```
import numpy as np
import pandas as pd
from sklearn.datasets import make_classification

X,y = make_classification(n_features=5, n_redundant=0,
n_informative=5,n_clusters_per_class=1)

df = pd.DataFrame(X,columns=['col1','col2','col3','col4','col5'])
df['target'] = y
print(df.shape)
df.head()
```

```
(100, 6)
```

	col1	col2	col3	col4	col5	target
0	0.551380	-1.876815	-1.807618	-1.557932	-0.039809	0
1	-0.148084	-3.129695	0.387900	-1.322573	-1.448057	0
2	-3.874607	-1.727474	-0.943985	-2.895265	0.601189	1
3	1.709298	-0.825889	2.392230	-1.987155	1.819194	0
4	1.802057	-0.911493	0.022074	-2.545045	2.194047	0

```
# function for row sampling

def sample_rows(df,percent):
  return df.sample(int(percent*df.shape[0]),replace=True)

# function for feature sampling
def sample_features(df,percent):
  cols = random.sample(df.columns.tolist()[:-
1],int(percent*(df.shape[1]-1)))
  new_df = df[cols]
  new_df['target'] = df['target']
  return new_df

# function for combined sampling

def combined_sampling(df,row_percent,col_percent):
  new_df = sample_rows(df,row_percent)
  return sample_features(new_df,col_percent)

df1 = combined_sampling(df,0.5,0.5)
```

```
/usr/local/lib/python3.7/dist-packages/ipykernel_launcher.py:5:
SettingWithCopyWarning:
A value is trying to be set on a copy of a slice from a DataFrame.
Try using .loc[row_indexer,col_indexer] = value instead

See the caveats in the documentation:
https://pandas.pydata.org/pandas-docs/stable/user_guide/indexing.html#
returning-a-view-versus-a-copy
  """
```

```
df2 = combined_sampling(df,0.5,0.5)
```

```
/usr/local/lib/python3.7/dist-packages/ipykernel_launcher.py:5:
SettingWithCopyWarning:
A value is trying to be set on a copy of a slice from a DataFrame.
Try using .loc[row_indexer,col_indexer] = value instead

See the caveats in the documentation:
https://pandas.pydata.org/pandas-docs/stable/user_guide/indexing.html#
returning-a-view-versus-a-copy
  """
```

```
df3 = combined_sampling(df,0.5,0.5)
```

```
/usr/local/lib/python3.7/dist-packages/ipykernel_launcher.py:5:
SettingWithCopyWarning:
A value is trying to be set on a copy of a slice from a DataFrame.
Try using .loc[row_indexer,col_indexer] = value instead

See the caveats in the documentation:
https://pandas.pydata.org/pandas-docs/stable/user_guide/indexing.html#
returning-a-view-versus-a-copy
  """
```

```
print(df1.columns)
print(df2.columns)
print(df3.columns)
```

```
Index(['col5', 'col1', 'target'], dtype='object')
Index(['col5', 'col1', 'target'], dtype='object')
Index(['col3', 'col2', 'target'], dtype='object')
```

```
df3
```

```
        col3      col2  target
2  -0.943985 -1.727474       1
53  2.879522 -1.179645       0
17 -0.601854  0.240279       1
12 -1.209724  0.077615       1
8  -0.147061 -0.352877       0
6  -1.029536 -0.770751       1
94 -0.930578 -1.265605       1
4   0.022074 -0.911493       0
38  2.538559 -1.042250       0
40  0.595038 -0.162759       0
99  1.558165 -2.026716       0
25 -0.256852 -3.206283       1
91 -1.182347 -1.528637       0
12 -1.209724  0.077615       1
11 -0.679621 -1.275311       1
32 -1.343188 -0.141246       1
```

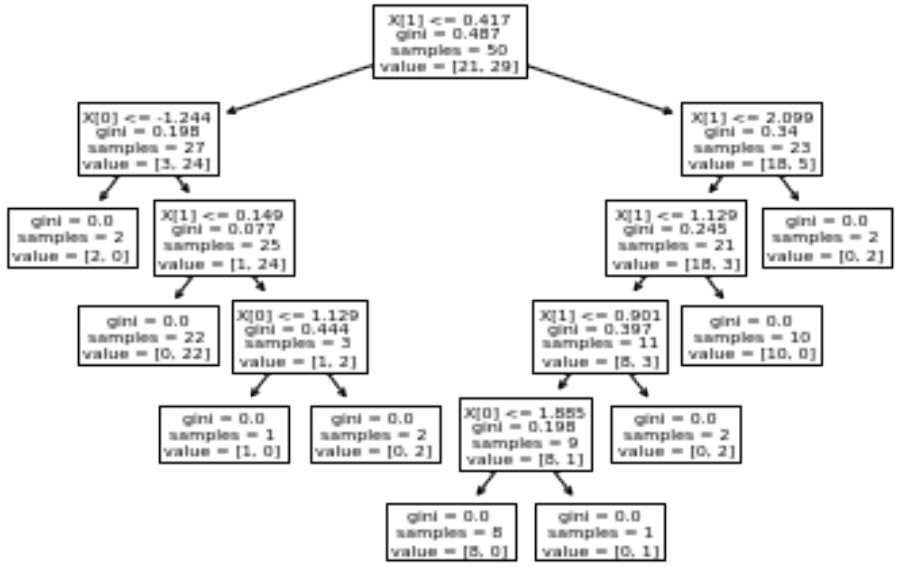
```
54 -0.384640 -0.270707       1
79 -0.558081 -1.985678       0
70 -0.438380 -1.497126       1
89  1.305171 -0.374577       0
10 -0.513609 -1.946675       1
22 -1.774446 -0.503487       1
87 -1.347947 -0.196919       1
96 -1.153825 -0.494453       1
14 -1.039782 -0.106427       1
84  1.986095 -1.284953       0
49  0.578898 -1.649036       0
74  1.125979 -2.884012       0
1   0.387900 -3.129695       0
73 -0.580873 -0.734898       1
86  1.411655  1.288265       0
66  0.885978 -3.087130       0
40  0.595038 -0.162759       0
91 -1.182347 -1.528637       0
48 -1.042498 -0.064323       1
92 -1.406179 -1.957413       1
8  -0.147061 -0.352877       0
89  1.305171 -0.374577       0
50  0.534164 -1.161223       0
98 -0.158598 -1.798861       0
83 -1.550002 -1.126191       1
51 -0.986968 -2.296564       1
54 -0.384640 -0.270707       1
56 -1.061683 -0.685227       1
91 -1.182347 -1.528637       0
94 -0.930578 -1.265605       1
49  0.578898 -1.649036       0
91 -1.182347 -1.528637       0
2  -0.943985 -1.727474       1
78 -1.013512 -1.587964       1
```

```
from sklearn.tree import DecisionTreeClassifier
clf1 = DecisionTreeClassifier()
clf2 = DecisionTreeClassifier()
clf3 = DecisionTreeClassifier()

clf1.fit(df1.iloc[:,0:2],df1.iloc[:,-1])
clf2.fit(df2.iloc[:,0:2],df2.iloc[:,-1])
clf3.fit(df3.iloc[:,0:2],df3.iloc[:,-1])

DecisionTreeClassifier(ccp_alpha=0.0, class_weight=None,
criterion='gini',
                       max_depth=None, max_features=None,
max_leaf_nodes=None,
                       min_impurity_decrease=0.0,
min_impurity_split=None,
```

```
                       min_samples_leaf=1, min_samples_split=2,
                       min_weight_fraction_leaf=0.0,
presort='deprecated',
                       random_state=None, splitter='best')
```

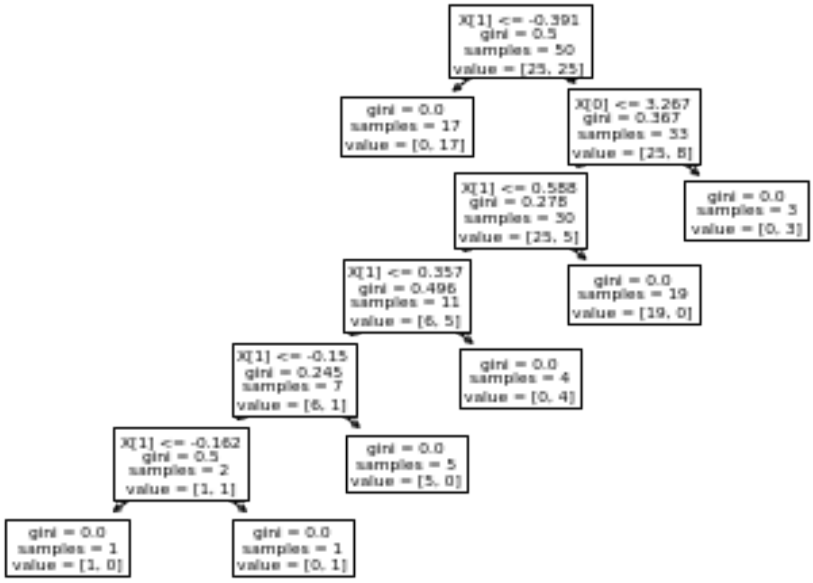
```
from sklearn.tree import plot_tree

plot_tree(clf1)
```

```
[Text(167.4, 199.32, 'X[1] <= 0.417\ngini = 0.487\nsamples = 50\nvalue
= [21, 29]'),
 Text(55.800000000000004, 163.07999999999998, 'X[0] <= -1.244\ngini =
0.198\nsamples = 27\nvalue = [3, 24]'),
 Text(27.900000000000002, 126.83999999999999, 'gini = 0.0\nsamples =
2\nvalue = [2, 0]'),
 Text(83.7, 126.83999999999999, 'X[1] <= 0.149\ngini = 0.077\nsamples
= 25\nvalue = [1, 24]'),
 Text(55.800000000000004, 90.6, 'gini = 0.0\nsamples = 22\nvalue = [0,
22]'),
 Text(111.60000000000001, 90.6, 'X[0] <= 1.129\ngini = 0.444\nsamples
= 3\nvalue = [1, 2]'),
 Text(83.7, 54.359999999999985, 'gini = 0.0\nsamples = 1\nvalue = [1,
0]'),
 Text(139.5, 54.359999999999985, 'gini = 0.0\nsamples = 2\nvalue = [0,
2]'),
 Text(279.0, 163.07999999999998, 'X[1] <= 2.099\ngini = 0.34\nsamples
= 23\nvalue = [18, 5]'),
 Text(251.10000000000002, 126.83999999999999, 'X[1] <= 1.129\ngini =
0.245\nsamples = 21\nvalue = [18, 3]'),
 Text(223.20000000000002, 90.6, 'X[1] <= 0.901\ngini = 0.397\nsamples
= 11\nvalue = [8, 3]'),
 Text(195.3, 54.359999999999985, 'X[0] <= 1.885\ngini = 0.198\nsamples
= 9\nvalue = [8, 1]'),
 Text(167.4, 18.119999999999976, 'gini = 0.0\nsamples = 8\nvalue = [8,
0]'),
 Text(223.20000000000002, 18.119999999999976, 'gini = 0.0\nsamples =
1\nvalue = [0, 1]'),
 Text(251.10000000000002, 54.359999999999985, 'gini = 0.0\nsamples =
2\nvalue = [0, 2]'),
 Text(279.0, 90.6, 'gini = 0.0\nsamples = 10\nvalue = [10, 0]'),
 Text(306.90000000000003, 126.83999999999999, 'gini = 0.0\nsamples =
2\nvalue = [0, 2]')]
```



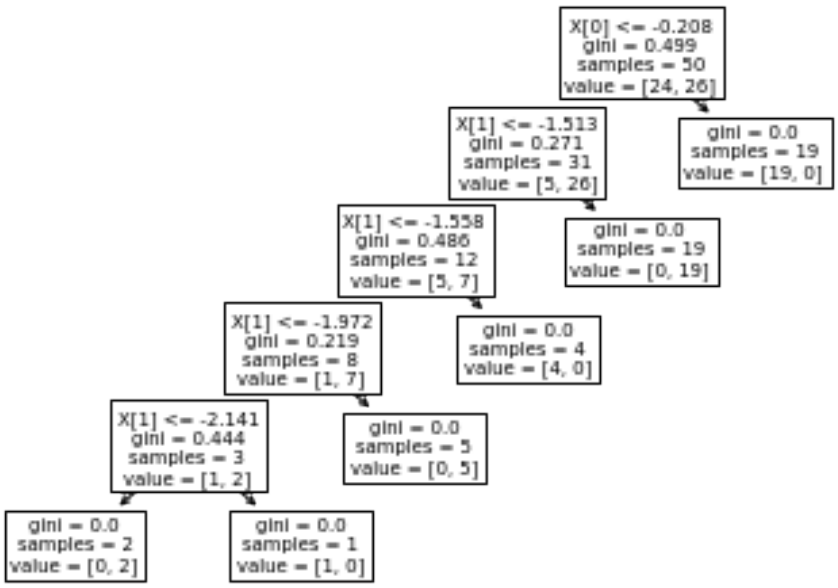

```
plot_tree(clf2)
```

```
[Text(209.25, 201.90857142857143, 'X[1] <= -0.391\ngini = 0.5\nsamples
= 50\nvalue = [25, 25]'),
 Text(167.4, 170.84571428571428, 'gini = 0.0\nsamples = 17\nvalue =
[0, 17]'),
 Text(251.10000000000002, 170.84571428571428, 'X[0] <= 3.267\ngini =
0.367\nsamples = 33\nvalue = [25, 8]'),
 Text(209.25, 139.78285714285715, 'X[1] <= 0.588\ngini = 0.278\
nsamples = 30\nvalue = [25, 5]'),
 Text(167.4, 108.72, 'X[1] <= 0.357\ngini = 0.496\nsamples = 11\nvalue
= [6, 5]'),
 Text(125.55000000000001, 77.65714285714284, 'X[1] <= -0.15\ngini =
0.245\nsamples = 7\nvalue = [6, 1]'),
 Text(83.7, 46.59428571428572, 'X[1] <= -0.162\ngini = 0.5\nsamples =
2\nvalue = [1, 1]'),
 Text(41.85, 15.531428571428563, 'gini = 0.0\nsamples = 1\nvalue = [1,
0]'),
 Text(125.55000000000001, 15.531428571428563, 'gini = 0.0\nsamples =
1\nvalue = [0, 1]'),
 Text(167.4, 46.59428571428572, 'gini = 0.0\nsamples = 5\nvalue = [5,
0]'),
 Text(209.25, 77.65714285714284, 'gini = 0.0\nsamples = 4\nvalue = [0,
4]'),
 Text(251.10000000000002, 108.72, 'gini = 0.0\nsamples = 19\nvalue =
[19, 0]'),
 Text(292.95, 139.78285714285715, 'gini = 0.0\nsamples = 3\nvalue =
[0, 3]')]
```




```
plot_tree(clf3)
```

```
[Text(251.10000000000002, 199.32, 'X[0] <= -0.208\ngini = 0.499\
nsamples = 50\nvalue = [24, 26]'),
 Text(209.25, 163.07999999999998, 'X[1] <= -1.513\ngini = 0.271\
nsamples = 31\nvalue = [5, 26]'),
 Text(167.4, 126.83999999999999, 'X[1] <= -1.558\ngini = 0.486\
nsamples = 12\nvalue = [5, 7]'),
 Text(125.55000000000001, 90.6, 'X[1] <= -1.972\ngini = 0.219\nsamples
= 8\nvalue = [1, 7]'),
 Text(83.7, 54.359999999999985, 'X[1] <= -2.141\ngini = 0.444\nsamples
= 3\nvalue = [1, 2]'),
 Text(41.85, 18.119999999999976, 'gini = 0.0\nsamples = 2\nvalue = [0,
2]'),
 Text(125.55000000000001, 18.119999999999976, 'gini = 0.0\nsamples =
1\nvalue = [1, 0]'),
 Text(167.4, 54.359999999999985, 'gini = 0.0\nsamples = 5\nvalue = [0,
5]'),
 Text(209.25, 90.6, 'gini = 0.0\nsamples = 4\nvalue = [4, 0]'),
 Text(251.10000000000002, 126.83999999999999, 'gini = 0.0\nsamples =
19\nvalue = [0, 19]'),
 Text(292.95, 163.07999999999998, 'gini = 0.0\nsamples = 19\nvalue =
[19, 0]')]
```




```
clf1.predict(np.array([-1.042498,     -0.064323]).reshape(1,2))
```

```
array([1])
```

```
clf2.predict(np.array([-1.042498,     -0.064323]).reshape(1,2))
```

```
array([0])
```

```
clf3.predict(np.array([-1.042498,     -0.064323]).reshape(1,2))
```

```
array([1])
```

```
df.sample(14,replace=True)
```

```
    humidity  wind  play
0          0     1     0
0          0     1     0
0          0     1     0
10         1     0     1
13         0     0     0
4          1     1     1
7          0     1     0
6          1     0     1
4          1     1     1
3          0     1     1
9          1     1     1
8          1     1     1
10         1     0     1
2          0     1     1
```