/tree/_classes.py:269:
FutureWarning: `max_features='auto'` has been deprecated in 1.1 and will be
removed in 1.3. To keep the past behaviour, explicitly set
`max_features='sqrt'`.
  warnings.warn(
/opt/conda/lib/python3.10/site-packages/sklearn/tree/_classes.py:269:
FutureWarning: `max_features='auto'` has been deprecated in 1.1 and will be
removed in 1.3. To keep the past behaviour, explicitly set
`max_features='sqrt'`.
```

```
  warnings.warn(
/opt/conda/lib/python3.10/site-packages/sklearn/tree/_classes.py:269:
FutureWarning: `max_features='auto'` has been deprecated in 1.1 and will be
removed in 1.3. To keep the past behaviour, explicitly set
`max_features='sqrt'`.
  warnings.warn(
/opt/conda/lib/python3.10/site-packages/sklearn/tree/_classes.py:269:
FutureWarning: `max_features='auto'` has been deprecated in 1.1 and will be
removed in 1.3. To keep the past behaviour, explicitly set
`max_features='sqrt'`.
  warnings.warn(
/opt/conda/lib/python3.10/site-packages/sklearn/tree/_classes.py:269:
FutureWarning: `max_features='auto'` has been deprecated in 1.1 and will be
removed in 1.3. To keep the past behaviour, explicitly set
`max_features='sqrt'`.
  warnings.warn(
/opt/conda/lib/python3.10/site-packages/sklearn/tree/_classes.py:269:
FutureWarning: `max_features='auto'` has been deprecated in 1.1 and will be
removed in 1.3. To keep the past behaviour, explicitly set
`max_features='sqrt'`.
  warnings.warn(
/opt/conda/lib/python3.10/site-packages/sklearn/tree/_classes.py:269:
FutureWarning: `max_features='auto'` has been deprecated in 1.1 and will be
removed in 1.3. To keep the past behaviour, explicitly set
`max_features='sqrt'`.
  warnings.warn(
/opt/conda/lib/python3.10/site-packages/sklearn/tree/_classes.py:269:
FutureWarning: `max_features='auto'` has been deprecated in 1.1 and will be
removed in 1.3. To keep the past behaviour, explicitly set
`max_features='sqrt'`.
  warnings.warn(
/opt/conda/lib/python3.10/site-packages/sklearn/tree/_classes.py:269:
FutureWarning: `max_features='auto'` has been deprecated in 1.1 and will be
removed in 1.3. To keep the past behaviour, explicitly set
`max_features='sqrt'`.
  warnings.warn(
/opt/conda/lib/python3.10/site-packages/sklearn/tree/_classes.py:269:
FutureWarning: `max_features='auto'` has been deprecated in 1.1 and will be
removed in 1.3. To keep the past behaviour, explicitly set
`max_features='sqrt'`.
  warnings.warn(
/opt/conda/lib/python3.10/site-packages/sklearn/tree/_classes.py:269:
FutureWarning: `max_features='auto'` has been deprecated in 1.1 and will be
```

```
removed in 1.3. To keep the past behaviour, explicitly set
`max_features='sqrt'`.
  warnings.warn(
/opt/conda/lib/python3.10/site-packages/sklearn/tree/_classes.py:269:
FutureWarning: `max_features='auto'` has been deprecated in 1.1 and will be
removed in 1.3. To keep the past behaviour, explicitly set
`max_features='sqrt'`.
  warnings.warn(
/opt/conda/lib/python3.10/site-packages/sklearn/tree/_classes.py:269:
FutureWarning: `max_features='auto'` has been deprecated in 1.1 and will be
removed in 1.3. To keep the past behaviour, explicitly set
`max_features='sqrt'`.
  warnings.warn(
/opt/conda/lib/python3.10/site-packages/sklearn/tree/_classes.py:269:
FutureWarning: `max_features='auto'` has been deprecated in 1.1 and will be
removed in 1.3. To keep the past behaviour, explicitly set
`max_features='sqrt'`.
  warnings.warn(
/opt/conda/lib/python3.10/site-packages/sklearn/tree/_classes.py:269:
FutureWarning: `max_features='auto'` has been deprecated in 1.1 and will be
removed in 1.3. To keep the past behaviour, explicitly set
`max_features='sqrt'`.
  warnings.warn(
/opt/conda/lib/python3.10/site-packages/sklearn/tree/_classes.py:269:
FutureWarning: `max_features='auto'` has been deprecated in 1.1 and will be
removed in 1.3. To keep the past behaviour, explicitly set
`max_features='sqrt'`.
  warnings.warn(
/opt/conda/lib/python3.10/site-packages/sklearn/tree/_classes.py:269:
FutureWarning: `max_features='auto'` has been deprecated in 1.1 and will be
removed in 1.3. To keep the past behaviour, explicitly set
`max_features='sqrt'`.
  warnings.warn(
/opt/conda/lib/python3.10/site-packages/sklearn/tree/_classes.py:269:
FutureWarning: `max_features='auto'` has been deprecated in 1.1 and will be
removed in 1.3. To keep the past behaviour, explicitly set
`max_features='sqrt'`.
  warnings.warn(
/opt/conda/lib/python3.10/site-packages/sklearn/tree/_classes.py:269:
FutureWarning: `max_features='auto'` has been deprecated in 1.1 and will be
removed in 1.3. To keep the past behaviour, explicitly set
`max_features='sqrt'`.
  warnings.warn(
```

```
/opt/conda/lib/python3.10/site-packages/sklearn/tree/_classes.py:269:
FutureWarning: `max_features='auto'` has been deprecated in 1.1 and will be
removed in 1.3. To keep the past behaviour, explicitly set
`max_features='sqrt'`.
  warnings.warn(
/opt/conda/lib/python3.10/site-packages/sklearn/tree/_classes.py:269:
FutureWarning: `max_features='auto'` has been deprecated in 1.1 and will be
removed in 1.3. To keep the past behaviour, explicitly set
`max_features='sqrt'`.
  warnings.warn(
/opt/conda/lib/python3.10/site-packages/sklearn/tree/_classes.py:269:
FutureWarning: `max_features='auto'` has been deprecated in 1.1 and will be
removed in 1.3. To keep the past behaviour, explicitly set
`max_features='sqrt'`.
  warnings.warn(
/opt/conda/lib/python3.10/site-packages/sklearn/tree/_classes.py:269:
FutureWarning: `max_features='auto'` has been deprecated in 1.1 and will be
removed in 1.3. To keep the past behaviour, explicitly set
`max_features='sqrt'`.
  warnings.warn(
/opt/conda/lib/python3.10/site-packages/sklearn/tree/_classes.py:269:
FutureWarning: `max_features='auto'` has been deprecated in 1.1 and will be
removed in 1.3. To keep the past behaviour, explicitly set
`max_features='sqrt'`.
  warnings.warn(
/opt/conda/lib/python3.10/site-packages/sklearn/tree/_classes.py:269:
FutureWarning: `max_features='auto'` has been deprecated in 1.1 and will be
removed in 1.3. To keep the past behaviour, explicitly set
`max_features='sqrt'`.
  warnings.warn(
/opt/conda/lib/python3.10/site-packages/sklearn/tree/_classes.py:269:
FutureWarning: `max_features='auto'` has been deprecated in 1.1 and will be
removed in 1.3. To keep the past behaviour, explicitly set
`max_features='sqrt'`.
  warnings.warn(
/opt/conda/lib/python3.10/site-packages/sklearn/tree/_classes.py:269:
FutureWarning: `max_features='auto'` has been deprecated in 1.1 and will be
removed in 1.3. To keep the past behaviour, explicitly set
`max_features='sqrt'`.
  warnings.warn(
/opt/conda/lib/python3.10/site-packages/sklearn/tree/_classes.py:269:
FutureWarning: `max_features='auto'` has been deprecated in 1.1 and will be
removed in 1.3. To keep the past behaviour, explicitly set
```

```
`max_features='sqrt'`.
  warnings.warn(
/opt/conda/lib/python3.10/site-packages/sklearn/tree/_classes.py:269:
FutureWarning: `max_features='auto'` has been deprecated in 1.1 and will be
removed in 1.3. To keep the past behaviour, explicitly set
`max_features='sqrt'`.
  warnings.warn(
/opt/conda/lib/python3.10/site-packages/sklearn/tree/_classes.py:269:
FutureWarning: `max_features='auto'` has been deprecated in 1.1 and will be
removed in 1.3. To keep the past behaviour, explicitly set
`max_features='sqrt'`.
  warnings.warn(
/opt/conda/lib/python3.10/site-packages/sklearn/tree/_classes.py:269:
FutureWarning: `max_features='auto'` has been deprecated in 1.1 and will be
removed in 1.3. To keep the past behaviour, explicitly set
`max_features='sqrt'`.
  warnings.warn(
/opt/conda/lib/python3.10/site-packages/sklearn/tree/_classes.py:269:
FutureWarning: `max_features='auto'` has been deprecated in 1.1 and will be
removed in 1.3. To keep the past behaviour, explicitly set
`max_features='sqrt'`.
  warnings.warn(
/opt/conda/lib/python3.10/site-packages/sklearn/tree/_classes.py:269:
FutureWarning: `max_features='auto'` has been deprecated in 1.1 and will be
removed in 1.3. To keep the past behaviour, explicitly set
`max_features='sqrt'`.
  warnings.warn(
/opt/conda/lib/python3.10/site-packages/sklearn/tree/_classes.py:269:
FutureWarning: `max_features='auto'` has been deprecated in 1.1 and will be
removed in 1.3. To keep the past behaviour, explicitly set
`max_features='sqrt'`.
  warnings.warn(
/opt/conda/lib/python3.10/site-packages/sklearn/tree/_classes.py:269:
FutureWarning: `max_features='auto'` has been deprecated in 1.1 and will be
removed in 1.3. To keep the past behaviour, explicitly set
`max_features='sqrt'`.
  warnings.warn(
/opt/conda/lib/python3.10/site-packages/sklearn/tree/_classes.py:269:
FutureWarning: `max_features='auto'` has been deprecated in 1.1 and will be
removed in 1.3. To keep the past behaviour, explicitly set
`max_features='sqrt'`.
  warnings.warn(
/opt/conda/lib/python3.10/site-packages/sklearn/tree/_classes.py:269:
FutureWarning: `max_features='auto'` has been deprecated in 1.1 and will be
removed in 1.3. To keep the past behaviour, explicitly set
`max_features='sqrt'`.
  warnings.warn(
/opt/conda/lib/python3.10/site-packages/sklearn/tree/_classes.py:269:
```

```
FutureWarning: `max_features='auto'` has been deprecated in 1.1 and will be
removed in 1.3. To keep the past behaviour, explicitly set
`max_features='sqrt'`.
  warnings.warn(
/opt/conda/lib/python3.10/site-packages/sklearn/tree/_classes.py:269:
FutureWarning: `max_features='auto'` has been deprecated in 1.1 and will be
removed in 1.3. To keep the past behaviour, explicitly set
`max_features='sqrt'`.
  warnings.warn(
/opt/conda/lib/python3.10/site-packages/sklearn/tree/_classes.py:269:
FutureWarning: `max_features='auto'` has been deprecated in 1.1 and will be
removed in 1.3. To keep the past behaviour, explicitly set
`max_features='sqrt'`.
  warnings.warn(
/opt/conda/lib/python3.10/site-packages/sklearn/tree/_classes.py:269:
FutureWarning: `max_features='auto'` has been deprecated in 1.1 and will be
removed in 1.3. To keep the past behaviour, explicitly set
`max_features='sqrt'`.
  warnings.warn(
/opt/conda/lib/python3.10/site-packages/sklearn/tree/_classes.py:269:
FutureWarning: `max_features='auto'` has been deprecated in 1.1 and will be
removed in 1.3. To keep the past behaviour, explicitly set
`max_features='sqrt'`.
  warnings.warn(
/opt/conda/lib/python3.10/site-packages/sklearn/tree/_classes.py:269:
FutureWarning: `max_features='auto'` has been deprecated in 1.1 and will be
removed in 1.3. To keep the past behaviour, explicitly set
`max_features='sqrt'`.
  warnings.warn(
/opt/conda/lib/python3.10/site-packages/sklearn/tree/_classes.py:269:
FutureWarning: `max_features='auto'` has been deprecated in 1.1 and will be
removed in 1.3. To keep the past behaviour, explicitly set
`max_features='sqrt'`.
  warnings.warn(
/opt/conda/lib/python3.10/site-packages/sklearn/tree/_classes.py:269:
FutureWarning: `max_features='auto'` has been deprecated in 1.1 and will be
removed in 1.3. To keep the past behaviour, explicitly set
`max_features='sqrt'`.
  warnings.warn(
/opt/conda/lib/python3.10/site-packages/sklearn/tree/_classes.py:269:
FutureWarning: `max_features='auto'` has been deprecated in 1.1 and will be
removed in 1.3. To keep the past behaviour, explicitly set
`max_features='sqrt'`.
  warnings.warn(
/opt/conda/lib/python3.10/site-packages/sklearn/tree/_classes.py:269:
FutureWarning: `max_features='auto'` has been deprecated in 1.1 and will be
removed in 1.3. To keep the past behaviour, explicitly set
`max_features='sqrt'`.
```

```
  warnings.warn(
/opt/conda/lib/python3.10/site-packages/sklearn/tree/_classes.py:269:
FutureWarning: `max_features='auto'` has been deprecated in 1.1 and will be
removed in 1.3. To keep the past behaviour, explicitly set
`max_features='sqrt'`.
  warnings.warn(
/opt/conda/lib/python3.10/site-packages/sklearn/tree/_classes.py:269:
FutureWarning: `max_features='auto'` has been deprecated in 1.1 and will be
removed in 1.3. To keep the past behaviour, explicitly set
`max_features='sqrt'`.
  warnings.warn(
/opt/conda/lib/python3.10/site-packages/sklearn/tree/_classes.py:269:
FutureWarning: `max_features='auto'` has been deprecated in 1.1 and will be
removed in 1.3. To keep the past behaviour, explicitly set
`max_features='sqrt'`.
  warnings.warn(
/opt/conda/lib/python3.10/site-packages/sklearn/tree/_classes.py:269:
FutureWarning: `max_features='auto'` has been deprecated in 1.1 and will be
removed in 1.3. To keep the past behaviour, explicitly set
`max_features='sqrt'`.
  warnings.warn(
/opt/conda/lib/python3.10/site-packages/sklearn/tree/_classes.py:269:
FutureWarning: `max_features='auto'` has been deprecated in 1.1 and will be
removed in 1.3. To keep the past behaviour, explicitly set
`max_features='sqrt'`.
  warnings.warn(
/opt/conda/lib/python3.10/site-packages/sklearn/tree/_classes.py:269:
FutureWarning: `max_features='auto'` has been deprecated in 1.1 and will be
removed in 1.3. To keep the past behaviour, explicitly set
`max_features='sqrt'`.
  warnings.warn(
/opt/conda/lib/python3.10/site-packages/sklearn/tree/_classes.py:269:
FutureWarning: `max_features='auto'` has been deprecated in 1.1 and will be
removed in 1.3. To keep the past behaviour, explicitly set
`max_features='sqrt'`.
  warnings.warn(
/opt/conda/lib/python3.10/site-packages/sklearn/tree/_classes.py:269:
FutureWarning: `max_features='auto'` has been deprecated in 1.1 and will be
removed in 1.3. To keep the past behaviour, explicitly set
`max_features='sqrt'`.
  warnings.warn(
/opt/conda/lib/python3.10/site-packages/sklearn/tree/_classes.py:269:
FutureWarning: `max_features='auto'` has been deprecated in 1.1 and will be
```

```
removed in 1.3. To keep the past behaviour, explicitly set
`max_features='sqrt'`.
  warnings.warn(
/opt/conda/lib/python3.10/site-packages/sklearn/tree/_classes.py:269:
FutureWarning: `max_features='auto'` has been deprecated in 1.1 and will be
removed in 1.3. To keep the past behaviour, explicitly set
`max_features='sqrt'`.
  warnings.warn(
/opt/conda/lib/python3.10/site-packages/sklearn/tree/_classes.py:269:
FutureWarning: `max_features='auto'` has been deprecated in 1.1 and will be
removed in 1.3. To keep the past behaviour, explicitly set
`max_features='sqrt'`.
  warnings.warn(
/opt/conda/lib/python3.10/site-packages/sklearn/tree/_classes.py:269:
FutureWarning: `max_features='auto'` has been deprecated in 1.1 and will be
removed in 1.3. To keep the past behaviour, explicitly set
`max_features='sqrt'`.
  warnings.warn(
/opt/conda/lib/python3.10/site-packages/sklearn/tree/_classes.py:269:
FutureWarning: `max_features='auto'` has been deprecated in 1.1 and will be
removed in 1.3. To keep the past behaviour, explicitly set
`max_features='sqrt'`.
  warnings.warn(
/opt/conda/lib/python3.10/site-packages/sklearn/tree/_classes.py:269:
FutureWarning: `max_features='auto'` has been deprecated in 1.1 and will be
removed in 1.3. To keep the past behaviour, explicitly set
`max_features='sqrt'`.
  warnings.warn(
```

```
[54]: GridSearchCV(cv=5, estimator=DecisionTreeClassifier(),
                   param_grid={'criterion': ['gini', 'entropy'],
                               'max_depth': [1, 2, 3, 4, 5, 6, 7, 8, 9, 10],
                               'max_features': ['auto', 'sqrt', 'log2'],
                               'splitter': ['best', 'random']},
                   scoring='accuracy')
```

```
[56]: grid_search.best_params_
```

```
[56]: {'criterion': 'entropy',
       'max_depth': 5,
       'max_features': 'log2',
       'splitter': 'best'}
```

```
[57]: dtc_cv=DecisionTreeClassifier(criterion= 'entropy',
      max_depth= 4,
      max_features= 'sqrt',
      splitter= 'best')
```

```
      dtc_cv.fit(x_train,y_train)
```

[57]: DecisionTreeClassifier(criterion='entropy', max_depth=4, max_features='sqrt')

[59]:
```python
from sklearn.ensemble import RandomForestClassifier
classifier = RandomForestClassifier(n_estimators = 1000, criterion =␣
 ↪'entropy',random_state=100)
classifier.fit(x_train, y_train)
```

[59]: RandomForestClassifier(criterion='entropy', n_estimators=1000, random_state=100)

[60]:
```python
from sklearn.metrics import confusion_matrix, accuracy_score
y_pred = classifier.predict(x_test)
cm = confusion_matrix(y_test, y_pred)
print(cm)
accuracy_score(y_test, y_pred)
```

```
[[254    1]
 [ 35    4]]
```

[60]: 0.8775510204081632

[70]:
```python
from sklearn.ensemble import RandomForestClassifier
rfc=RandomForestClassifier()
forest_params = [
    {'max_depth': list(range(10, 15)), 'max_features': list(range(0, 14))},

]
rfc_cv=GridSearchCV(rfc,param_grid=forest_params,cv=10,scoring="accuracy")
rfc_cv.fit(x_train,y_train)
```

```
/opt/conda/lib/python3.10/site-
packages/sklearn/model_selection/_validation.py:378: FitFailedWarning:
50 fits failed out of a total of 700.
The score on these train-test partitions for these parameters will be set to
nan.
If these failures are not expected, you can try to debug them by setting
error_score='raise'.

Below are more details about the failures:
--------------------------------------------------------------------------------
50 fits failed with the following error:
Traceback (most recent call last):
  File "/opt/conda/lib/python3.10/site-
packages/sklearn/model_selection/_validation.py", line 686, in _fit_and_score
    estimator.fit(X_train, y_train, **fit_params)
  File "/opt/conda/lib/python3.10/site-packages/sklearn/ensemble/_forest.py",
line 340, in fit
```

```
      self._validate_params()
    File "/opt/conda/lib/python3.10/site-packages/sklearn/base.py", line 600, in
  _validate_params
      validate_parameter_constraints(
    File "/opt/conda/lib/python3.10/site-
  packages/sklearn/utils/_param_validation.py", line 97, in
  validate_parameter_constraints
      raise InvalidParameterError(
  sklearn.utils._param_validation.InvalidParameterError: The 'max_features'
  parameter of RandomForestClassifier must be an int in the range [1, inf), a
  float in the range (0.0, 1.0], a str among {'sqrt', 'auto' (deprecated), 'log2'}
  or None. Got 0 instead.

    warnings.warn(some_fits_failed_message, FitFailedWarning)
  /opt/conda/lib/python3.10/site-packages/sklearn/model_selection/_search.py:952:
  UserWarning: One or more of the test scores are non-finite: [       nan
  0.83675938 0.84440099 0.84611039 0.84694336 0.85291902
   0.85629436 0.84950022 0.8596842  0.85714182 0.86308851 0.86138635
   0.85459221 0.85969144        nan 0.83759235 0.84184413 0.8478053
   0.84611039 0.85204983 0.85289729 0.85882949 0.85882949 0.85287556
   0.85712009 0.86051717 0.85885122 0.85713458        nan 0.84101115
   0.85205708 0.84440823 0.84526293 0.85205708 0.85376648 0.85714907
   0.85883674 0.85714907 0.85459945 0.86223381 0.86223381 0.85800377
          nan 0.83930175 0.84524844 0.84781255 0.85291178 0.84950022
   0.85881501 0.85882949 0.85627264 0.85627988 0.85627988 0.85800377
   0.85966971 0.8613936         nan 0.84185137 0.84525569 0.84950746
   0.85290453 0.85545415 0.85882949 0.85374475 0.85798204 0.85545415
   0.85881501 0.85798204 0.85798928 0.86137187]
    warnings.warn(

[70]: GridSearchCV(cv=10, estimator=RandomForestClassifier(),
              param_grid=[{'max_depth': [10, 11, 12, 13, 14],
                           'max_features': [0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11,
                                            12, 13]}],
              scoring='accuracy')

[65]: print(classification_report(y_test,y_pred))
```

	precision	recall	f1-score	support
No	0.88	1.00	0.93	255
Yes	0.80	0.10	0.18	39
accuracy			0.88	294
macro avg	0.84	0.55	0.56	294
weighted avg	0.87	0.88	0.83	294