VERDICKT_JULIA-PS5

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1 Problem Set 5: Trees, Forests, and Fairness in ML

Your mission for this problem set is to use your knowledge of tree-based methods and supervised learning to – among other things! – explore issues of fairness in machine learning (ML). Unlike in previous psets, where we were implementing algorithms from scratch, this pset will rely more heavily on sklearn. Unless explicitly noted otherwise, you are allowed (encouraged!) to make good use of this wonderful library.

This problem set will also rely on the resources provided by the folktables project. Before getting started, take some time to understand what folktables is about and how it can be used to benchmark ML algorithms in social science. If you don't understand the basics, this pset will be very challenging!!

Some resources you might find useful:

Folktables paper

Folktables video

PUMS_Data_Dictionary_2018

Fairness in ML

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

1.1 Part I: Setup of prediction task

1.1.1 1.1 Define the income prediction task

For this first question we are providing the code. Run it to download the data you'll be using throughout this problem set.

Begin by explaining what this prediction task is about and what is this code accomplishing:

- Where do the data come from
- What is the sample?
- What are we trying to predict?
- What are the features that we will be using?
- What is the "group" feature?

```python
from folktables import ACSDataSource, generate_categories

def adult_filter(data):
    """Mimic the filters in place for Adult data.

    Adult documentation notes: Extraction was done by Barry Becker from
    the 1994 Census database. A set of reasonably clean records was extracted
    using the following conditions:
    ((AAGE>16) && (AGI>100) && (AFNLWGT>1)&& (HRSWK>0))
    """
    df = data
    df = df[df['AGEP'] > 16]
    df = df[df['PINCP'] > 100]
    df = df[df['WKHP'] > 0]
    df = df[df['PWGTP'] >= 1]
    return df

ACSIncome = folktables.BasicProblem(
    features=[
        'AGEP',
        'COW',
        'SCHL',
        'MAR',
        'POBP',
        'RELP',
        'WKHP',
        'SEX',
        'RAC1P',
    ],
    target='PINCP',
    target_transform=lambda x: x > 50000,
    group='RAC1P',
    preprocess=adult_filter,
    postprocess=lambda x: np.nan_to_num(x, -1),
)

data_source = ACSDataSource(survey_year='2018', horizon='1-Year',
  survey='person')
acs_data = data_source.get_data(states=["CA"], download=True)
definition_df = data_source.get_definitions(download=True)
categories = generate_categories(features=ACSIncome.features,
  definition_df=definition_df)
features, target, group = ACSIncome.df_to_pandas(acs_data)

feature_names = ACSIncome.features
target_name = ACSIncome.target
group_name = ACSIncome.group
```

your answer here

- Where do the data come from
  - Data was extracted from the 1994 Census database. The particular data we are using is the 2018 1-year American Community Survey.
- What is the sample?
  - The sample is adults in California in 2018 with age greater than 16, positive income greater than 100, more than 0 hours of work per week, and a final weight greater than or equal to 1.
- What are we trying to predict?
  - The target variable is `PINCP` or an individual's income represented as a binary variables with True (or "1" in one-hot encoding) meaning income greater thant $50,000. Thus, this is a binary classification problem, where we attempt to classify based on being over or under the given threshold.
- What are the features that we will be using?
  - The features used for prediction include:
    * `AGEP`: Age of the person.
    * `COW`: Class of worker.
    * `SCHL`: Educational attainment.
    * `MAR`: Marital status.
    * `POBP`: Place of birth.
    * `RELP`: Relationship to the householder/reference person.
    * `WKHP`: Hours worked per week.
    * `SEX`: Sex of the individual.
    * `RAC1P`: Race.
- What is the "group" feature?
  - The "group" feature is `RAC1P` or Race of the individual.

1.1.2 1.2 Split into train and test

Split your data into 80%-20% train and test splits. Please use sklearn.model_selection.train_test_split and set the random_state parameter equal to 0.

```
[ ]: from sklearn.model_selection import train_test_split

     # your code here

     X_train, X_test, y_train, y_test = train_test_split(features, target,␣
      ↪test_size=0.2, random_state=0)
```

1.1.3 1.3 Explore the data and set appropriate data types

Create 2-3 figures and tables that explore the training data, and tell us what insights you can draw from those figures. Which features are best represented as numerical data types? Which features are best represented as categorical data types? Set each feature to its desired data type in both train and test splits. Make sure that the target variable in both splits is numeric before moving ahead.

```
mode = X_train.mode().T
numsum = X_train.describe().T
numsum['mode'] = mode
numsum['IQR'] = numsum['75%'] - numsum['25%']
numsum
```

```
           count        mean          std   min   25%   50%    75%    max  mode  \
AGEP    156532.0   42.744800    14.890900  17.0  30.0  42.0   55.0   94.0  30.0
COW     156532.0    2.144111     1.888192   1.0   1.0   1.0    3.0    8.0   1.0
SCHL    156532.0   18.469035     3.942033   1.0  16.0  19.0   21.0   24.0  21.0
MAR     156532.0    2.654147     1.846824   1.0   1.0   1.0    5.0    5.0   1.0
POBP    156532.0   94.326847   123.497988   1.0   6.0   9.0  212.0  554.0   6.0
RELP    156532.0    2.503641     4.437141   0.0   0.0   1.0    2.0   17.0   0.0
WKHP    156532.0   37.863185    13.037727   1.0  32.0  40.0   40.0   99.0  40.0
SEX     156532.0    1.471737     0.499202   1.0   1.0   1.0    2.0    2.0   1.0
RAC1P   156532.0    3.071915     2.915066   1.0   1.0   1.0    6.0    9.0   1.0

          IQR
AGEP     25.0
COW       2.0
SCHL      5.0
MAR       4.0
POBP    206.0
RELP      2.0
WKHP      8.0
SEX       1.0
RAC1P     5.0
```

```python
#your code here

# Create a new DataFrame that combines X_train and y_train for plotting
combined_df = X_train.copy()
combined_df['target'] = y_train.values


race_mapping = {
    1: 'White alone',
    2: 'Black or African American alone',
    3: 'American Indian alone',
    4: 'Alaska Native alone',
    5: 'American Indian and Alaska Native tribes specified; or American Indian↵
  ↪or Alaska Native, not specified and no other races',
    6: 'Asian alone',
    7: 'Native Hawaiian and Other Pacific Islander alone',
    8: 'Some Other Race alone',
    9: 'Two or More Races'
}
```

```
# Replace numerical RAC1P values with the provided labels
combined_df['RAC1P'] = combined_df['RAC1P'].replace(race_mapping)


# Now, let's create a stacked bar chart

# Count the number of occurrences for each race within each target category
race_counts = combined_df.groupby(['target', 'RAC1P']).size().
  ↪unstack(fill_value=0)

# Calculate the proportions
race_proportions = race_counts.div(race_counts.sum(axis=1), axis=0)

# Plot
race_proportions.plot(kind='bar', stacked=True, figsize=(10, 6),␣
  ↪colormap='tab20')
plt.title('Proportion of Each Race by Target Category')
plt.ylabel('Proportion')
plt.xlabel('Target')
plt.legend(title='Race', bbox_to_anchor=(1.05, 1), loc='upper left')
plt.show()
```
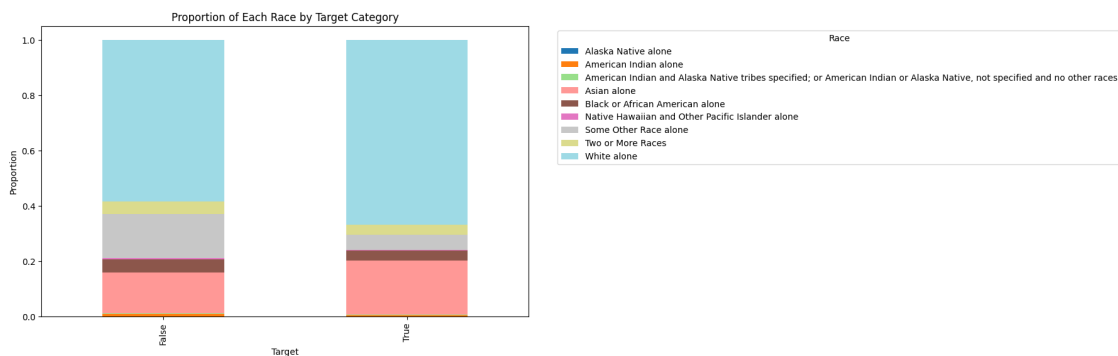


```
from scipy import stats
# First, filtering the DataFrame to include only the three groups of interest

combined_df = X_train.copy()
combined_df['target'] = y_train.values
groups_of_interest = [1, 2, 6]  # Corresponding to White, Black or African␣
  ↪American, and Asian
filtered_df = combined_df[combined_df['RAC1P'].isin(groups_of_interest)]

# Calculating proportions of True target values for each race
proportions = filtered_df.groupby('RAC1P')['target'].mean()
```

```python
groups = [(1, 2), (1, 6), (2, 6)]  # Groups identified by their numerical codes

# Dictionary to store t-test results
ttest_results = {}

for group1, group2 in groups:
    data1 = filtered_df[filtered_df['RAC1P'] == group1]['target']
    data2 = filtered_df[filtered_df['RAC1P'] == group2]['target']

    # Perform Welch's t-test
    t_stat, p_value = stats.ttest_ind(data1, data2, equal_var=False)

    if group1 == 1:
        group_1 = "White"
    else:
        group_1 = "African American"

    if group2 == 2:
        group_2 = "African American"
    else:
        group_2 = "Asian"
    # Store results
    ttest_results[f'{group_1} vs {group_2}'] = {'t_stat': t_stat, 'p_value':
 ↪p_value, 'is_significant': p_value < 0.05}

# Convert the results dictionary to a DataFrame for easier viewing
results_df = pd.DataFrame(ttest_results).T

results_df
```

```
[ ]:                            t_stat p_value is_significant
     White vs African American  17.469764     0.0           True
     White vs Asian            -10.764837     0.0           True
     African American vs Asian -21.717433     0.0           True
```

```python
[ ]: # Convert numerical features
     numerical_features = ['AGEP', 'WKHP']
     for feature in numerical_features:
         X_train[feature] = pd.to_numeric(X_train[feature], errors='coerce')
         X_test[feature] = pd.to_numeric(X_test[feature], errors='coerce')

     # Convert categorical features
     categorical_features = ['COW', 'SCHL', 'MAR', 'POBP', 'RELP', 'SEX', 'RAC1P']
     for feature in categorical_features:
         X_train[feature] = X_train[feature].astype('category')
```

```
    X_test[feature] = X_test[feature].astype('category')

# Ensure y_train is numerical
y_train = pd.to_numeric(y_train['PINCP'], errors='coerce')
y_test = pd.to_numeric(y_test['PINCP'], errors='coerce')
```

your answer here

- What insights you can draw from those figures?
    - We can see in the first table that all of the data is coded in numerically even if the value is technically categorical. Thus, most of the values in that table are actually meaningless for the categorical variables. For the categorical variables, one can still look at mode as valuable, but it's not very easy draw any major/interesting conclusion from that. For the two numerical variables of age and hours worked per weeks, we can see that the median age is about 42 and the median number of hours worked per week is about 40 hours. Thus, the typical observation is reasonable: a middle-age individual working full time.
    - The second graph is a stacked bar chart that attempts to compare the racial distribution of the sample for individuals below and above the threshold. Visually, we can already see that the distributions differ. Considering this visualization, I followed up with a t-test for some of the larger subgroups: "White", "Asian", and "Black or African American." The graph seems to indicate the realtive proportion of white individuals in higher above the threshold.
    - The t-test confirms what I saw visually, indicating significant differences in proportion of individuals above the threshold when grouping by race.
- Which features are best represented as numerical data types?
    - `AGEP`: Age of the person.
    - `WKHP`: Hours worked per week.
- Which features are best represented as categorical data types?
    - `COW`: Class of worker.
    - `SCHL`: Educational attainment.
    - `MAR`: Marital status.
    - `POBP`: Place of birth.
    - `RELP`: Relationship to the householder/reference person.
    - `SEX`: Sex of the individual.
    - `RAC1P`: Race.

`SCHL` is a bit tricky because many people may not follow a "linear" educational, path where increased years means increased educational attainment. Even though the data is ordinal to some extent, the "space" between each level is not consistent, especially when considering higher degrees. Looking at the PUMS data dictionary confirmed this. For example 22 represent a Master's degree while 23 represent Professional degree beyond a bachelor's degree. While 23 is a higher numerical representation, the categories they represent are not easily ranked as being "higher" or "lower". Thus, I found it more reasonable to simply treat it as a categorical variable.

1.2   Part II: ML pipeline for a Classification Tree

Next, you'll build an ML pipeline using sklearn. Take some time to familiarize yourself with sklearn.pipeline.Pipeline before proceeding.

1.2.1 2.1 Pre-processing of features

The first step of the pipeline will standardize the numeric features and one-hot encode the categorical features. Write the code for this preprocessing step below.

Hint: Take a look at sklearn's ColumnTransformer, OneHotEncoder and StandardScaler for this task.

```python
from sklearn.pipeline import Pipeline
from sklearn.compose import ColumnTransformer
from sklearn.preprocessing import OneHotEncoder, StandardScaler
```

```python
# your code here

# Define the numeric and categorical features as before
numerical_features = ['AGEP', 'WKHP']
categorical_features = ['COW', 'SCHL', 'MAR', 'POBP', 'RELP', 'SEX', 'RAC1P']

# Create the transformers for numeric and categorical features
numeric_transformer = StandardScaler()
categorical_transformer = OneHotEncoder(handle_unknown='ignore')

# Combine transformers into a ColumnTransformer
preprocessor = ColumnTransformer(
    transformers=[
        ('num', numeric_transformer, numerical_features),
        ('cat', categorical_transformer, categorical_features)
    ]
)
```

1.2.2 2.2 Use your pre-processed data to fit a basic DecisionTreeClassifier

Now, bring together the pre-processing step with a Decision Tree Classifier in a pipeline. For now, use the default values; we'll take care of hyperparameter optimization later. Fit the pipeline on the training data. How deep is the resulting tree? How many leafs are in the tree? Print the 10 variables with highest feature importance and tell us what those importances mean in plain English. Plot the top 5 levels of the fitted decision tree. Make sure that the nodes are appropriately labeled. Comment on anything that you find interesting.

```python
from sklearn.tree import DecisionTreeClassifier
from sklearn import tree
```

```python
# your code here

# Create a pipeline with the preprocessor and a DecisionTreeClassifier
pipeline = Pipeline(steps=[('preprocessor', preprocessor),
                           ('classifier',␣
  ↪DecisionTreeClassifier(random_state=0))])
```

```python
# Fit the pipeline on the training data
pipeline.fit(X_train, y_train)

# Access the DecisionTreeClassifier to get details about the tree
tree_classifier = pipeline.named_steps['classifier']

# Get the depth of the tree
tree_depth = tree_classifier.tree_.max_depth

# Get the number of leaves
tree_leaves = tree_classifier.get_n_leaves()

# Get feature importances
feature_importances = tree_classifier.feature_importances_

# Numerical features remain the same
numerical_feature_names = numerical_features

# Get one-hot encoded feature names
ohe_feature_names = pipeline.named_steps['preprocessor'].
 ↪named_transformers_['cat'].get_feature_names_out(categorical_features)

# Combine all feature names
all_feature_names = np.concatenate([numerical_feature_names, ohe_feature_names])

important_features = sorted(zip(all_feature_names, feature_importances),␣
 ↪key=lambda x: x[1], reverse=True)
```

```python
[ ]: # Print the depth and number of leaves of the tree
print(f"The depth of the tree is: {tree_depth}")
print(f"The number of leaves in the tree is: {tree_leaves}")

# Print the 10 variables with the highest feature importance
print("Top 10 variables by feature importance:")
for feature, importance in important_features[:10]:
    print(f"{feature}: {importance}")
```
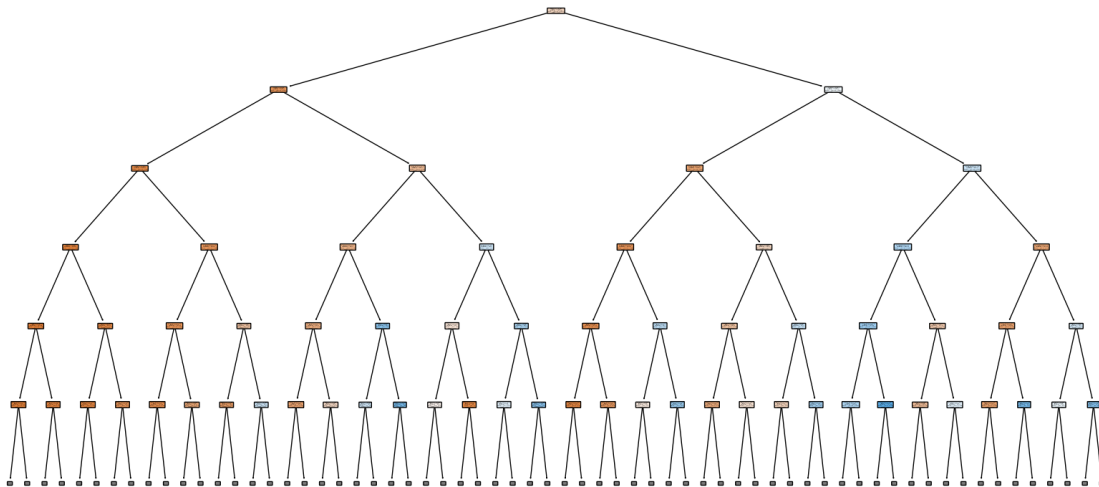
```
The depth of the tree is: 95
The number of leaves in the tree is: 37905
Top 10 variables by feature importance:
AGEP: 0.2335372092489254
WKHP: 0.2015925815408864
POBP_303.0: 0.048571073409023335
SCHL_21.0: 0.03189362272285797
SCHL_22.0: 0.02711601005941546
SCHL_16.0: 0.024472359427994278
SCHL_23.0: 0.018337869033878747
```

```
POBP_6.0: 0.016809922875534445
COW_1.0: 0.016648526165042494
RELP_0.0: 0.01634738010233044
```

[ ]: # Plot the top 5 levels of the fitted decision tree. Difficitul to read so I␣
      ↪plot fewer levels below
      plt.figure(figsize=(20,10))
      tree.plot_tree(tree_classifier, max_depth=5, feature_names=all_feature_names,␣
      ↪class_names=True, filled=True, rounded=True)
      plt.show()

[ ]: # Plot the top 3 levels of the fitted decision tree as this is easier to read
      plt.figure(figsize=(20,10))
      tree.plot_tree(tree_classifier, max_depth=2, feature_names=all_feature_names,␣
      ↪class_names=True, filled=True, rounded=True)
      plt.show()

WKHP <= -0.181
gini = 0.484
samples = 156532
value = [92232, 64300]
class = y[0]

AGEP <= 0.924
gini = 0.242
samples = 44240
value = [38000, 6240]
class = y[0]

AGEP <= -0.957
gini = 0.499
samples = 112292
value = [54232, 58060]
class = y[1]

AGEP <= -0.755
gini = 0.149
samples = 33319
value = [30614, 2705]
class = y[0]

SCHL_22.0 <= 0.5
gini = 0.438
samples = 10921
value = [7386, 3535]
class = y[0]

SCHL_21.0 <= 0.5
gini = 0.344
samples = 17642
value = [13749, 3893]
class = y[0]

POBP_303.0 <= 0.5
gini = 0.49
samples = 94650
value = [40483, 54167]
class = y[1]

(...) (...) (...) (...) (...) (...) (...) (...)

your answer here

- How deep is the resulting tree?
  - The resulting tree has a depth of `95`.
- How many leafs are in the tree?
  - The number of leaves if `37905`.
- Print the 10 variables with highest feature importance and tell us what those importances mean in plain English.
  - `AGEP`: 0.2335372092489254
  - `WKHP`: 0.2015925815408864
  - `POBP_303.0`: 0.048571073409023335
  - `SCHL_21.0`: 0.03189362272285797
  - `SCHL_22.0`: 0.02711601005941546
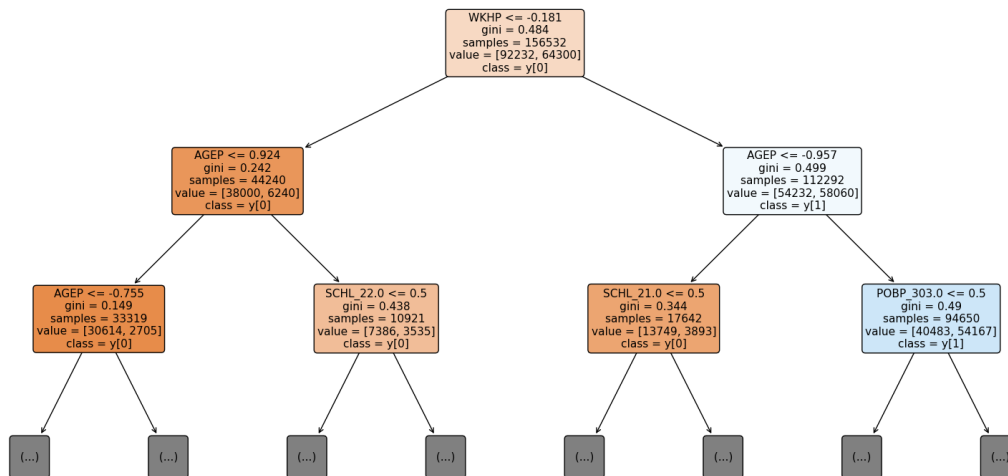 - `SCHL_16.0`: 0.024472359427994278
  - `SCHL_23.0`: 0.018337869033878747
  - `POBP_6.0`: 0.016809922875534445
  - `COW_1.0`: 0.016648526165042494
  - `RELP_0.0`: 0.01634738010233044
  - For Binary Variables, higher feature importance means that it occurs higher in the tree. For the numerical variables, higher feature importance means that they occur more frequently in the tree. This is evidenced by looking at the first three layers of the tree I printed above. The first split occurs at `WKHP` and the next two at some value of `AGEP`. Then we see splits at `POB_303` and `SCHL_21` and `SCHL_22`. These split mirror the top 5 features in the list of 10 variables with highest feature importance. Overall, the general intuition is that these 10 features have a bigger weight in determining classification outcomes. While this is somewhat interesting and informative, as I discuss in the next bullet point, it's always important to analyze these feature importances with caution.
- Comment on anything that you find interesting.
  - One thing I found interesting was that the education levels with the highest feature im-

portance are related to either getting a high school diploma or getting a higher degree. This makes sense and mirrors a lot of existing research in Economics on the relationship between eduation and income. While we do have to exercise caution when interpeting feature importance, contextual support can help us be more certain about our conclusions. This is not to claim there is a causal relationship. I just want to note that is is an interesting association commonly observed.

– The top two feature importances are related to age and hours worked per week. One reason for this might be that if you are older, you might be more likely to be in a higher position at work due to experience. If you work more hours per week with hourly pay, you will also earn more money. These are just hypotheses for the patterns I found in the tree. I am not making any causal claims.

1.2.3 2.3 Estimate AUC using K-Fold CV

Calculate the 5-fold cross-validated AUC-ROC for this simple tree pipeline. Report the score for each fold as well as the average across all folds.

Hint 1: sklearn.model_selection.cross_val_score is your friend. Setting the verbose option to 3 is useful.

```python
from sklearn.model_selection import cross_val_score

# Calculate 5-fold cross-validated scores
auc_scores = cross_val_score(pipeline, X_train, y_train, cv=5,
  ↪scoring='roc_auc', verbose=3)

# Report the scores for each fold
print("AUC-ROC scores for each fold:", auc_scores)

# Report the average AUC-ROC score across all folds
print("Average AUC-ROC score:", auc_scores.mean())
```

```
[CV] END … score: (test=0.737) total time=  14.0s
[CV] END … score: (test=0.739) total time=  13.7s
[CV] END … score: (test=0.736) total time=  13.3s
[CV] END … score: (test=0.737) total time=  13.8s
[CV] END … score: (test=0.736) total time=  14.2s
AUC-ROC scores for each fold: [0.73700855 0.73854879 0.73619348 0.73660509
0.73579443]
Average AUC-ROC score: 0.7368300699436423
```

1.2.4 2.4 Estimating AUC using nested CV

Let's try to improve on the results of the decision tree by tweaking its hyperparameters. Since you already are an expert using nested CV, this is going to be a walk in the park! Compute the nested cv AUC-ROC of a decision tree pipeline. Use 5 folds for the inner loop and 3 folds for the outer loop. Include different values for "max_depth", "max_features" and "max_leave_nodes" in your hyperparameter grid. Report the inner and outer fold scores for all combinations of hyperparams and interpret the results. Report the best hyperparameters used in each outer fold. How stable are

the results?

What else do you notice in these results? To what extent do you think specific hyperparameters might lead to overfitting? How is run-time impacted by your choice of hyperparameters? Is hyperparameter optimization worth the trouble?

Hint 1: The pipeline remains the same. You can access the list of all the hyperparams in your pipeline with pipeline.get_params_keys(). Notice the naming convention.

Hint 2: GridSearchCV and cross_val_score are your friends– especially if you run them with verbose = 3.

Hint 3: This gets computationally expensive quickly. Be intelligent about the hyperparameter values you include in the grid and the number of outer and inner folds you use (we use 5 inner folds and 3 outer folds).

```python
from sklearn.model_selection import KFold, GridSearchCV, cross_val_score
from sklearn.metrics import roc_auc_score
```

```python
# your code here


# Define the parameter grid
param_grid = {
    'classifier__max_depth': [5, 15, 25, 50],
    'classifier__max_features': ['sqrt', 'log2', 0.5],
    'classifier__max_leaf_nodes': [10, 15, 25, 50],
}

# Define cross-validation strategies
inner_cv = KFold(n_splits=5, shuffle=True, random_state=0)
outer_cv = KFold(n_splits=3, shuffle=True, random_state=0)

# Initialize lists to store results
outer_fold_scores = []
best_params_per_fold = []

# Manually iterate over outer folds
fold_count = 1
for train_index, test_index in outer_cv.split(X_train, y_train):
    print(f"\nStarting outer fold {fold_count}")
    X_train_fold, X_test_fold = X_train.iloc[train_index], X_train.
 ↪iloc[test_index]
    y_train_fold, y_test_fold = y_train.iloc[train_index], y_train.
 ↪iloc[test_index]

    # Initialize GridSearchCV with the inner fold strategy
    grid_search = GridSearchCV(estimator=pipeline,
                               param_grid=param_grid,
```

```
                                cv=inner_cv,
                                scoring='roc_auc',
                                verbose=3,
                                return_train_score=True,
                                n_jobs = 3)  # To report inner fold scores
    grid_search.fit(X_train_fold, y_train_fold)

    # Evaluate on the outer fold's test set
    best_model = grid_search.best_estimator_
    y_pred_proba = best_model.predict_proba(X_test_fold)[:, 1]
    roc_auc = roc_auc_score(y_test_fold, y_pred_proba)
    outer_fold_scores.append(roc_auc)

    # Save and print the best parameters for this outer fold
    best_params = grid_search.best_params_
    best_params_per_fold.append(best_params)
    print(f"Best parameters for outer fold {fold_count}: {best_params}")
    print(f"ROC AUC for outer fold {fold_count}: {roc_auc}")

    fold_count += 1
```

```
Starting outer fold 1
Fitting 5 folds for each of 48 candidates, totalling 240 fits
[CV 2/5] END classifier__max_depth=5, classifier__max_features=sqrt,
classifier__max_leaf_nodes=10;, score=(train=0.682, test=0.682) total time=
0.2s
[CV 3/5] END classifier__max_depth=5, classifier__max_features=sqrt,
classifier__max_leaf_nodes=10;, score=(train=0.741, test=0.741) total time=
0.2s
[CV 1/5] END classifier__max_depth=5, classifier__max_features=sqrt,
classifier__max_leaf_nodes=10;, score=(train=0.743, test=0.746) total time=
0.2s
[CV 4/5] END classifier__max_depth=5, classifier__max_features=sqrt,
classifier__max_leaf_nodes=10;, score=(train=0.745, test=0.747) total time=
0.2s
[CV 5/5] END classifier__max_depth=5, classifier__max_features=sqrt,
classifier__max_leaf_nodes=10;, score=(train=0.737, test=0.734) total time=
0.2s
[CV 1/5] END classifier__max_depth=5, classifier__max_features=sqrt,
classifier__max_leaf_nodes=15;, score=(train=0.747, test=0.750) total time=
0.2s
[CV 2/5] END classifier__max_depth=5, classifier__max_features=sqrt,
classifier__max_leaf_nodes=15;, score=(train=0.690, test=0.690) total time=
0.2s
[CV 3/5] END classifier__max_depth=5, classifier__max_features=sqrt,
classifier__max_leaf_nodes=15;, score=(train=0.744, test=0.745) total time=
```

0.2s

[CV 4/5] END classifier__max_depth=5, classifier__max_features=sqrt,
classifier__max_leaf_nodes=15;, score=(train=0.753, test=0.754) total time=
0.2s

[CV 5/5] END classifier__max_depth=5, classifier__max_features=sqrt,
classifier__max_leaf_nodes=15;, score=(train=0.755, test=0.750) total time=
0.2s

[CV 1/5] END classifier__max_depth=5, classifier__max_features=sqrt,
classifier__max_leaf_nodes=25;, score=(train=0.749, test=0.750) total time=
0.2s

[CV 2/5] END classifier__max_depth=5, classifier__max_features=sqrt,
classifier__max_leaf_nodes=25;, score=(train=0.691, test=0.690) total time=
0.2s

[CV 3/5] END classifier__max_depth=5, classifier__max_features=sqrt,
classifier__max_leaf_nodes=25;, score=(train=0.749, test=0.748) total time=
0.2s

[CV 4/5] END classifier__max_depth=5, classifier__max_features=sqrt,
classifier__max_leaf_nodes=25;, score=(train=0.756, test=0.756) total time=
0.2s

[CV 5/5] END classifier__max_depth=5, classifier__max_features=sqrt,
classifier__max_leaf_nodes=25;, score=(train=0.757, test=0.752) total time=
0.2s

[CV 1/5] END classifier__max_depth=5, classifier__max_features=sqrt,
classifier__max_leaf_nodes=50;, score=(train=0.749, test=0.751) total time=
0.3s

[CV 2/5] END classifier__max_depth=5, classifier__max_features=sqrt,
classifier__max_leaf_nodes=50;, score=(train=0.691, test=0.690) total time=
0.2s

[CV 3/5] END classifier__max_depth=5, classifier__max_features=sqrt,
classifier__max_leaf_nodes=50;, score=(train=0.749, test=0.748) total time=
0.3s

[CV 4/5] END classifier__max_depth=5, classifier__max_features=sqrt,
classifier__max_leaf_nodes=50;, score=(train=0.756, test=0.756) total time=
0.3s

[CV 5/5] END classifier__max_depth=5, classifier__max_features=sqrt,
classifier__max_leaf_nodes=50;, score=(train=0.757, test=0.752) total time=
0.3s

[CV 1/5] END classifier__max_depth=5, classifier__max_features=log2,
classifier__max_leaf_nodes=10;, score=(train=0.626, test=0.626) total time=
0.3s

[CV 2/5] END classifier__max_depth=5, classifier__max_features=log2,
classifier__max_leaf_nodes=10;, score=(train=0.644, test=0.644) total time=
0.2s

[CV 3/5] END classifier__max_depth=5, classifier__max_features=log2,
classifier__max_leaf_nodes=10;, score=(train=0.682, test=0.680) total time=
0.2s

[CV 4/5] END classifier__max_depth=5, classifier__max_features=log2,
classifier__max_leaf_nodes=10;, score=(train=0.581, test=0.581) total time=

0.2s

[CV 5/5] END classifier__max_depth=5, classifier__max_features=log2,
classifier__max_leaf_nodes=10;, score=(train=0.581, test=0.582) total time=
0.2s

[CV 1/5] END classifier__max_depth=5, classifier__max_features=log2,
classifier__max_leaf_nodes=15;, score=(train=0.627, test=0.626) total time=
0.2s

[CV 2/5] END classifier__max_depth=5, classifier__max_features=log2,
classifier__max_leaf_nodes=15;, score=(train=0.644, test=0.644) total time=
0.2s

[CV 3/5] END classifier__max_depth=5, classifier__max_features=log2,
classifier__max_leaf_nodes=15;, score=(train=0.689, test=0.686) total time=
0.2s

[CV 4/5] END classifier__max_depth=5, classifier__max_features=log2,
classifier__max_leaf_nodes=15;, score=(train=0.583, test=0.583) total time=
0.2s

[CV 5/5] END classifier__max_depth=5, classifier__max_features=log2,
classifier__max_leaf_nodes=15;, score=(train=0.581, test=0.583) total time=
0.2s

[CV 1/5] END classifier__max_depth=5, classifier__max_features=log2,
classifier__max_leaf_nodes=25;, score=(train=0.627, test=0.626) total time=
0.2s

[CV 2/5] END classifier__max_depth=5, classifier__max_features=log2,
classifier__max_leaf_nodes=25;, score=(train=0.644, test=0.644) total time=
0.2s

[CV 3/5] END classifier__max_depth=5, classifier__max_features=log2,
classifier__max_leaf_nodes=25;, score=(train=0.689, test=0.686) total time=
0.2s

[CV 4/5] END classifier__max_depth=5, classifier__max_features=log2,
classifier__max_leaf_nodes=25;, score=(train=0.583, test=0.583) total time=
0.2s

[CV 5/5] END classifier__max_depth=5, classifier__max_features=log2,
classifier__max_leaf_nodes=25;, score=(train=0.581, test=0.583) total time=
0.2s

[CV 1/5] END classifier__max_depth=5, classifier__max_features=log2,
classifier__max_leaf_nodes=50;, score=(train=0.627, test=0.626) total time=
0.2s

[CV 2/5] END classifier__max_depth=5, classifier__max_features=log2,
classifier__max_leaf_nodes=50;, score=(train=0.644, test=0.644) total time=
0.2s

[CV 3/5] END classifier__max_depth=5, classifier__max_features=log2,
classifier__max_leaf_nodes=50;, score=(train=0.689, test=0.686) total time=
0.2s

[CV 4/5] END classifier__max_depth=5, classifier__max_features=log2,
classifier__max_leaf_nodes=50;, score=(train=0.583, test=0.583) total time=
0.2s

[CV 5/5] END classifier__max_depth=5, classifier__max_features=log2,
classifier__max_leaf_nodes=50;, score=(train=0.581, test=0.583) total time=

0.2s
[CV 1/5] END classifier__max_depth=5, classifier__max_features=0.5,
classifier__max_leaf_nodes=10;, score=(train=0.789, test=0.792) total time=
0.3s
[CV 2/5] END classifier__max_depth=5, classifier__max_features=0.5,
classifier__max_leaf_nodes=10;, score=(train=0.784, test=0.782) total time=
0.3s
[CV 3/5] END classifier__max_depth=5, classifier__max_features=0.5,
classifier__max_leaf_nodes=10;, score=(train=0.774, test=0.770) total time=
0.3s
[CV 4/5] END classifier__max_depth=5, classifier__max_features=0.5,
classifier__max_leaf_nodes=10;, score=(train=0.767, test=0.767) total time=
0.3s
[CV 5/5] END classifier__max_depth=5, classifier__max_features=0.5,
classifier__max_leaf_nodes=10;, score=(train=0.794, test=0.787) total time=
0.3s
[CV 1/5] END classifier__max_depth=5, classifier__max_features=0.5,
classifier__max_leaf_nodes=15;, score=(train=0.795, test=0.798) total time=
0.3s
[CV 2/5] END classifier__max_depth=5, classifier__max_features=0.5,
classifier__max_leaf_nodes=15;, score=(train=0.790, test=0.788) total time=
0.3s
[CV 3/5] END classifier__max_depth=5, classifier__max_features=0.5,
classifier__max_leaf_nodes=15;, score=(train=0.800, test=0.795) total time=
0.3s
[CV 4/5] END classifier__max_depth=5, classifier__max_features=0.5,
classifier__max_leaf_nodes=15;, score=(train=0.794, test=0.793) total time=
0.3s
[CV 5/5] END classifier__max_depth=5, classifier__max_features=0.5,
classifier__max_leaf_nodes=15;, score=(train=0.806, test=0.802) total time=
0.3s
[CV 1/5] END classifier__max_depth=5, classifier__max_features=0.5,
classifier__max_leaf_nodes=25;, score=(train=0.802, test=0.804) total time=
0.3s
[CV 2/5] END classifier__max_depth=5, classifier__max_features=0.5,
classifier__max_leaf_nodes=25;, score=(train=0.797, test=0.794) total time=
0.3s
[CV 3/5] END classifier__max_depth=5, classifier__max_features=0.5,
classifier__max_leaf_nodes=25;, score=(train=0.811, test=0.809) total time=
0.3s
[CV 4/5] END classifier__max_depth=5, classifier__max_features=0.5,
classifier__max_leaf_nodes=25;, score=(train=0.801, test=0.799) total time=
0.3s
[CV 5/5] END classifier__max_depth=5, classifier__max_features=0.5,
classifier__max_leaf_nodes=25;, score=(train=0.812, test=0.806) total time=
0.3s
[CV 1/5] END classifier__max_depth=5, classifier__max_features=0.5,
classifier__max_leaf_nodes=50;, score=(train=0.803, test=0.804) total time=

0.3s

[CV 2/5] END classifier__max_depth=5, classifier__max_features=0.5,
classifier__max_leaf_nodes=50;, score=(train=0.798, test=0.796) total time=
0.3s

[CV 3/5] END classifier__max_depth=5, classifier__max_features=0.5,
classifier__max_leaf_nodes=50;, score=(train=0.812, test=0.810) total time=
0.3s

[CV 4/5] END classifier__max_depth=5, classifier__max_features=0.5,
classifier__max_leaf_nodes=50;, score=(train=0.801, test=0.799) total time=
0.3s

[CV 5/5] END classifier__max_depth=5, classifier__max_features=0.5,
classifier__max_leaf_nodes=50;, score=(train=0.813, test=0.807) total time=
0.3s

[CV 1/5] END classifier__max_depth=15, classifier__max_features=sqrt,
classifier__max_leaf_nodes=10;, score=(train=0.743, test=0.746) total time=
0.2s

[CV 2/5] END classifier__max_depth=15, classifier__max_features=sqrt,
classifier__max_leaf_nodes=10;, score=(train=0.682, test=0.682) total time=
0.2s

[CV 3/5] END classifier__max_depth=15, classifier__max_features=sqrt,
classifier__max_leaf_nodes=10;, score=(train=0.746, test=0.748) total time=
0.2s

[CV 4/5] END classifier__max_depth=15, classifier__max_features=sqrt,
classifier__max_leaf_nodes=10;, score=(train=0.743, test=0.745) total time=
0.2s

[CV 5/5] END classifier__max_depth=15, classifier__max_features=sqrt,
classifier__max_leaf_nodes=10;, score=(train=0.737, test=0.734) total time=
0.2s

[CV 1/5] END classifier__max_depth=15, classifier__max_features=sqrt,
classifier__max_leaf_nodes=15;, score=(train=0.763, test=0.766) total time=
0.2s

[CV 2/5] END classifier__max_depth=15, classifier__max_features=sqrt,
classifier__max_leaf_nodes=15;, score=(train=0.747, test=0.749) total time=
0.2s

[CV 3/5] END classifier__max_depth=15, classifier__max_features=sqrt,
classifier__max_leaf_nodes=15;, score=(train=0.752, test=0.753) total time=
0.2s

[CV 4/5] END classifier__max_depth=15, classifier__max_features=sqrt,
classifier__max_leaf_nodes=15;, score=(train=0.754, test=0.757) total time=
0.2s

[CV 5/5] END classifier__max_depth=15, classifier__max_features=sqrt,
classifier__max_leaf_nodes=15;, score=(train=0.743, test=0.740) total time=
0.2s

[CV 1/5] END classifier__max_depth=15, classifier__max_features=sqrt,
classifier__max_leaf_nodes=25;, score=(train=0.778, test=0.779) total time=
0.2s

[CV 2/5] END classifier__max_depth=15, classifier__max_features=sqrt,
classifier__max_leaf_nodes=25;, score=(train=0.761, test=0.762) total time=

0.2s
[CV 3/5] END classifier__max_depth=15, classifier__max_features=sqrt,
classifier__max_leaf_nodes=25;, score=(train=0.763, test=0.762) total time=
0.2s
[CV 4/5] END classifier__max_depth=15, classifier__max_features=sqrt,
classifier__max_leaf_nodes=25;, score=(train=0.758, test=0.760) total time=
0.2s
[CV 5/5] END classifier__max_depth=15, classifier__max_features=sqrt,
classifier__max_leaf_nodes=25;, score=(train=0.766, test=0.759) total time=
0.2s
[CV 1/5] END classifier__max_depth=15, classifier__max_features=sqrt,
classifier__max_leaf_nodes=50;, score=(train=0.800, test=0.801) total time=
0.2s
[CV 2/5] END classifier__max_depth=15, classifier__max_features=sqrt,
classifier__max_leaf_nodes=50;, score=(train=0.792, test=0.790) total time=
0.2s
[CV 3/5] END classifier__max_depth=15, classifier__max_features=sqrt,
classifier__max_leaf_nodes=50;, score=(train=0.772, test=0.771) total time=
0.3s
[CV 4/5] END classifier__max_depth=15, classifier__max_features=sqrt,
classifier__max_leaf_nodes=50;, score=(train=0.791, test=0.791) total time=
0.3s
[CV 5/5] END classifier__max_depth=15, classifier__max_features=sqrt,
classifier__max_leaf_nodes=50;, score=(train=0.778, test=0.771) total time=
0.2s
[CV 1/5] END classifier__max_depth=15, classifier__max_features=log2,
classifier__max_leaf_nodes=10;, score=(train=0.666, test=0.665) total time=
0.2s
[CV 2/5] END classifier__max_depth=15, classifier__max_features=log2,
classifier__max_leaf_nodes=10;, score=(train=0.646, test=0.646) total time=
0.2s
[CV 3/5] END classifier__max_depth=15, classifier__max_features=log2,
classifier__max_leaf_nodes=10;, score=(train=0.700, test=0.699) total time=
0.2s
[CV 4/5] END classifier__max_depth=15, classifier__max_features=log2,
classifier__max_leaf_nodes=10;, score=(train=0.585, test=0.585) total time=
0.2s
[CV 5/5] END classifier__max_depth=15, classifier__max_features=log2,
classifier__max_leaf_nodes=10;, score=(train=0.581, test=0.582) total time=
0.2s
[CV 1/5] END classifier__max_depth=15, classifier__max_features=log2,
classifier__max_leaf_nodes=15;, score=(train=0.693, test=0.689) total time=
0.2s
[CV 2/5] END classifier__max_depth=15, classifier__max_features=log2,
classifier__max_leaf_nodes=15;, score=(train=0.659, test=0.657) total time=
0.2s
[CV 3/5] END classifier__max_depth=15, classifier__max_features=log2,
classifier__max_leaf_nodes=15;, score=(train=0.714, test=0.715) total time=

0.2s

[CV 4/5] END classifier__max_depth=15, classifier__max_features=log2,
classifier__max_leaf_nodes=15;, score=(train=0.651, test=0.652) total time=
0.2s

[CV 5/5] END classifier__max_depth=15, classifier__max_features=log2,
classifier__max_leaf_nodes=15;, score=(train=0.581, test=0.582) total time=
0.2s

[CV 1/5] END classifier__max_depth=15, classifier__max_features=log2,
classifier__max_leaf_nodes=25;, score=(train=0.700, test=0.695) total time=
0.2s

[CV 2/5] END classifier__max_depth=15, classifier__max_features=log2,
classifier__max_leaf_nodes=25;, score=(train=0.710, test=0.707) total time=
0.2s

[CV 3/5] END classifier__max_depth=15, classifier__max_features=log2,
classifier__max_leaf_nodes=25;, score=(train=0.718, test=0.718) total time=
0.2s

[CV 4/5] END classifier__max_depth=15, classifier__max_features=log2,
classifier__max_leaf_nodes=25;, score=(train=0.688, test=0.688) total time=
0.2s

[CV 5/5] END classifier__max_depth=15, classifier__max_features=log2,
classifier__max_leaf_nodes=25;, score=(train=0.615, test=0.612) total time=
0.2s

[CV 1/5] END classifier__max_depth=15, classifier__max_features=log2,
classifier__max_leaf_nodes=50;, score=(train=0.734, test=0.729) total time=
0.2s

[CV 2/5] END classifier__max_depth=15, classifier__max_features=log2,
classifier__max_leaf_nodes=50;, score=(train=0.731, test=0.725) total time=
0.2s

[CV 3/5] END classifier__max_depth=15, classifier__max_features=log2,
classifier__max_leaf_nodes=50;, score=(train=0.747, test=0.746) total time=
0.2s

[CV 4/5] END classifier__max_depth=15, classifier__max_features=log2,
classifier__max_leaf_nodes=50;, score=(train=0.710, test=0.706) total time=
0.2s

[CV 5/5] END classifier__max_depth=15, classifier__max_features=log2,
classifier__max_leaf_nodes=50;, score=(train=0.680, test=0.675) total time=
0.2s

[CV 1/5] END classifier__max_depth=15, classifier__max_features=0.5,
classifier__max_leaf_nodes=10;, score=(train=0.811, test=0.815) total time=
0.3s

[CV 2/5] END classifier__max_depth=15, classifier__max_features=0.5,
classifier__max_leaf_nodes=10;, score=(train=0.801, test=0.803) total time=
0.3s

[CV 3/5] END classifier__max_depth=15, classifier__max_features=0.5,
classifier__max_leaf_nodes=10;, score=(train=0.774, test=0.770) total time=
0.3s

[CV 4/5] END classifier__max_depth=15, classifier__max_features=0.5,
classifier__max_leaf_nodes=10;, score=(train=0.773, test=0.773) total time=

0.3s

[CV 5/5] END classifier__max_depth=15, classifier__max_features=0.5,
classifier__max_leaf_nodes=10;, score=(train=0.782, test=0.775) total time=
0.3s

[CV 1/5] END classifier__max_depth=15, classifier__max_features=0.5,
classifier__max_leaf_nodes=15;, score=(train=0.828, test=0.831) total time=
0.4s

[CV 2/5] END classifier__max_depth=15, classifier__max_features=0.5,
classifier__max_leaf_nodes=15;, score=(train=0.815, test=0.817) total time=
0.4s

[CV 3/5] END classifier__max_depth=15, classifier__max_features=0.5,
classifier__max_leaf_nodes=15;, score=(train=0.796, test=0.792) total time=
0.3s

[CV 4/5] END classifier__max_depth=15, classifier__max_features=0.5,
classifier__max_leaf_nodes=15;, score=(train=0.784, test=0.785) total time=
0.3s

[CV 5/5] END classifier__max_depth=15, classifier__max_features=0.5,
classifier__max_leaf_nodes=15;, score=(train=0.805, test=0.801) total time=
0.3s

[CV 1/5] END classifier__max_depth=15, classifier__max_features=0.5,
classifier__max_leaf_nodes=25;, score=(train=0.841, test=0.844) total time=
0.4s

[CV 2/5] END classifier__max_depth=15, classifier__max_features=0.5,
classifier__max_leaf_nodes=25;, score=(train=0.829, test=0.830) total time=
0.4s

[CV 3/5] END classifier__max_depth=15, classifier__max_features=0.5,
classifier__max_leaf_nodes=25;, score=(train=0.820, test=0.817) total time=
0.4s

[CV 4/5] END classifier__max_depth=15, classifier__max_features=0.5,
classifier__max_leaf_nodes=25;, score=(train=0.819, test=0.815) total time=
0.4s

[CV 5/5] END classifier__max_depth=15, classifier__max_features=0.5,
classifier__max_leaf_nodes=25;, score=(train=0.834, test=0.830) total time=
0.4s

[CV 1/5] END classifier__max_depth=15, classifier__max_features=0.5,
classifier__max_leaf_nodes=50;, score=(train=0.852, test=0.855) total time=
0.5s

[CV 2/5] END classifier__max_depth=15, classifier__max_features=0.5,
classifier__max_leaf_nodes=50;, score=(train=0.845, test=0.845) total time=
0.5s

[CV 3/5] END classifier__max_depth=15, classifier__max_features=0.5,
classifier__max_leaf_nodes=50;, score=(train=0.844, test=0.842) total time=
0.5s

[CV 4/5] END classifier__max_depth=15, classifier__max_features=0.5,
classifier__max_leaf_nodes=50;, score=(train=0.841, test=0.835) total time=
0.5s

[CV 1/5] END classifier__max_depth=25, classifier__max_features=sqrt,
classifier__max_leaf_nodes=10;, score=(train=0.743, test=0.746) total time=

0.2s
[CV 5/5] END classifier__max_depth=15, classifier__max_features=0.5,
classifier__max_leaf_nodes=50;, score=(train=0.850, test=0.845) total time=
0.5s
[CV 2/5] END classifier__max_depth=25, classifier__max_features=sqrt,
classifier__max_leaf_nodes=10;, score=(train=0.682, test=0.682) total time=
0.2s
[CV 3/5] END classifier__max_depth=25, classifier__max_features=sqrt,
classifier__max_leaf_nodes=10;, score=(train=0.746, test=0.748) total time=
0.2s
[CV 4/5] END classifier__max_depth=25, classifier__max_features=sqrt,
classifier__max_leaf_nodes=10;, score=(train=0.743, test=0.745) total time=
0.2s
[CV 5/5] END classifier__max_depth=25, classifier__max_features=sqrt,
classifier__max_leaf_nodes=10;, score=(train=0.737, test=0.734) total time=
0.2s
[CV 1/5] END classifier__max_depth=25, classifier__max_features=sqrt,
classifier__max_leaf_nodes=15;, score=(train=0.763, test=0.766) total time=
0.2s
[CV 2/5] END classifier__max_depth=25, classifier__max_features=sqrt,
classifier__max_leaf_nodes=15;, score=(train=0.747, test=0.749) total time=
0.2s
[CV 3/5] END classifier__max_depth=25, classifier__max_features=sqrt,
classifier__max_leaf_nodes=15;, score=(train=0.752, test=0.753) total time=
0.2s
[CV 4/5] END classifier__max_depth=25, classifier__max_features=sqrt,
classifier__max_leaf_nodes=15;, score=(train=0.754, test=0.757) total time=
0.2s
[CV 5/5] END classifier__max_depth=25, classifier__max_features=sqrt,
classifier__max_leaf_nodes=15;, score=(train=0.743, test=0.740) total time=
0.2s
[CV 1/5] END classifier__max_depth=25, classifier__max_features=sqrt,
classifier__max_leaf_nodes=25;, score=(train=0.778, test=0.779) total time=
0.2s
[CV 2/5] END classifier__max_depth=25, classifier__max_features=sqrt,
classifier__max_leaf_nodes=25;, score=(train=0.761, test=0.762) total time=
0.3s
[CV 3/5] END classifier__max_depth=25, classifier__max_features=sqrt,
classifier__max_leaf_nodes=25;, score=(train=0.763, test=0.762) total time=
0.3s
[CV 4/5] END classifier__max_depth=25, classifier__max_features=sqrt,
classifier__max_leaf_nodes=25;, score=(train=0.758, test=0.760) total time=
0.3s
[CV 5/5] END classifier__max_depth=25, classifier__max_features=sqrt,
classifier__max_leaf_nodes=25;, score=(train=0.766, test=0.759) total time=
0.2s
[CV 1/5] END classifier__max_depth=25, classifier__max_features=sqrt,
classifier__max_leaf_nodes=50;, score=(train=0.795, test=0.796) total time=

0.2s

[CV 2/5] END classifier__max_depth=25, classifier__max_features=sqrt, classifier__max_leaf_nodes=50;, score=(train=0.779, test=0.779) total time= 0.2s

[CV 3/5] END classifier__max_depth=25, classifier__max_features=sqrt, classifier__max_leaf_nodes=50;, score=(train=0.781, test=0.781) total time= 0.3s

[CV 4/5] END classifier__max_depth=25, classifier__max_features=sqrt, classifier__max_leaf_nodes=50;, score=(train=0.779, test=0.780) total time= 0.3s

[CV 5/5] END classifier__max_depth=25, classifier__max_features=sqrt, classifier__max_leaf_nodes=50;, score=(train=0.796, test=0.790) total time= 0.3s

[CV 1/5] END classifier__max_depth=25, classifier__max_features=log2, classifier__max_leaf_nodes=10;, score=(train=0.666, test=0.665) total time= 0.2s

[CV 2/5] END classifier__max_depth=25, classifier__max_features=log2, classifier__max_leaf_nodes=10;, score=(train=0.646, test=0.646) total time= 0.2s

[CV 3/5] END classifier__max_depth=25, classifier__max_features=log2, classifier__max_leaf_nodes=10;, score=(train=0.700, test=0.699) total time= 0.2s

[CV 4/5] END classifier__max_depth=25, classifier__max_features=log2, classifier__max_leaf_nodes=10;, score=(train=0.585, test=0.585) total time= 0.2s

[CV 5/5] END classifier__max_depth=25, classifier__max_features=log2, classifier__max_leaf_nodes=10;, score=(train=0.581, test=0.582) total time= 0.2s

[CV 1/5] END classifier__max_depth=25, classifier__max_features=log2, classifier__max_leaf_nodes=15;, score=(train=0.693, test=0.689) total time= 0.2s

[CV 2/5] END classifier__max_depth=25, classifier__max_features=log2, classifier__max_leaf_nodes=15;, score=(train=0.659, test=0.657) total time= 0.2s

[CV 3/5] END classifier__max_depth=25, classifier__max_features=log2, classifier__max_leaf_nodes=15;, score=(train=0.714, test=0.715) total time= 0.2s

[CV 4/5] END classifier__max_depth=25, classifier__max_features=log2, classifier__max_leaf_nodes=15;, score=(train=0.651, test=0.652) total time= 0.2s

[CV 5/5] END classifier__max_depth=25, classifier__max_features=log2, classifier__max_leaf_nodes=15;, score=(train=0.581, test=0.582) total time= 0.2s

[CV 1/5] END classifier__max_depth=25, classifier__max_features=log2, classifier__max_leaf_nodes=25;, score=(train=0.700, test=0.695) total time= 0.2s

[CV 2/5] END classifier__max_depth=25, classifier__max_features=log2, classifier__max_leaf_nodes=25;, score=(train=0.710, test=0.707) total time=

0.2s
[CV 3/5] END classifier__max_depth=25, classifier__max_features=log2,
classifier__max_leaf_nodes=25;, score=(train=0.718, test=0.718) total time=
0.2s
[CV 4/5] END classifier__max_depth=25, classifier__max_features=log2,
classifier__max_leaf_nodes=25;, score=(train=0.685, test=0.685) total time=
0.2s
[CV 5/5] END classifier__max_depth=25, classifier__max_features=log2,
classifier__max_leaf_nodes=25;, score=(train=0.615, test=0.612) total time=
0.2s
[CV 1/5] END classifier__max_depth=25, classifier__max_features=log2,
classifier__max_leaf_nodes=50;, score=(train=0.737, test=0.734) total time=
0.2s
[CV 2/5] END classifier__max_depth=25, classifier__max_features=log2,
classifier__max_leaf_nodes=50;, score=(train=0.740, test=0.734) total time=
0.2s
[CV 3/5] END classifier__max_depth=25, classifier__max_features=log2,
classifier__max_leaf_nodes=50;, score=(train=0.729, test=0.731) total time=
0.2s
[CV 4/5] END classifier__max_depth=25, classifier__max_features=log2,
classifier__max_leaf_nodes=50;, score=(train=0.734, test=0.731) total time=
0.2s
[CV 5/5] END classifier__max_depth=25, classifier__max_features=log2,
classifier__max_leaf_nodes=50;, score=(train=0.729, test=0.723) total time=
0.2s
[CV 1/5] END classifier__max_depth=25, classifier__max_features=0.5,
classifier__max_leaf_nodes=10;, score=(train=0.811, test=0.815) total time=
0.3s
[CV 2/5] END classifier__max_depth=25, classifier__max_features=0.5,
classifier__max_leaf_nodes=10;, score=(train=0.801, test=0.803) total time=
0.3s
[CV 3/5] END classifier__max_depth=25, classifier__max_features=0.5,
classifier__max_leaf_nodes=10;, score=(train=0.774, test=0.770) total time=
0.3s
[CV 4/5] END classifier__max_depth=25, classifier__max_features=0.5,
classifier__max_leaf_nodes=10;, score=(train=0.773, test=0.773) total time=
0.3s
[CV 5/5] END classifier__max_depth=25, classifier__max_features=0.5,
classifier__max_leaf_nodes=10;, score=(train=0.782, test=0.775) total time=
0.3s
[CV 1/5] END classifier__max_depth=25, classifier__max_features=0.5,
classifier__max_leaf_nodes=15;, score=(train=0.828, test=0.831) total time=
0.3s
[CV 2/5] END classifier__max_depth=25, classifier__max_features=0.5,
classifier__max_leaf_nodes=15;, score=(train=0.815, test=0.817) total time=
0.3s
[CV 3/5] END classifier__max_depth=25, classifier__max_features=0.5,
classifier__max_leaf_nodes=15;, score=(train=0.796, test=0.792) total time=

0.3s

[CV 4/5] END classifier__max_depth=25, classifier__max_features=0.5,
classifier__max_leaf_nodes=15;, score=(train=0.784, test=0.785) total time=
0.3s

[CV 5/5] END classifier__max_depth=25, classifier__max_features=0.5,
classifier__max_leaf_nodes=15;, score=(train=0.805, test=0.801) total time=
0.3s

[CV 1/5] END classifier__max_depth=25, classifier__max_features=0.5,
classifier__max_leaf_nodes=25;, score=(train=0.841, test=0.844) total time=
0.4s

[CV 2/5] END classifier__max_depth=25, classifier__max_features=0.5,
classifier__max_leaf_nodes=25;, score=(train=0.829, test=0.830) total time=
0.4s

[CV 3/5] END classifier__max_depth=25, classifier__max_features=0.5,
classifier__max_leaf_nodes=25;, score=(train=0.820, test=0.817) total time=
0.4s

[CV 4/5] END classifier__max_depth=25, classifier__max_features=0.5,
classifier__max_leaf_nodes=25;, score=(train=0.819, test=0.815) total time=
0.4s

[CV 5/5] END classifier__max_depth=25, classifier__max_features=0.5,
classifier__max_leaf_nodes=25;, score=(train=0.834, test=0.830) total time=
0.4s

[CV 1/5] END classifier__max_depth=25, classifier__max_features=0.5,
classifier__max_leaf_nodes=50;, score=(train=0.852, test=0.855) total time=
0.5s

[CV 2/5] END classifier__max_depth=25, classifier__max_features=0.5,
classifier__max_leaf_nodes=50;, score=(train=0.845, test=0.845) total time=
0.5s

[CV 3/5] END classifier__max_depth=25, classifier__max_features=0.5,
classifier__max_leaf_nodes=50;, score=(train=0.844, test=0.842) total time=
0.5s

[CV 4/5] END classifier__max_depth=25, classifier__max_features=0.5,
classifier__max_leaf_nodes=50;, score=(train=0.841, test=0.835) total time=
0.5s

[CV 1/5] END classifier__max_depth=50, classifier__max_features=sqrt,
classifier__max_leaf_nodes=10;, score=(train=0.743, test=0.746) total time=
0.2s

[CV 5/5] END classifier__max_depth=25, classifier__max_features=0.5,
classifier__max_leaf_nodes=50;, score=(train=0.850, test=0.845) total time=
0.5s

[CV 2/5] END classifier__max_depth=50, classifier__max_features=sqrt,
classifier__max_leaf_nodes=10;, score=(train=0.682, test=0.682) total time=
0.2s

[CV 3/5] END classifier__max_depth=50, classifier__max_features=sqrt,
classifier__max_leaf_nodes=10;, score=(train=0.746, test=0.748) total time=
0.2s

[CV 4/5] END classifier__max_depth=50, classifier__max_features=sqrt,
classifier__max_leaf_nodes=10;, score=(train=0.743, test=0.745) total time=

0.2s

[CV 5/5] END classifier__max_depth=50, classifier__max_features=sqrt, classifier__max_leaf_nodes=10;, score=(train=0.737, test=0.734) total time= 0.2s

[CV 1/5] END classifier__max_depth=50, classifier__max_features=sqrt, classifier__max_leaf_nodes=15;, score=(train=0.763, test=0.766) total time= 0.2s

[CV 2/5] END classifier__max_depth=50, classifier__max_features=sqrt, classifier__max_leaf_nodes=15;, score=(train=0.747, test=0.749) total time= 0.2s

[CV 3/5] END classifier__max_depth=50, classifier__max_features=sqrt, classifier__max_leaf_nodes=15;, score=(train=0.752, test=0.753) total time= 0.2s

[CV 4/5] END classifier__max_depth=50, classifier__max_features=sqrt, classifier__max_leaf_nodes=15;, score=(train=0.754, test=0.757) total time= 0.2s

[CV 5/5] END classifier__max_depth=50, classifier__max_features=sqrt, classifier__max_leaf_nodes=15;, score=(train=0.743, test=0.740) total time= 0.2s

[CV 1/5] END classifier__max_depth=50, classifier__max_features=sqrt, classifier__max_leaf_nodes=25;, score=(train=0.778, test=0.779) total time= 0.2s

[CV 2/5] END classifier__max_depth=50, classifier__max_features=sqrt, classifier__max_leaf_nodes=25;, score=(train=0.761, test=0.762) total time= 0.2s

[CV 3/5] END classifier__max_depth=50, classifier__max_features=sqrt, classifier__max_leaf_nodes=25;, score=(train=0.763, test=0.762) total time= 0.2s

[CV 4/5] END classifier__max_depth=50, classifier__max_features=sqrt, classifier__max_leaf_nodes=25;, score=(train=0.758, test=0.760) total time= 0.2s

[CV 5/5] END classifier__max_depth=50, classifier__max_features=sqrt, classifier__max_leaf_nodes=25;, score=(train=0.766, test=0.759) total time= 0.2s

[CV 1/5] END classifier__max_depth=50, classifier__max_features=sqrt, classifier__max_leaf_nodes=50;, score=(train=0.795, test=0.796) total time= 0.2s

[CV 2/5] END classifier__max_depth=50, classifier__max_features=sqrt, classifier__max_leaf_nodes=50;, score=(train=0.779, test=0.779) total time= 0.2s

[CV 3/5] END classifier__max_depth=50, classifier__max_features=sqrt, classifier__max_leaf_nodes=50;, score=(train=0.781, test=0.781) total time= 0.3s

[CV 4/5] END classifier__max_depth=50, classifier__max_features=sqrt, classifier__max_leaf_nodes=50;, score=(train=0.779, test=0.780) total time= 0.3s

[CV 5/5] END classifier__max_depth=50, classifier__max_features=sqrt, classifier__max_leaf_nodes=50;, score=(train=0.796, test=0.790) total time=

0.3s

[CV 1/5] END classifier__max_depth=50, classifier__max_features=log2,
classifier__max_leaf_nodes=10;, score=(train=0.666, test=0.665) total time=
0.2s

[CV 2/5] END classifier__max_depth=50, classifier__max_features=log2,
classifier__max_leaf_nodes=10;, score=(train=0.646, test=0.646) total time=
0.2s

[CV 3/5] END classifier__max_depth=50, classifier__max_features=log2,
classifier__max_leaf_nodes=10;, score=(train=0.700, test=0.699) total time=
0.2s

[CV 4/5] END classifier__max_depth=50, classifier__max_features=log2,
classifier__max_leaf_nodes=10;, score=(train=0.585, test=0.585) total time=
0.2s

[CV 5/5] END classifier__max_depth=50, classifier__max_features=log2,
classifier__max_leaf_nodes=10;, score=(train=0.581, test=0.582) total time=
0.2s

[CV 1/5] END classifier__max_depth=50, classifier__max_features=log2,
classifier__max_leaf_nodes=15;, score=(train=0.693, test=0.689) total time=
0.2s

[CV 2/5] END classifier__max_depth=50, classifier__max_features=log2,
classifier__max_leaf_nodes=15;, score=(train=0.659, test=0.657) total time=
0.2s

[CV 3/5] END classifier__max_depth=50, classifier__max_features=log2,
classifier__max_leaf_nodes=15;, score=(train=0.714, test=0.715) total time=
0.2s

[CV 4/5] END classifier__max_depth=50, classifier__max_features=log2,
classifier__max_leaf_nodes=15;, score=(train=0.651, test=0.652) total time=
0.2s

[CV 5/5] END classifier__max_depth=50, classifier__max_features=log2,
classifier__max_leaf_nodes=15;, score=(train=0.581, test=0.582) total time=
0.2s

[CV 1/5] END classifier__max_depth=50, classifier__max_features=log2,
classifier__max_leaf_nodes=25;, score=(train=0.700, test=0.695) total time=
0.2s

[CV 2/5] END classifier__max_depth=50, classifier__max_features=log2,
classifier__max_leaf_nodes=25;, score=(train=0.710, test=0.707) total time=
0.2s

[CV 3/5] END classifier__max_depth=50, classifier__max_features=log2,
classifier__max_leaf_nodes=25;, score=(train=0.718, test=0.718) total time=
0.2s

[CV 4/5] END classifier__max_depth=50, classifier__max_features=log2,
classifier__max_leaf_nodes=25;, score=(train=0.685, test=0.685) total time=
0.3s

[CV 5/5] END classifier__max_depth=50, classifier__max_features=log2,
classifier__max_leaf_nodes=25;, score=(train=0.615, test=0.612) total time=
0.3s

[CV 1/5] END classifier__max_depth=50, classifier__max_features=log2,
classifier__max_leaf_nodes=50;, score=(train=0.737, test=0.734) total time=

0.2s
[CV 2/5] END classifier__max_depth=50, classifier__max_features=log2,
classifier__max_leaf_nodes=50;, score=(train=0.740, test=0.734) total time=
0.2s
[CV 3/5] END classifier__max_depth=50, classifier__max_features=log2,
classifier__max_leaf_nodes=50;, score=(train=0.729, test=0.731) total time=
0.2s
[CV 4/5] END classifier__max_depth=50, classifier__max_features=log2,
classifier__max_leaf_nodes=50;, score=(train=0.734, test=0.731) total time=
0.2s
[CV 5/5] END classifier__max_depth=50, classifier__max_features=log2,
classifier__max_leaf_nodes=50;, score=(train=0.730, test=0.723) total time=
0.2s
[CV 1/5] END classifier__max_depth=50, classifier__max_features=0.5,
classifier__max_leaf_nodes=10;, score=(train=0.811, test=0.815) total time=
0.3s
[CV 2/5] END classifier__max_depth=50, classifier__max_features=0.5,
classifier__max_leaf_nodes=10;, score=(train=0.801, test=0.803) total time=
0.3s
[CV 3/5] END classifier__max_depth=50, classifier__max_features=0.5,
classifier__max_leaf_nodes=10;, score=(train=0.774, test=0.770) total time=
0.3s
[CV 4/5] END classifier__max_depth=50, classifier__max_features=0.5,
classifier__max_leaf_nodes=10;, score=(train=0.773, test=0.773) total time=
0.3s
[CV 5/5] END classifier__max_depth=50, classifier__max_features=0.5,
classifier__max_leaf_nodes=10;, score=(train=0.782, test=0.775) total time=
0.3s
[CV 1/5] END classifier__max_depth=50, classifier__max_features=0.5,
classifier__max_leaf_nodes=15;, score=(train=0.828, test=0.831) total time=
0.3s
[CV 2/5] END classifier__max_depth=50, classifier__max_features=0.5,
classifier__max_leaf_nodes=15;, score=(train=0.815, test=0.817) total time=
0.3s
[CV 3/5] END classifier__max_depth=50, classifier__max_features=0.5,
classifier__max_leaf_nodes=15;, score=(train=0.796, test=0.792) total time=
0.3s
[CV 4/5] END classifier__max_depth=50, classifier__max_features=0.5,
classifier__max_leaf_nodes=15;, score=(train=0.784, test=0.785) total time=
0.3s
[CV 5/5] END classifier__max_depth=50, classifier__max_features=0.5,
classifier__max_leaf_nodes=15;, score=(train=0.805, test=0.801) total time=
0.3s
[CV 1/5] END classifier__max_depth=50, classifier__max_features=0.5,
classifier__max_leaf_nodes=25;, score=(train=0.841, test=0.844) total time=
0.4s
[CV 2/5] END classifier__max_depth=50, classifier__max_features=0.5,
classifier__max_leaf_nodes=25;, score=(train=0.829, test=0.830) total time=

0.4s
[CV 3/5] END classifier__max_depth=50, classifier__max_features=0.5,
classifier__max_leaf_nodes=25;, score=(train=0.820, test=0.817) total time=
0.4s
[CV 4/5] END classifier__max_depth=50, classifier__max_features=0.5,
classifier__max_leaf_nodes=25;, score=(train=0.819, test=0.815) total time=
0.4s
[CV 5/5] END classifier__max_depth=50, classifier__max_features=0.5,
classifier__max_leaf_nodes=25;, score=(train=0.834, test=0.830) total time=
0.4s
[CV 1/5] END classifier__max_depth=50, classifier__max_features=0.5,
classifier__max_leaf_nodes=50;, score=(train=0.852, test=0.855) total time=
0.5s
[CV 2/5] END classifier__max_depth=50, classifier__max_features=0.5,
classifier__max_leaf_nodes=50;, score=(train=0.845, test=0.845) total time=
0.5s
[CV 3/5] END classifier__max_depth=50, classifier__max_features=0.5,
classifier__max_leaf_nodes=50;, score=(train=0.844, test=0.842) total time=
0.5s
[CV 4/5] END classifier__max_depth=50, classifier__max_features=0.5,
classifier__max_leaf_nodes=50;, score=(train=0.841, test=0.835) total time=
0.5s
[CV 5/5] END classifier__max_depth=50, classifier__max_features=0.5,
classifier__max_leaf_nodes=50;, score=(train=0.850, test=0.845) total time=
0.5s
Best parameters for outer fold 1: {'classifier__max_depth': 15,
'classifier__max_features': 0.5, 'classifier__max_leaf_nodes': 50}
ROC AUC for outer fold 1: 0.845031118507005

Starting outer fold 2
Fitting 5 folds for each of 48 candidates, totalling 240 fits
[CV 1/5] END classifier__max_depth=5, classifier__max_features=sqrt,
classifier__max_leaf_nodes=10;, score=(train=0.671, test=0.666) total time=
0.2s
[CV 2/5] END classifier__max_depth=5, classifier__max_features=sqrt,
classifier__max_leaf_nodes=10;, score=(train=0.716, test=0.710) total time=
0.2s
[CV 3/5] END classifier__max_depth=5, classifier__max_features=sqrt,
classifier__max_leaf_nodes=10;, score=(train=0.755, test=0.753) total time=
0.2s
[CV 4/5] END classifier__max_depth=5, classifier__max_features=sqrt,
classifier__max_leaf_nodes=10;, score=(train=0.722, test=0.719) total time=
0.2s
[CV 5/5] END classifier__max_depth=5, classifier__max_features=sqrt,
classifier__max_leaf_nodes=10;, score=(train=0.721, test=0.723) total time=
0.2s
[CV 1/5] END classifier__max_depth=5, classifier__max_features=sqrt,
classifier__max_leaf_nodes=15;, score=(train=0.673, test=0.668) total time=

0.2s
[CV 2/5] END classifier__max_depth=5, classifier__max_features=sqrt,
classifier__max_leaf_nodes=15;, score=(train=0.717, test=0.711) total time=
0.2s
[CV 3/5] END classifier__max_depth=5, classifier__max_features=sqrt,
classifier__max_leaf_nodes=15;, score=(train=0.760, test=0.758) total time=
0.2s
[CV 4/5] END classifier__max_depth=5, classifier__max_features=sqrt,
classifier__max_leaf_nodes=15;, score=(train=0.722, test=0.721) total time=
0.2s
[CV 5/5] END classifier__max_depth=5, classifier__max_features=sqrt,
classifier__max_leaf_nodes=15;, score=(train=0.726, test=0.727) total time=
0.2s
[CV 1/5] END classifier__max_depth=5, classifier__max_features=sqrt,
classifier__max_leaf_nodes=25;, score=(train=0.674, test=0.668) total time=
0.2s
[CV 2/5] END classifier__max_depth=5, classifier__max_features=sqrt,
classifier__max_leaf_nodes=25;, score=(train=0.718, test=0.712) total time=
0.2s
[CV 3/5] END classifier__max_depth=5, classifier__max_features=sqrt,
classifier__max_leaf_nodes=25;, score=(train=0.761, test=0.760) total time=
0.2s
[CV 4/5] END classifier__max_depth=5, classifier__max_features=sqrt,
classifier__max_leaf_nodes=25;, score=(train=0.722, test=0.721) total time=
0.2s
[CV 5/5] END classifier__max_depth=5, classifier__max_features=sqrt,
classifier__max_leaf_nodes=25;, score=(train=0.742, test=0.743) total time=
0.2s
[CV 1/5] END classifier__max_depth=5, classifier__max_features=sqrt,
classifier__max_leaf_nodes=50;, score=(train=0.674, test=0.668) total time=
0.2s
[CV 2/5] END classifier__max_depth=5, classifier__max_features=sqrt,
classifier__max_leaf_nodes=50;, score=(train=0.718, test=0.712) total time=
0.2s
[CV 3/5] END classifier__max_depth=5, classifier__max_features=sqrt,
classifier__max_leaf_nodes=50;, score=(train=0.761, test=0.760) total time=
0.2s
[CV 4/5] END classifier__max_depth=5, classifier__max_features=sqrt,
classifier__max_leaf_nodes=50;, score=(train=0.723, test=0.721) total time=
0.2s
[CV 5/5] END classifier__max_depth=5, classifier__max_features=sqrt,
classifier__max_leaf_nodes=50;, score=(train=0.742, test=0.743) total time=
0.2s
[CV 1/5] END classifier__max_depth=5, classifier__max_features=log2,
classifier__max_leaf_nodes=10;, score=(train=0.611, test=0.613) total time=
0.2s
[CV 2/5] END classifier__max_depth=5, classifier__max_features=log2,
classifier__max_leaf_nodes=10;, score=(train=0.644, test=0.642) total time=

0.2s

[CV 3/5] END classifier__max_depth=5, classifier__max_features=log2, classifier__max_leaf_nodes=10;, score=(train=0.582, test=0.576) total time= 0.2s

[CV 4/5] END classifier__max_depth=5, classifier__max_features=log2, classifier__max_leaf_nodes=10;, score=(train=0.641, test=0.645) total time= 0.2s

[CV 5/5] END classifier__max_depth=5, classifier__max_features=log2, classifier__max_leaf_nodes=10;, score=(train=0.586, test=0.586) total time= 0.2s

[CV 1/5] END classifier__max_depth=5, classifier__max_features=log2, classifier__max_leaf_nodes=15;, score=(train=0.611, test=0.613) total time= 0.2s

[CV 2/5] END classifier__max_depth=5, classifier__max_features=log2, classifier__max_leaf_nodes=15;, score=(train=0.645, test=0.642) total time= 0.2s

[CV 3/5] END classifier__max_depth=5, classifier__max_features=log2, classifier__max_leaf_nodes=15;, score=(train=0.582, test=0.576) total time= 0.2s

[CV 4/5] END classifier__max_depth=5, classifier__max_features=log2, classifier__max_leaf_nodes=15;, score=(train=0.642, test=0.645) total time= 0.2s

[CV 5/5] END classifier__max_depth=5, classifier__max_features=log2, classifier__max_leaf_nodes=15;, score=(train=0.586, test=0.586) total time= 0.2s

[CV 1/5] END classifier__max_depth=5, classifier__max_features=log2, classifier__max_leaf_nodes=25;, score=(train=0.612, test=0.613) total time= 0.2s

[CV 2/5] END classifier__max_depth=5, classifier__max_features=log2, classifier__max_leaf_nodes=25;, score=(train=0.645, test=0.643) total time= 0.2s

[CV 3/5] END classifier__max_depth=5, classifier__max_features=log2, classifier__max_leaf_nodes=25;, score=(train=0.582, test=0.576) total time= 0.2s

[CV 4/5] END classifier__max_depth=5, classifier__max_features=log2, classifier__max_leaf_nodes=25;, score=(train=0.642, test=0.645) total time= 0.2s

[CV 5/5] END classifier__max_depth=5, classifier__max_features=log2, classifier__max_leaf_nodes=25;, score=(train=0.587, test=0.586) total time= 0.2s

[CV 1/5] END classifier__max_depth=5, classifier__max_features=log2, classifier__max_leaf_nodes=50;, score=(train=0.612, test=0.613) total time= 0.2s

[CV 2/5] END classifier__max_depth=5, classifier__max_features=log2, classifier__max_leaf_nodes=50;, score=(train=0.645, test=0.643) total time= 0.2s

[CV 3/5] END classifier__max_depth=5, classifier__max_features=log2, classifier__max_leaf_nodes=50;, score=(train=0.582, test=0.576) total time=

0.2s

[CV 4/5] END classifier__max_depth=5, classifier__max_features=log2, classifier__max_leaf_nodes=50;, score=(train=0.642, test=0.645) total time= 0.2s

[CV 5/5] END classifier__max_depth=5, classifier__max_features=log2, classifier__max_leaf_nodes=50;, score=(train=0.587, test=0.586) total time= 0.2s

[CV 1/5] END classifier__max_depth=5, classifier__max_features=0.5, classifier__max_leaf_nodes=10;, score=(train=0.780, test=0.778) total time= 0.3s

[CV 2/5] END classifier__max_depth=5, classifier__max_features=0.5, classifier__max_leaf_nodes=10;, score=(train=0.785, test=0.781) total time= 0.3s

[CV 3/5] END classifier__max_depth=5, classifier__max_features=0.5, classifier__max_leaf_nodes=10;, score=(train=0.796, test=0.798) total time= 0.3s

[CV 4/5] END classifier__max_depth=5, classifier__max_features=0.5, classifier__max_leaf_nodes=10;, score=(train=0.793, test=0.790) total time= 0.3s

[CV 5/5] END classifier__max_depth=5, classifier__max_features=0.5, classifier__max_leaf_nodes=10;, score=(train=0.786, test=0.789) total time= 0.3s

[CV 1/5] END classifier__max_depth=5, classifier__max_features=0.5, classifier__max_leaf_nodes=15;, score=(train=0.797, test=0.794) total time= 0.3s

[CV 2/5] END classifier__max_depth=5, classifier__max_features=0.5, classifier__max_leaf_nodes=15;, score=(train=0.790, test=0.788) total time= 0.3s

[CV 3/5] END classifier__max_depth=5, classifier__max_features=0.5, classifier__max_leaf_nodes=15;, score=(train=0.811, test=0.811) total time= 0.3s

[CV 4/5] END classifier__max_depth=5, classifier__max_features=0.5, classifier__max_leaf_nodes=15;, score=(train=0.799, test=0.794) total time= 0.3s

[CV 5/5] END classifier__max_depth=5, classifier__max_features=0.5, classifier__max_leaf_nodes=15;, score=(train=0.798, test=0.801) total time= 0.3s

[CV 1/5] END classifier__max_depth=5, classifier__max_features=0.5, classifier__max_leaf_nodes=25;, score=(train=0.804, test=0.800) total time= 0.3s

[CV 2/5] END classifier__max_depth=5, classifier__max_features=0.5, classifier__max_leaf_nodes=25;, score=(train=0.793, test=0.790) total time= 0.3s

[CV 3/5] END classifier__max_depth=5, classifier__max_features=0.5, classifier__max_leaf_nodes=25;, score=(train=0.816, test=0.816) total time= 0.3s

[CV 4/5] END classifier__max_depth=5, classifier__max_features=0.5, classifier__max_leaf_nodes=25;, score=(train=0.802, test=0.796) total time=

0.3s
[CV 5/5] END classifier__max_depth=5, classifier__max_features=0.5,
classifier__max_leaf_nodes=25;, score=(train=0.804, test=0.808) total time=
0.3s
[CV 1/5] END classifier__max_depth=5, classifier__max_features=0.5,
classifier__max_leaf_nodes=50;, score=(train=0.805, test=0.801) total time=
0.3s
[CV 2/5] END classifier__max_depth=5, classifier__max_features=0.5,
classifier__max_leaf_nodes=50;, score=(train=0.793, test=0.790) total time=
0.3s
[CV 3/5] END classifier__max_depth=5, classifier__max_features=0.5,
classifier__max_leaf_nodes=50;, score=(train=0.817, test=0.816) total time=
0.3s
[CV 4/5] END classifier__max_depth=5, classifier__max_features=0.5,
classifier__max_leaf_nodes=50;, score=(train=0.802, test=0.796) total time=
0.3s
[CV 5/5] END classifier__max_depth=5, classifier__max_features=0.5,
classifier__max_leaf_nodes=50;, score=(train=0.804, test=0.808) total time=
0.3s
[CV 1/5] END classifier__max_depth=15, classifier__max_features=sqrt,
classifier__max_leaf_nodes=10;, score=(train=0.709, test=0.704) total time=
0.2s
[CV 2/5] END classifier__max_depth=15, classifier__max_features=sqrt,
classifier__max_leaf_nodes=10;, score=(train=0.743, test=0.736) total time=
0.2s
[CV 3/5] END classifier__max_depth=15, classifier__max_features=sqrt,
classifier__max_leaf_nodes=10;, score=(train=0.755, test=0.753) total time=
0.2s
[CV 4/5] END classifier__max_depth=15, classifier__max_features=sqrt,
classifier__max_leaf_nodes=10;, score=(train=0.726, test=0.723) total time=
0.2s
[CV 5/5] END classifier__max_depth=15, classifier__max_features=sqrt,
classifier__max_leaf_nodes=10;, score=(train=0.721, test=0.723) total time=
0.2s
[CV 1/5] END classifier__max_depth=15, classifier__max_features=sqrt,
classifier__max_leaf_nodes=15;, score=(train=0.729, test=0.726) total time=
0.2s
[CV 2/5] END classifier__max_depth=15, classifier__max_features=sqrt,
classifier__max_leaf_nodes=15;, score=(train=0.762, test=0.758) total time=
0.2s
[CV 3/5] END classifier__max_depth=15, classifier__max_features=sqrt,
classifier__max_leaf_nodes=15;, score=(train=0.765, test=0.763) total time=
0.2s
[CV 4/5] END classifier__max_depth=15, classifier__max_features=sqrt,
classifier__max_leaf_nodes=15;, score=(train=0.757, test=0.750) total time=
0.2s
[CV 5/5] END classifier__max_depth=15, classifier__max_features=sqrt,
classifier__max_leaf_nodes=15;, score=(train=0.728, test=0.728) total time=

0.2s
[CV 1/5] END classifier__max_depth=15, classifier__max_features=sqrt,
classifier__max_leaf_nodes=25;, score=(train=0.750, test=0.750) total time=
0.2s
[CV 2/5] END classifier__max_depth=15, classifier__max_features=sqrt,
classifier__max_leaf_nodes=25;, score=(train=0.766, test=0.762) total time=
0.2s
[CV 3/5] END classifier__max_depth=15, classifier__max_features=sqrt,
classifier__max_leaf_nodes=25;, score=(train=0.774, test=0.771) total time=
0.2s
[CV 4/5] END classifier__max_depth=15, classifier__max_features=sqrt,
classifier__max_leaf_nodes=25;, score=(train=0.773, test=0.767) total time=
0.2s
[CV 5/5] END classifier__max_depth=15, classifier__max_features=sqrt,
classifier__max_leaf_nodes=25;, score=(train=0.734, test=0.733) total time=
0.3s
[CV 1/5] END classifier__max_depth=15, classifier__max_features=sqrt,
classifier__max_leaf_nodes=50;, score=(train=0.778, test=0.776) total time=
0.3s
[CV 2/5] END classifier__max_depth=15, classifier__max_features=sqrt,
classifier__max_leaf_nodes=50;, score=(train=0.769, test=0.766) total time=
0.3s
[CV 3/5] END classifier__max_depth=15, classifier__max_features=sqrt,
classifier__max_leaf_nodes=50;, score=(train=0.782, test=0.779) total time=
0.3s
[CV 4/5] END classifier__max_depth=15, classifier__max_features=sqrt,
classifier__max_leaf_nodes=50;, score=(train=0.791, test=0.786) total time=
0.3s
[CV 5/5] END classifier__max_depth=15, classifier__max_features=sqrt,
classifier__max_leaf_nodes=50;, score=(train=0.756, test=0.759) total time=
0.3s
[CV 1/5] END classifier__max_depth=15, classifier__max_features=log2,
classifier__max_leaf_nodes=10;, score=(train=0.626, test=0.627) total time=
0.2s
[CV 2/5] END classifier__max_depth=15, classifier__max_features=log2,
classifier__max_leaf_nodes=10;, score=(train=0.694, test=0.694) total time=
0.2s
[CV 3/5] END classifier__max_depth=15, classifier__max_features=log2,
classifier__max_leaf_nodes=10;, score=(train=0.582, test=0.577) total time=
0.2s
[CV 4/5] END classifier__max_depth=15, classifier__max_features=log2,
classifier__max_leaf_nodes=10;, score=(train=0.686, test=0.692) total time=
0.2s
[CV 5/5] END classifier__max_depth=15, classifier__max_features=log2,
classifier__max_leaf_nodes=10;, score=(train=0.597, test=0.597) total time=
0.2s
[CV 1/5] END classifier__max_depth=15, classifier__max_features=log2,
classifier__max_leaf_nodes=15;, score=(train=0.697, test=0.700) total time=

0.2s
[CV 2/5] END classifier__max_depth=15, classifier__max_features=log2,
classifier__max_leaf_nodes=15;, score=(train=0.701, test=0.701) total time=
0.2s
[CV 3/5] END classifier__max_depth=15, classifier__max_features=log2,
classifier__max_leaf_nodes=15;, score=(train=0.582, test=0.577) total time=
0.2s
[CV 4/5] END classifier__max_depth=15, classifier__max_features=log2,
classifier__max_leaf_nodes=15;, score=(train=0.692, test=0.698) total time=
0.2s
[CV 5/5] END classifier__max_depth=15, classifier__max_features=log2,
classifier__max_leaf_nodes=15;, score=(train=0.627, test=0.628) total time=
0.2s
[CV 1/5] END classifier__max_depth=15, classifier__max_features=log2,
classifier__max_leaf_nodes=25;, score=(train=0.700, test=0.702) total time=
0.2s
[CV 2/5] END classifier__max_depth=15, classifier__max_features=log2,
classifier__max_leaf_nodes=25;, score=(train=0.720, test=0.721) total time=
0.2s
[CV 3/5] END classifier__max_depth=15, classifier__max_features=log2,
classifier__max_leaf_nodes=25;, score=(train=0.586, test=0.580) total time=
0.2s
[CV 4/5] END classifier__max_depth=15, classifier__max_features=log2,
classifier__max_leaf_nodes=25;, score=(train=0.711, test=0.715) total time=
0.2s
[CV 5/5] END classifier__max_depth=15, classifier__max_features=log2,
classifier__max_leaf_nodes=25;, score=(train=0.716, test=0.715) total time=
0.2s
[CV 1/5] END classifier__max_depth=15, classifier__max_features=log2,
classifier__max_leaf_nodes=50;, score=(train=0.723, test=0.724) total time=
0.3s
[CV 2/5] END classifier__max_depth=15, classifier__max_features=log2,
classifier__max_leaf_nodes=50;, score=(train=0.727, test=0.726) total time=
0.2s
[CV 3/5] END classifier__max_depth=15, classifier__max_features=log2,
classifier__max_leaf_nodes=50;, score=(train=0.587, test=0.581) total time=
0.2s
[CV 4/5] END classifier__max_depth=15, classifier__max_features=log2,
classifier__max_leaf_nodes=50;, score=(train=0.727, test=0.730) total time=
0.3s
[CV 5/5] END classifier__max_depth=15, classifier__max_features=log2,
classifier__max_leaf_nodes=50;, score=(train=0.718, test=0.717) total time=
0.2s
[CV 1/5] END classifier__max_depth=15, classifier__max_features=0.5,
classifier__max_leaf_nodes=10;, score=(train=0.789, test=0.786) total time=
0.3s
[CV 2/5] END classifier__max_depth=15, classifier__max_features=0.5,
classifier__max_leaf_nodes=10;, score=(train=0.804, test=0.800) total time=

0.3s
[CV 3/5] END classifier__max_depth=15, classifier__max_features=0.5,
classifier__max_leaf_nodes=10;, score=(train=0.796, test=0.798) total time=
0.3s
[CV 4/5] END classifier__max_depth=15, classifier__max_features=0.5,
classifier__max_leaf_nodes=10;, score=(train=0.806, test=0.803) total time=
0.3s
[CV 5/5] END classifier__max_depth=15, classifier__max_features=0.5,
classifier__max_leaf_nodes=10;, score=(train=0.783, test=0.787) total time=
0.3s
[CV 1/5] END classifier__max_depth=15, classifier__max_features=0.5,
classifier__max_leaf_nodes=15;, score=(train=0.807, test=0.802) total time=
0.3s
[CV 2/5] END classifier__max_depth=15, classifier__max_features=0.5,
classifier__max_leaf_nodes=15;, score=(train=0.818, test=0.814) total time=
0.3s
[CV 3/5] END classifier__max_depth=15, classifier__max_features=0.5,
classifier__max_leaf_nodes=15;, score=(train=0.815, test=0.816) total time=
0.3s
[CV 4/5] END classifier__max_depth=15, classifier__max_features=0.5,
classifier__max_leaf_nodes=15;, score=(train=0.817, test=0.816) total time=
0.3s
[CV 5/5] END classifier__max_depth=15, classifier__max_features=0.5,
classifier__max_leaf_nodes=15;, score=(train=0.801, test=0.805) total time=
0.4s
[CV 1/5] END classifier__max_depth=15, classifier__max_features=0.5,
classifier__max_leaf_nodes=25;, score=(train=0.824, test=0.820) total time=
0.4s
[CV 2/5] END classifier__max_depth=15, classifier__max_features=0.5,
classifier__max_leaf_nodes=25;, score=(train=0.830, test=0.827) total time=
0.4s
[CV 3/5] END classifier__max_depth=15, classifier__max_features=0.5,
classifier__max_leaf_nodes=25;, score=(train=0.834, test=0.833) total time=
0.4s
[CV 4/5] END classifier__max_depth=15, classifier__max_features=0.5,
classifier__max_leaf_nodes=25;, score=(train=0.833, test=0.829) total time=
0.4s
[CV 5/5] END classifier__max_depth=15, classifier__max_features=0.5,
classifier__max_leaf_nodes=25;, score=(train=0.826, test=0.828) total time=
0.4s
[CV 1/5] END classifier__max_depth=15, classifier__max_features=0.5,
classifier__max_leaf_nodes=50;, score=(train=0.841, test=0.836) total time=
0.5s
[CV 2/5] END classifier__max_depth=15, classifier__max_features=0.5,
classifier__max_leaf_nodes=50;, score=(train=0.844, test=0.842) total time=
0.5s
[CV 3/5] END classifier__max_depth=15, classifier__max_features=0.5,
classifier__max_leaf_nodes=50;, score=(train=0.849, test=0.846) total time=

0.5s
[CV 4/5] END classifier__max_depth=15, classifier__max_features=0.5,
classifier__max_leaf_nodes=50;, score=(train=0.850, test=0.843) total time=
0.5s
[CV 1/5] END classifier__max_depth=25, classifier__max_features=sqrt,
classifier__max_leaf_nodes=10;, score=(train=0.709, test=0.704) total time=
0.2s
[CV 5/5] END classifier__max_depth=15, classifier__max_features=0.5,
classifier__max_leaf_nodes=50;, score=(train=0.841, test=0.845) total time=
0.5s
[CV 2/5] END classifier__max_depth=25, classifier__max_features=sqrt,
classifier__max_leaf_nodes=10;, score=(train=0.743, test=0.736) total time=
0.2s
[CV 3/5] END classifier__max_depth=25, classifier__max_features=sqrt,
classifier__max_leaf_nodes=10;, score=(train=0.755, test=0.753) total time=
0.2s
[CV 4/5] END classifier__max_depth=25, classifier__max_features=sqrt,
classifier__max_leaf_nodes=10;, score=(train=0.726, test=0.723) total time=
0.2s
[CV 5/5] END classifier__max_depth=25, classifier__max_features=sqrt,
classifier__max_leaf_nodes=10;, score=(train=0.721, test=0.723) total time=
0.2s
[CV 1/5] END classifier__max_depth=25, classifier__max_features=sqrt,
classifier__max_leaf_nodes=15;, score=(train=0.729, test=0.726) total time=
0.2s
[CV 2/5] END classifier__max_depth=25, classifier__max_features=sqrt,
classifier__max_leaf_nodes=15;, score=(train=0.762, test=0.758) total time=
0.2s
[CV 3/5] END classifier__max_depth=25, classifier__max_features=sqrt,
classifier__max_leaf_nodes=15;, score=(train=0.765, test=0.763) total time=
0.2s
[CV 4/5] END classifier__max_depth=25, classifier__max_features=sqrt,
classifier__max_leaf_nodes=15;, score=(train=0.757, test=0.750) total time=
0.2s
[CV 5/5] END classifier__max_depth=25, classifier__max_features=sqrt,
classifier__max_leaf_nodes=15;, score=(train=0.728, test=0.728) total time=
0.2s
[CV 1/5] END classifier__max_depth=25, classifier__max_features=sqrt,
classifier__max_leaf_nodes=25;, score=(train=0.750, test=0.750) total time=
0.2s
[CV 2/5] END classifier__max_depth=25, classifier__max_features=sqrt,
classifier__max_leaf_nodes=25;, score=(train=0.766, test=0.762) total time=
0.2s
[CV 3/5] END classifier__max_depth=25, classifier__max_features=sqrt,
classifier__max_leaf_nodes=25;, score=(train=0.774, test=0.771) total time=
0.2s
[CV 4/5] END classifier__max_depth=25, classifier__max_features=sqrt,
classifier__max_leaf_nodes=25;, score=(train=0.773, test=0.767) total time=

0.2s
[CV 5/5] END classifier__max_depth=25, classifier__max_features=sqrt,
classifier__max_leaf_nodes=25;, score=(train=0.734, test=0.733) total time=
0.3s
[CV 1/5] END classifier__max_depth=25, classifier__max_features=sqrt,
classifier__max_leaf_nodes=50;, score=(train=0.780, test=0.780) total time=
0.3s
[CV 2/5] END classifier__max_depth=25, classifier__max_features=sqrt,
classifier__max_leaf_nodes=50;, score=(train=0.769, test=0.764) total time=
0.3s
[CV 3/5] END classifier__max_depth=25, classifier__max_features=sqrt,
classifier__max_leaf_nodes=50;, score=(train=0.796, test=0.794) total time=
0.3s
[CV 4/5] END classifier__max_depth=25, classifier__max_features=sqrt,
classifier__max_leaf_nodes=50;, score=(train=0.797, test=0.791) total time=
0.3s
[CV 5/5] END classifier__max_depth=25, classifier__max_features=sqrt,
classifier__max_leaf_nodes=50;, score=(train=0.756, test=0.756) total time=
0.3s
[CV 1/5] END classifier__max_depth=25, classifier__max_features=log2,
classifier__max_leaf_nodes=10;, score=(train=0.626, test=0.627) total time=
0.3s
[CV 2/5] END classifier__max_depth=25, classifier__max_features=log2,
classifier__max_leaf_nodes=10;, score=(train=0.694, test=0.694) total time=
0.2s
[CV 3/5] END classifier__max_depth=25, classifier__max_features=log2,
classifier__max_leaf_nodes=10;, score=(train=0.582, test=0.577) total time=
0.2s
[CV 4/5] END classifier__max_depth=25, classifier__max_features=log2,
classifier__max_leaf_nodes=10;, score=(train=0.686, test=0.692) total time=
0.2s
[CV 5/5] END classifier__max_depth=25, classifier__max_features=log2,
classifier__max_leaf_nodes=10;, score=(train=0.597, test=0.597) total time=
0.2s
[CV 1/5] END classifier__max_depth=25, classifier__max_features=log2,
classifier__max_leaf_nodes=15;, score=(train=0.697, test=0.700) total time=
0.2s
[CV 2/5] END classifier__max_depth=25, classifier__max_features=log2,
classifier__max_leaf_nodes=15;, score=(train=0.701, test=0.701) total time=
0.2s
[CV 3/5] END classifier__max_depth=25, classifier__max_features=log2,
classifier__max_leaf_nodes=15;, score=(train=0.582, test=0.577) total time=
0.2s
[CV 4/5] END classifier__max_depth=25, classifier__max_features=log2,
classifier__max_leaf_nodes=15;, score=(train=0.692, test=0.698) total time=
0.2s
[CV 5/5] END classifier__max_depth=25, classifier__max_features=log2,
classifier__max_leaf_nodes=15;, score=(train=0.627, test=0.628) total time=

0.2s
[CV 1/5] END classifier__max_depth=25, classifier__max_features=log2,
classifier__max_leaf_nodes=25;, score=(train=0.700, test=0.702) total time=
0.2s
[CV 2/5] END classifier__max_depth=25, classifier__max_features=log2,
classifier__max_leaf_nodes=25;, score=(train=0.704, test=0.704) total time=
0.2s
[CV 3/5] END classifier__max_depth=25, classifier__max_features=log2,
classifier__max_leaf_nodes=25;, score=(train=0.586, test=0.580) total time=
0.2s
[CV 4/5] END classifier__max_depth=25, classifier__max_features=log2,
classifier__max_leaf_nodes=25;, score=(train=0.711, test=0.715) total time=
0.2s
[CV 5/5] END classifier__max_depth=25, classifier__max_features=log2,
classifier__max_leaf_nodes=25;, score=(train=0.716, test=0.715) total time=
0.2s
[CV 1/5] END classifier__max_depth=25, classifier__max_features=log2,
classifier__max_leaf_nodes=50;, score=(train=0.738, test=0.740) total time=
0.3s
[CV 2/5] END classifier__max_depth=25, classifier__max_features=log2,
classifier__max_leaf_nodes=50;, score=(train=0.710, test=0.708) total time=
0.3s
[CV 3/5] END classifier__max_depth=25, classifier__max_features=log2,
classifier__max_leaf_nodes=50;, score=(train=0.588, test=0.582) total time=
0.2s
[CV 4/5] END classifier__max_depth=25, classifier__max_features=log2,
classifier__max_leaf_nodes=50;, score=(train=0.737, test=0.740) total time=
0.2s
[CV 5/5] END classifier__max_depth=25, classifier__max_features=log2,
classifier__max_leaf_nodes=50;, score=(train=0.750, test=0.749) total time=
0.3s
[CV 1/5] END classifier__max_depth=25, classifier__max_features=0.5,
classifier__max_leaf_nodes=10;, score=(train=0.789, test=0.786) total time=
0.3s
[CV 2/5] END classifier__max_depth=25, classifier__max_features=0.5,
classifier__max_leaf_nodes=10;, score=(train=0.804, test=0.800) total time=
0.3s
[CV 3/5] END classifier__max_depth=25, classifier__max_features=0.5,
classifier__max_leaf_nodes=10;, score=(train=0.796, test=0.798) total time=
0.3s
[CV 4/5] END classifier__max_depth=25, classifier__max_features=0.5,
classifier__max_leaf_nodes=10;, score=(train=0.806, test=0.803) total time=
0.3s
[CV 5/5] END classifier__max_depth=25, classifier__max_features=0.5,
classifier__max_leaf_nodes=10;, score=(train=0.783, test=0.787) total time=
0.3s
[CV 1/5] END classifier__max_depth=25, classifier__max_features=0.5,
classifier__max_leaf_nodes=15;, score=(train=0.807, test=0.802) total time=

```
0.3s
[CV 2/5] END classifier__max_depth=25, classifier__max_features=0.5,
classifier__max_leaf_nodes=15;, score=(train=0.818, test=0.814) total time=
0.3s
[CV 3/5] END classifier__max_depth=25, classifier__max_features=0.5,
classifier__max_leaf_nodes=15;, score=(train=0.815, test=0.816) total time=
0.3s
[CV 4/5] END classifier__max_depth=25, classifier__max_features=0.5,
classifier__max_leaf_nodes=15;, score=(train=0.817, test=0.816) total time=
0.3s
[CV 5/5] END classifier__max_depth=25, classifier__max_features=0.5,
classifier__max_leaf_nodes=15;, score=(train=0.801, test=0.805) total time=
0.4s
[CV 1/5] END classifier__max_depth=25, classifier__max_features=0.5,
classifier__max_leaf_nodes=25;, score=(train=0.824, test=0.820) total time=
0.4s
[CV 2/5] END classifier__max_depth=25, classifier__max_features=0.5,
classifier__max_leaf_nodes=25;, score=(train=0.830, test=0.827) total time=
0.4s
[CV 3/5] END classifier__max_depth=25, classifier__max_features=0.5,
classifier__max_leaf_nodes=25;, score=(train=0.834, test=0.833) total time=
0.4s
[CV 4/5] END classifier__max_depth=25, classifier__max_features=0.5,
classifier__max_leaf_nodes=25;, score=(train=0.833, test=0.829) total time=
0.4s
[CV 5/5] END classifier__max_depth=25, classifier__max_features=0.5,
classifier__max_leaf_nodes=25;, score=(train=0.826, test=0.828) total time=
0.4s
[CV 1/5] END classifier__max_depth=25, classifier__max_features=0.5,
classifier__max_leaf_nodes=50;, score=(train=0.841, test=0.836) total time=
0.6s
[CV 2/5] END classifier__max_depth=25, classifier__max_features=0.5,
classifier__max_leaf_nodes=50;, score=(train=0.844, test=0.842) total time=
0.5s
[CV 3/5] END classifier__max_depth=25, classifier__max_features=0.5,
classifier__max_leaf_nodes=50;, score=(train=0.849, test=0.846) total time=
0.5s
[CV 4/5] END classifier__max_depth=25, classifier__max_features=0.5,
classifier__max_leaf_nodes=50;, score=(train=0.850, test=0.843) total time=
0.5s
[CV 1/5] END classifier__max_depth=50, classifier__max_features=sqrt,
classifier__max_leaf_nodes=10;, score=(train=0.709, test=0.704) total time=
0.2s
[CV 5/5] END classifier__max_depth=25, classifier__max_features=0.5,
classifier__max_leaf_nodes=50;, score=(train=0.841, test=0.845) total time=
0.5s
[CV 2/5] END classifier__max_depth=50, classifier__max_features=sqrt,
classifier__max_leaf_nodes=10;, score=(train=0.743, test=0.736) total time=
```

0.2s

[CV 3/5] END classifier__max_depth=50, classifier__max_features=sqrt, classifier__max_leaf_nodes=10;, score=(train=0.755, test=0.753) total time= 0.2s

[CV 4/5] END classifier__max_depth=50, classifier__max_features=sqrt, classifier__max_leaf_nodes=10;, score=(train=0.726, test=0.723) total time= 0.2s

[CV 5/5] END classifier__max_depth=50, classifier__max_features=sqrt, classifier__max_leaf_nodes=10;, score=(train=0.721, test=0.723) total time= 0.2s

[CV 1/5] END classifier__max_depth=50, classifier__max_features=sqrt, classifier__max_leaf_nodes=15;, score=(train=0.729, test=0.726) total time= 0.2s

[CV 2/5] END classifier__max_depth=50, classifier__max_features=sqrt, classifier__max_leaf_nodes=15;, score=(train=0.762, test=0.758) total time= 0.2s

[CV 3/5] END classifier__max_depth=50, classifier__max_features=sqrt, classifier__max_leaf_nodes=15;, score=(train=0.765, test=0.763) total time= 0.2s

[CV 4/5] END classifier__max_depth=50, classifier__max_features=sqrt, classifier__max_leaf_nodes=15;, score=(train=0.757, test=0.750) total time= 0.2s

[CV 5/5] END classifier__max_depth=50, classifier__max_features=sqrt, classifier__max_leaf_nodes=15;, score=(train=0.728, test=0.728) total time= 0.2s

[CV 1/5] END classifier__max_depth=50, classifier__max_features=sqrt, classifier__max_leaf_nodes=25;, score=(train=0.750, test=0.750) total time= 0.2s

[CV 2/5] END classifier__max_depth=50, classifier__max_features=sqrt, classifier__max_leaf_nodes=25;, score=(train=0.766, test=0.762) total time= 0.2s

[CV 3/5] END classifier__max_depth=50, classifier__max_features=sqrt, classifier__max_leaf_nodes=25;, score=(train=0.774, test=0.771) total time= 0.2s

[CV 4/5] END classifier__max_depth=50, classifier__max_features=sqrt, classifier__max_leaf_nodes=25;, score=(train=0.773, test=0.767) total time= 0.3s

[CV 5/5] END classifier__max_depth=50, classifier__max_features=sqrt, classifier__max_leaf_nodes=25;, score=(train=0.734, test=0.733) total time= 0.3s

[CV 1/5] END classifier__max_depth=50, classifier__max_features=sqrt, classifier__max_leaf_nodes=50;, score=(train=0.780, test=0.780) total time= 0.3s

[CV 2/5] END classifier__max_depth=50, classifier__max_features=sqrt, classifier__max_leaf_nodes=50;, score=(train=0.769, test=0.764) total time= 0.3s

[CV 3/5] END classifier__max_depth=50, classifier__max_features=sqrt, classifier__max_leaf_nodes=50;, score=(train=0.796, test=0.794) total time=

0.3s
[CV 4/5] END classifier__max_depth=50, classifier__max_features=sqrt,
classifier__max_leaf_nodes=50;, score=(train=0.797, test=0.791) total time=
0.3s
[CV 5/5] END classifier__max_depth=50, classifier__max_features=sqrt,
classifier__max_leaf_nodes=50;, score=(train=0.756, test=0.756) total time=
0.3s
[CV 1/5] END classifier__max_depth=50, classifier__max_features=log2,
classifier__max_leaf_nodes=10;, score=(train=0.626, test=0.627) total time=
0.2s
[CV 2/5] END classifier__max_depth=50, classifier__max_features=log2,
classifier__max_leaf_nodes=10;, score=(train=0.694, test=0.694) total time=
0.2s
[CV 3/5] END classifier__max_depth=50, classifier__max_features=log2,
classifier__max_leaf_nodes=10;, score=(train=0.582, test=0.577) total time=
0.2s
[CV 4/5] END classifier__max_depth=50, classifier__max_features=log2,
classifier__max_leaf_nodes=10;, score=(train=0.686, test=0.692) total time=
0.2s
[CV 5/5] END classifier__max_depth=50, classifier__max_features=log2,
classifier__max_leaf_nodes=10;, score=(train=0.597, test=0.597) total time=
0.2s
[CV 1/5] END classifier__max_depth=50, classifier__max_features=log2,
classifier__max_leaf_nodes=15;, score=(train=0.697, test=0.700) total time=
0.2s
[CV 2/5] END classifier__max_depth=50, classifier__max_features=log2,
classifier__max_leaf_nodes=15;, score=(train=0.701, test=0.701) total time=
0.2s
[CV 3/5] END classifier__max_depth=50, classifier__max_features=log2,
classifier__max_leaf_nodes=15;, score=(train=0.582, test=0.577) total time=
0.2s
[CV 4/5] END classifier__max_depth=50, classifier__max_features=log2,
classifier__max_leaf_nodes=15;, score=(train=0.692, test=0.698) total time=
0.2s
[CV 5/5] END classifier__max_depth=50, classifier__max_features=log2,
classifier__max_leaf_nodes=15;, score=(train=0.627, test=0.628) total time=
0.2s
[CV 1/5] END classifier__max_depth=50, classifier__max_features=log2,
classifier__max_leaf_nodes=25;, score=(train=0.700, test=0.702) total time=
0.2s
[CV 2/5] END classifier__max_depth=50, classifier__max_features=log2,
classifier__max_leaf_nodes=25;, score=(train=0.704, test=0.704) total time=
0.2s
[CV 3/5] END classifier__max_depth=50, classifier__max_features=log2,
classifier__max_leaf_nodes=25;, score=(train=0.586, test=0.580) total time=
0.2s
[CV 4/5] END classifier__max_depth=50, classifier__max_features=log2,
classifier__max_leaf_nodes=25;, score=(train=0.711, test=0.715) total time=

0.2s

[CV 5/5] END classifier__max_depth=50, classifier__max_features=log2, classifier__max_leaf_nodes=25;, score=(train=0.716, test=0.715) total time= 0.2s

[CV 1/5] END classifier__max_depth=50, classifier__max_features=log2, classifier__max_leaf_nodes=50;, score=(train=0.738, test=0.740) total time= 0.3s

[CV 2/5] END classifier__max_depth=50, classifier__max_features=log2, classifier__max_leaf_nodes=50;, score=(train=0.710, test=0.708) total time= 0.2s

[CV 3/5] END classifier__max_depth=50, classifier__max_features=log2, classifier__max_leaf_nodes=50;, score=(train=0.588, test=0.582) total time= 0.2s

[CV 4/5] END classifier__max_depth=50, classifier__max_features=log2, classifier__max_leaf_nodes=50;, score=(train=0.737, test=0.740) total time= 0.3s

[CV 5/5] END classifier__max_depth=50, classifier__max_features=log2, classifier__max_leaf_nodes=50;, score=(train=0.750, test=0.749) total time= 0.2s

[CV 1/5] END classifier__max_depth=50, classifier__max_features=0.5, classifier__max_leaf_nodes=10;, score=(train=0.789, test=0.786) total time= 0.3s

[CV 2/5] END classifier__max_depth=50, classifier__max_features=0.5, classifier__max_leaf_nodes=10;, score=(train=0.804, test=0.800) total time= 0.4s

[CV 3/5] END classifier__max_depth=50, classifier__max_features=0.5, classifier__max_leaf_nodes=10;, score=(train=0.796, test=0.798) total time= 0.3s

[CV 4/5] END classifier__max_depth=50, classifier__max_features=0.5, classifier__max_leaf_nodes=10;, score=(train=0.806, test=0.803) total time= 0.3s

[CV 5/5] END classifier__max_depth=50, classifier__max_features=0.5, classifier__max_leaf_nodes=10;, score=(train=0.783, test=0.787) total time= 0.3s

[CV 1/5] END classifier__max_depth=50, classifier__max_features=0.5, classifier__max_leaf_nodes=15;, score=(train=0.807, test=0.802) total time= 0.3s

[CV 2/5] END classifier__max_depth=50, classifier__max_features=0.5, classifier__max_leaf_nodes=15;, score=(train=0.818, test=0.814) total time= 0.3s

[CV 3/5] END classifier__max_depth=50, classifier__max_features=0.5, classifier__max_leaf_nodes=15;, score=(train=0.815, test=0.816) total time= 0.3s

[CV 4/5] END classifier__max_depth=50, classifier__max_features=0.5, classifier__max_leaf_nodes=15;, score=(train=0.817, test=0.816) total time= 0.3s

[CV 5/5] END classifier__max_depth=50, classifier__max_features=0.5, classifier__max_leaf_nodes=15;, score=(train=0.801, test=0.805) total time=

0.4s
[CV 1/5] END classifier__max_depth=50, classifier__max_features=0.5,
classifier__max_leaf_nodes=25;, score=(train=0.824, test=0.820) total time=
0.4s
[CV 2/5] END classifier__max_depth=50, classifier__max_features=0.5,
classifier__max_leaf_nodes=25;, score=(train=0.830, test=0.827) total time=
0.4s
[CV 3/5] END classifier__max_depth=50, classifier__max_features=0.5,
classifier__max_leaf_nodes=25;, score=(train=0.834, test=0.833) total time=
0.4s
[CV 4/5] END classifier__max_depth=50, classifier__max_features=0.5,
classifier__max_leaf_nodes=25;, score=(train=0.833, test=0.829) total time=
0.4s
[CV 5/5] END classifier__max_depth=50, classifier__max_features=0.5,
classifier__max_leaf_nodes=25;, score=(train=0.826, test=0.828) total time=
0.4s
[CV 1/5] END classifier__max_depth=50, classifier__max_features=0.5,
classifier__max_leaf_nodes=50;, score=(train=0.841, test=0.836) total time=
0.5s
[CV 3/5] END classifier__max_depth=50, classifier__max_features=0.5,
classifier__max_leaf_nodes=50;, score=(train=0.849, test=0.846) total time=
0.5s
[CV 2/5] END classifier__max_depth=50, classifier__max_features=0.5,
classifier__max_leaf_nodes=50;, score=(train=0.844, test=0.842) total time=
0.5s
[CV 4/5] END classifier__max_depth=50, classifier__max_features=0.5,
classifier__max_leaf_nodes=50;, score=(train=0.850, test=0.843) total time=
0.5s
[CV 5/5] END classifier__max_depth=50, classifier__max_features=0.5,
classifier__max_leaf_nodes=50;, score=(train=0.841, test=0.845) total time=
0.5s
Best parameters for outer fold 2: {'classifier__max_depth': 25,
'classifier__max_features': 0.5, 'classifier__max_leaf_nodes': 50}
ROC AUC for outer fold 2: 0.8488108002369288

Starting outer fold 3
Fitting 5 folds for each of 48 candidates, totalling 240 fits
[CV 1/5] END classifier__max_depth=5, classifier__max_features=sqrt,
classifier__max_leaf_nodes=10;, score=(train=0.665, test=0.663) total time=
0.2s
[CV 2/5] END classifier__max_depth=5, classifier__max_features=sqrt,
classifier__max_leaf_nodes=10;, score=(train=0.687, test=0.685) total time=
0.2s
[CV 3/5] END classifier__max_depth=5, classifier__max_features=sqrt,
classifier__max_leaf_nodes=10;, score=(train=0.664, test=0.671) total time=
0.2s
[CV 4/5] END classifier__max_depth=5, classifier__max_features=sqrt,
classifier__max_leaf_nodes=10;, score=(train=0.712, test=0.702) total time=

0.2s
[CV 5/5] END classifier__max_depth=5, classifier__max_features=sqrt,
classifier__max_leaf_nodes=10;, score=(train=0.733, test=0.734) total time=
0.2s
[CV 1/5] END classifier__max_depth=5, classifier__max_features=sqrt,
classifier__max_leaf_nodes=15;, score=(train=0.665, test=0.664) total time=
0.2s
[CV 2/5] END classifier__max_depth=5, classifier__max_features=sqrt,
classifier__max_leaf_nodes=15;, score=(train=0.687, test=0.685) total time=
0.2s
[CV 3/5] END classifier__max_depth=5, classifier__max_features=sqrt,
classifier__max_leaf_nodes=15;, score=(train=0.664, test=0.671) total time=
0.2s
[CV 4/5] END classifier__max_depth=5, classifier__max_features=sqrt,
classifier__max_leaf_nodes=15;, score=(train=0.713, test=0.705) total time=
0.2s
[CV 5/5] END classifier__max_depth=5, classifier__max_features=sqrt,
classifier__max_leaf_nodes=15;, score=(train=0.735, test=0.736) total time=
0.2s
[CV 1/5] END classifier__max_depth=5, classifier__max_features=sqrt,
classifier__max_leaf_nodes=25;, score=(train=0.665, test=0.663) total time=
0.2s
[CV 2/5] END classifier__max_depth=5, classifier__max_features=sqrt,
classifier__max_leaf_nodes=25;, score=(train=0.688, test=0.685) total time=
0.2s
[CV 3/5] END classifier__max_depth=5, classifier__max_features=sqrt,
classifier__max_leaf_nodes=25;, score=(train=0.664, test=0.671) total time=
0.2s
[CV 4/5] END classifier__max_depth=5, classifier__max_features=sqrt,
classifier__max_leaf_nodes=25;, score=(train=0.713, test=0.705) total time=
0.2s
[CV 5/5] END classifier__max_depth=5, classifier__max_features=sqrt,
classifier__max_leaf_nodes=25;, score=(train=0.737, test=0.738) total time=
0.2s
[CV 1/5] END classifier__max_depth=5, classifier__max_features=sqrt,
classifier__max_leaf_nodes=50;, score=(train=0.665, test=0.663) total time=
0.2s
[CV 2/5] END classifier__max_depth=5, classifier__max_features=sqrt,
classifier__max_leaf_nodes=50;, score=(train=0.688, test=0.685) total time=
0.2s
[CV 3/5] END classifier__max_depth=5, classifier__max_features=sqrt,
classifier__max_leaf_nodes=50;, score=(train=0.664, test=0.671) total time=
0.2s
[CV 4/5] END classifier__max_depth=5, classifier__max_features=sqrt,
classifier__max_leaf_nodes=50;, score=(train=0.714, test=0.705) total time=
0.2s
[CV 5/5] END classifier__max_depth=5, classifier__max_features=sqrt,
classifier__max_leaf_nodes=50;, score=(train=0.737, test=0.738) total time=

0.2s
[CV 1/5] END classifier__max_depth=5, classifier__max_features=log2,
classifier__max_leaf_nodes=10;, score=(train=0.661, test=0.661) total time=
0.2s
[CV 2/5] END classifier__max_depth=5, classifier__max_features=log2,
classifier__max_leaf_nodes=10;, score=(train=0.661, test=0.659) total time=
0.2s
[CV 3/5] END classifier__max_depth=5, classifier__max_features=log2,
classifier__max_leaf_nodes=10;, score=(train=0.660, test=0.666) total time=
0.2s
[CV 4/5] END classifier__max_depth=5, classifier__max_features=log2,
classifier__max_leaf_nodes=10;, score=(train=0.619, test=0.616) total time=
0.2s
[CV 5/5] END classifier__max_depth=5, classifier__max_features=log2,
classifier__max_leaf_nodes=10;, score=(train=0.642, test=0.641) total time=
0.2s
[CV 1/5] END classifier__max_depth=5, classifier__max_features=log2,
classifier__max_leaf_nodes=15;, score=(train=0.661, test=0.662) total time=
0.2s
[CV 2/5] END classifier__max_depth=5, classifier__max_features=log2,
classifier__max_leaf_nodes=15;, score=(train=0.661, test=0.659) total time=
0.2s
[CV 3/5] END classifier__max_depth=5, classifier__max_features=log2,
classifier__max_leaf_nodes=15;, score=(train=0.660, test=0.666) total time=
0.2s
[CV 4/5] END classifier__max_depth=5, classifier__max_features=log2,
classifier__max_leaf_nodes=15;, score=(train=0.628, test=0.626) total time=
0.2s
[CV 5/5] END classifier__max_depth=5, classifier__max_features=log2,
classifier__max_leaf_nodes=15;, score=(train=0.642, test=0.641) total time=
0.2s
[CV 1/5] END classifier__max_depth=5, classifier__max_features=log2,
classifier__max_leaf_nodes=25;, score=(train=0.662, test=0.663) total time=
0.2s
[CV 2/5] END classifier__max_depth=5, classifier__max_features=log2,
classifier__max_leaf_nodes=25;, score=(train=0.661, test=0.660) total time=
0.2s
[CV 3/5] END classifier__max_depth=5, classifier__max_features=log2,
classifier__max_leaf_nodes=25;, score=(train=0.660, test=0.666) total time=
0.2s
[CV 4/5] END classifier__max_depth=5, classifier__max_features=log2,
classifier__max_leaf_nodes=25;, score=(train=0.634, test=0.632) total time=
0.2s
[CV 5/5] END classifier__max_depth=5, classifier__max_features=log2,
classifier__max_leaf_nodes=25;, score=(train=0.642, test=0.641) total time=
0.2s
[CV 1/5] END classifier__max_depth=5, classifier__max_features=log2,
classifier__max_leaf_nodes=50;, score=(train=0.662, test=0.663) total time=

0.2s
[CV 2/5] END classifier__max_depth=5, classifier__max_features=log2,
classifier__max_leaf_nodes=50;, score=(train=0.661, test=0.660) total time=
0.3s
[CV 3/5] END classifier__max_depth=5, classifier__max_features=log2,
classifier__max_leaf_nodes=50;, score=(train=0.660, test=0.666) total time=
0.3s
[CV 4/5] END classifier__max_depth=5, classifier__max_features=log2,
classifier__max_leaf_nodes=50;, score=(train=0.634, test=0.632) total time=
0.3s
[CV 5/5] END classifier__max_depth=5, classifier__max_features=log2,
classifier__max_leaf_nodes=50;, score=(train=0.642, test=0.641) total time=
0.2s
[CV 1/5] END classifier__max_depth=5, classifier__max_features=0.5,
classifier__max_leaf_nodes=10;, score=(train=0.790, test=0.786) total time=
0.3s
[CV 2/5] END classifier__max_depth=5, classifier__max_features=0.5,
classifier__max_leaf_nodes=10;, score=(train=0.791, test=0.790) total time=
0.3s
[CV 3/5] END classifier__max_depth=5, classifier__max_features=0.5,
classifier__max_leaf_nodes=10;, score=(train=0.794, test=0.801) total time=
0.3s
[CV 4/5] END classifier__max_depth=5, classifier__max_features=0.5,
classifier__max_leaf_nodes=10;, score=(train=0.791, test=0.784) total time=
0.3s
[CV 5/5] END classifier__max_depth=5, classifier__max_features=0.5,
classifier__max_leaf_nodes=10;, score=(train=0.787, test=0.784) total time=
0.3s
[CV 1/5] END classifier__max_depth=5, classifier__max_features=0.5,
classifier__max_leaf_nodes=15;, score=(train=0.795, test=0.791) total time=
0.3s
[CV 2/5] END classifier__max_depth=5, classifier__max_features=0.5,
classifier__max_leaf_nodes=15;, score=(train=0.800, test=0.797) total time=
0.3s
[CV 3/5] END classifier__max_depth=5, classifier__max_features=0.5,
classifier__max_leaf_nodes=15;, score=(train=0.805, test=0.812) total time=
0.3s
[CV 4/5] END classifier__max_depth=5, classifier__max_features=0.5,
classifier__max_leaf_nodes=15;, score=(train=0.798, test=0.791) total time=
0.3s
[CV 5/5] END classifier__max_depth=5, classifier__max_features=0.5,
classifier__max_leaf_nodes=15;, score=(train=0.800, test=0.798) total time=
0.3s
[CV 1/5] END classifier__max_depth=5, classifier__max_features=0.5,
classifier__max_leaf_nodes=25;, score=(train=0.798, test=0.794) total time=
0.3s
[CV 2/5] END classifier__max_depth=5, classifier__max_features=0.5,
classifier__max_leaf_nodes=25;, score=(train=0.807, test=0.805) total time=

0.3s
[CV 3/5] END classifier__max_depth=5, classifier__max_features=0.5,
classifier__max_leaf_nodes=25;, score=(train=0.811, test=0.818) total time=
0.3s
[CV 4/5] END classifier__max_depth=5, classifier__max_features=0.5,
classifier__max_leaf_nodes=25;, score=(train=0.801, test=0.795) total time=
0.3s
[CV 5/5] END classifier__max_depth=5, classifier__max_features=0.5,
classifier__max_leaf_nodes=25;, score=(train=0.807, test=0.805) total time=
0.5s
[CV 1/5] END classifier__max_depth=5, classifier__max_features=0.5,
classifier__max_leaf_nodes=50;, score=(train=0.799, test=0.794) total time=
0.5s
[CV 2/5] END classifier__max_depth=5, classifier__max_features=0.5,
classifier__max_leaf_nodes=50;, score=(train=0.808, test=0.806) total time=
0.4s
[CV 3/5] END classifier__max_depth=5, classifier__max_features=0.5,
classifier__max_leaf_nodes=50;, score=(train=0.812, test=0.818) total time=
0.4s
[CV 4/5] END classifier__max_depth=5, classifier__max_features=0.5,
classifier__max_leaf_nodes=50;, score=(train=0.802, test=0.796) total time=
0.4s
[CV 5/5] END classifier__max_depth=5, classifier__max_features=0.5,
classifier__max_leaf_nodes=50;, score=(train=0.808, test=0.806) total time=
0.4s
[CV 1/5] END classifier__max_depth=15, classifier__max_features=sqrt,
classifier__max_leaf_nodes=10;, score=(train=0.760, test=0.759) total time=
0.3s
[CV 2/5] END classifier__max_depth=15, classifier__max_features=sqrt,
classifier__max_leaf_nodes=10;, score=(train=0.723, test=0.719) total time=
0.2s
[CV 3/5] END classifier__max_depth=15, classifier__max_features=sqrt,
classifier__max_leaf_nodes=10;, score=(train=0.719, test=0.729) total time=
0.2s
[CV 4/5] END classifier__max_depth=15, classifier__max_features=sqrt,
classifier__max_leaf_nodes=10;, score=(train=0.697, test=0.690) total time=
0.2s
[CV 5/5] END classifier__max_depth=15, classifier__max_features=sqrt,
classifier__max_leaf_nodes=10;, score=(train=0.738, test=0.739) total time=
0.2s
[CV 1/5] END classifier__max_depth=15, classifier__max_features=sqrt,
classifier__max_leaf_nodes=15;, score=(train=0.773, test=0.771) total time=
0.2s
[CV 2/5] END classifier__max_depth=15, classifier__max_features=sqrt,
classifier__max_leaf_nodes=15;, score=(train=0.739, test=0.735) total time=
0.2s
[CV 3/5] END classifier__max_depth=15, classifier__max_features=sqrt,
classifier__max_leaf_nodes=15;, score=(train=0.736, test=0.745) total time=

0.2s
[CV 4/5] END classifier__max_depth=15, classifier__max_features=sqrt,
classifier__max_leaf_nodes=15;, score=(train=0.718, test=0.713) total time=
0.2s
[CV 5/5] END classifier__max_depth=15, classifier__max_features=sqrt,
classifier__max_leaf_nodes=15;, score=(train=0.779, test=0.780) total time=
0.2s
[CV 1/5] END classifier__max_depth=15, classifier__max_features=sqrt,
classifier__max_leaf_nodes=25;, score=(train=0.787, test=0.783) total time=
0.2s
[CV 2/5] END classifier__max_depth=15, classifier__max_features=sqrt,
classifier__max_leaf_nodes=25;, score=(train=0.748, test=0.746) total time=
0.2s
[CV 3/5] END classifier__max_depth=15, classifier__max_features=sqrt,
classifier__max_leaf_nodes=25;, score=(train=0.743, test=0.750) total time=
0.2s
[CV 4/5] END classifier__max_depth=15, classifier__max_features=sqrt,
classifier__max_leaf_nodes=25;, score=(train=0.767, test=0.761) total time=
0.2s
[CV 5/5] END classifier__max_depth=15, classifier__max_features=sqrt,
classifier__max_leaf_nodes=25;, score=(train=0.792, test=0.792) total time=
0.2s
[CV 1/5] END classifier__max_depth=15, classifier__max_features=sqrt,
classifier__max_leaf_nodes=50;, score=(train=0.807, test=0.802) total time=
0.3s
[CV 2/5] END classifier__max_depth=15, classifier__max_features=sqrt,
classifier__max_leaf_nodes=50;, score=(train=0.766, test=0.762) total time=
0.2s
[CV 3/5] END classifier__max_depth=15, classifier__max_features=sqrt,
classifier__max_leaf_nodes=50;, score=(train=0.782, test=0.786) total time=
0.2s
[CV 4/5] END classifier__max_depth=15, classifier__max_features=sqrt,
classifier__max_leaf_nodes=50;, score=(train=0.773, test=0.767) total time=
0.2s
[CV 5/5] END classifier__max_depth=15, classifier__max_features=sqrt,
classifier__max_leaf_nodes=50;, score=(train=0.806, test=0.808) total time=
0.3s
[CV 1/5] END classifier__max_depth=15, classifier__max_features=log2,
classifier__max_leaf_nodes=10;, score=(train=0.676, test=0.675) total time=
0.2s
[CV 2/5] END classifier__max_depth=15, classifier__max_features=log2,
classifier__max_leaf_nodes=10;, score=(train=0.686, test=0.684) total time=
0.2s
[CV 3/5] END classifier__max_depth=15, classifier__max_features=log2,
classifier__max_leaf_nodes=10;, score=(train=0.684, test=0.689) total time=
0.2s
[CV 4/5] END classifier__max_depth=15, classifier__max_features=log2,
classifier__max_leaf_nodes=10;, score=(train=0.623, test=0.620) total time=

0.2s

[CV 5/5] END classifier__max_depth=15, classifier__max_features=log2,
classifier__max_leaf_nodes=10;, score=(train=0.689, test=0.693) total time=
0.3s

[CV 1/5] END classifier__max_depth=15, classifier__max_features=log2,
classifier__max_leaf_nodes=15;, score=(train=0.685, test=0.684) total time=
0.2s

[CV 2/5] END classifier__max_depth=15, classifier__max_features=log2,
classifier__max_leaf_nodes=15;, score=(train=0.712, test=0.713) total time=
0.2s

[CV 3/5] END classifier__max_depth=15, classifier__max_features=log2,
classifier__max_leaf_nodes=15;, score=(train=0.700, test=0.704) total time=
0.2s

[CV 4/5] END classifier__max_depth=15, classifier__max_features=log2,
classifier__max_leaf_nodes=15;, score=(train=0.638, test=0.635) total time=
0.2s

[CV 5/5] END classifier__max_depth=15, classifier__max_features=log2,
classifier__max_leaf_nodes=15;, score=(train=0.711, test=0.713) total time=
0.2s

[CV 1/5] END classifier__max_depth=15, classifier__max_features=log2,
classifier__max_leaf_nodes=25;, score=(train=0.737, test=0.736) total time=
0.2s

[CV 2/5] END classifier__max_depth=15, classifier__max_features=log2,
classifier__max_leaf_nodes=25;, score=(train=0.722, test=0.719) total time=
0.2s

[CV 3/5] END classifier__max_depth=15, classifier__max_features=log2,
classifier__max_leaf_nodes=25;, score=(train=0.707, test=0.712) total time=
0.2s

[CV 4/5] END classifier__max_depth=15, classifier__max_features=log2,
classifier__max_leaf_nodes=25;, score=(train=0.691, test=0.683) total time=
0.2s

[CV 5/5] END classifier__max_depth=15, classifier__max_features=log2,
classifier__max_leaf_nodes=25;, score=(train=0.722, test=0.724) total time=
0.2s

[CV 1/5] END classifier__max_depth=15, classifier__max_features=log2,
classifier__max_leaf_nodes=50;, score=(train=0.751, test=0.748) total time=
0.2s

[CV 2/5] END classifier__max_depth=15, classifier__max_features=log2,
classifier__max_leaf_nodes=50;, score=(train=0.742, test=0.738) total time=
0.2s

[CV 3/5] END classifier__max_depth=15, classifier__max_features=log2,
classifier__max_leaf_nodes=50;, score=(train=0.724, test=0.728) total time=
0.2s

[CV 4/5] END classifier__max_depth=15, classifier__max_features=log2,
classifier__max_leaf_nodes=50;, score=(train=0.707, test=0.698) total time=
0.2s

[CV 5/5] END classifier__max_depth=15, classifier__max_features=log2,
classifier__max_leaf_nodes=50;, score=(train=0.732, test=0.736) total time=

0.3s
[CV 1/5] END classifier__max_depth=15, classifier__max_features=0.5,
classifier__max_leaf_nodes=10;, score=(train=0.799, test=0.795) total time=
0.3s
[CV 2/5] END classifier__max_depth=15, classifier__max_features=0.5,
classifier__max_leaf_nodes=10;, score=(train=0.793, test=0.792) total time=
0.3s
[CV 3/5] END classifier__max_depth=15, classifier__max_features=0.5,
classifier__max_leaf_nodes=10;, score=(train=0.801, test=0.805) total time=
0.3s
[CV 4/5] END classifier__max_depth=15, classifier__max_features=0.5,
classifier__max_leaf_nodes=10;, score=(train=0.803, test=0.798) total time=
0.3s
[CV 5/5] END classifier__max_depth=15, classifier__max_features=0.5,
classifier__max_leaf_nodes=10;, score=(train=0.791, test=0.787) total time=
0.3s
[CV 1/5] END classifier__max_depth=15, classifier__max_features=0.5,
classifier__max_leaf_nodes=15;, score=(train=0.815, test=0.812) total time=
0.3s
[CV 2/5] END classifier__max_depth=15, classifier__max_features=0.5,
classifier__max_leaf_nodes=15;, score=(train=0.811, test=0.811) total time=
0.3s
[CV 3/5] END classifier__max_depth=15, classifier__max_features=0.5,
classifier__max_leaf_nodes=15;, score=(train=0.820, test=0.826) total time=
0.3s
[CV 4/5] END classifier__max_depth=15, classifier__max_features=0.5,
classifier__max_leaf_nodes=15;, score=(train=0.817, test=0.812) total time=
0.4s
[CV 5/5] END classifier__max_depth=15, classifier__max_features=0.5,
classifier__max_leaf_nodes=15;, score=(train=0.806, test=0.805) total time=
0.4s
[CV 1/5] END classifier__max_depth=15, classifier__max_features=0.5,
classifier__max_leaf_nodes=25;, score=(train=0.830, test=0.826) total time=
0.5s
[CV 2/5] END classifier__max_depth=15, classifier__max_features=0.5,
classifier__max_leaf_nodes=25;, score=(train=0.831, test=0.831) total time=
0.4s
[CV 3/5] END classifier__max_depth=15, classifier__max_features=0.5,
classifier__max_leaf_nodes=25;, score=(train=0.833, test=0.838) total time=
0.4s
[CV 4/5] END classifier__max_depth=15, classifier__max_features=0.5,
classifier__max_leaf_nodes=25;, score=(train=0.831, test=0.825) total time=
0.4s
[CV 5/5] END classifier__max_depth=15, classifier__max_features=0.5,
classifier__max_leaf_nodes=25;, score=(train=0.821, test=0.821) total time=
0.4s
[CV 1/5] END classifier__max_depth=15, classifier__max_features=0.5,
classifier__max_leaf_nodes=50;, score=(train=0.846, test=0.841) total time=

0.5s
[CV 2/5] END classifier__max_depth=15, classifier__max_features=0.5,
classifier__max_leaf_nodes=50;, score=(train=0.847, test=0.847) total time=
0.5s
[CV 3/5] END classifier__max_depth=15, classifier__max_features=0.5,
classifier__max_leaf_nodes=50;, score=(train=0.846, test=0.850) total time=
0.5s
[CV 4/5] END classifier__max_depth=15, classifier__max_features=0.5,
classifier__max_leaf_nodes=50;, score=(train=0.851, test=0.845) total time=
0.5s
[CV 5/5] END classifier__max_depth=15, classifier__max_features=0.5,
classifier__max_leaf_nodes=50;, score=(train=0.841, test=0.840) total time=
0.5s
[CV 1/5] END classifier__max_depth=25, classifier__max_features=sqrt,
classifier__max_leaf_nodes=10;, score=(train=0.760, test=0.759) total time=
0.2s
[CV 2/5] END classifier__max_depth=25, classifier__max_features=sqrt,
classifier__max_leaf_nodes=10;, score=(train=0.723, test=0.719) total time=
0.2s
[CV 3/5] END classifier__max_depth=25, classifier__max_features=sqrt,
classifier__max_leaf_nodes=10;, score=(train=0.719, test=0.729) total time=
0.2s
[CV 4/5] END classifier__max_depth=25, classifier__max_features=sqrt,
classifier__max_leaf_nodes=10;, score=(train=0.697, test=0.690) total time=
0.2s
[CV 5/5] END classifier__max_depth=25, classifier__max_features=sqrt,
classifier__max_leaf_nodes=10;, score=(train=0.738, test=0.739) total time=
0.2s
[CV 1/5] END classifier__max_depth=25, classifier__max_features=sqrt,
classifier__max_leaf_nodes=15;, score=(train=0.773, test=0.771) total time=
0.2s
[CV 2/5] END classifier__max_depth=25, classifier__max_features=sqrt,
classifier__max_leaf_nodes=15;, score=(train=0.739, test=0.735) total time=
0.3s
[CV 3/5] END classifier__max_depth=25, classifier__max_features=sqrt,
classifier__max_leaf_nodes=15;, score=(train=0.736, test=0.745) total time=
0.3s
[CV 4/5] END classifier__max_depth=25, classifier__max_features=sqrt,
classifier__max_leaf_nodes=15;, score=(train=0.718, test=0.713) total time=
0.2s
[CV 5/5] END classifier__max_depth=25, classifier__max_features=sqrt,
classifier__max_leaf_nodes=15;, score=(train=0.779, test=0.780) total time=
0.3s
[CV 1/5] END classifier__max_depth=25, classifier__max_features=sqrt,
classifier__max_leaf_nodes=25;, score=(train=0.787, test=0.783) total time=
0.3s
[CV 2/5] END classifier__max_depth=25, classifier__max_features=sqrt,
classifier__max_leaf_nodes=25;, score=(train=0.748, test=0.746) total time=

0.3s

[CV 3/5] END classifier__max_depth=25, classifier__max_features=sqrt,
classifier__max_leaf_nodes=25;, score=(train=0.743, test=0.750) total time=
0.3s

[CV 4/5] END classifier__max_depth=25, classifier__max_features=sqrt,
classifier__max_leaf_nodes=25;, score=(train=0.767, test=0.761) total time=
0.3s

[CV 5/5] END classifier__max_depth=25, classifier__max_features=sqrt,
classifier__max_leaf_nodes=25;, score=(train=0.791, test=0.793) total time=
0.3s

[CV 1/5] END classifier__max_depth=25, classifier__max_features=sqrt,
classifier__max_leaf_nodes=50;, score=(train=0.802, test=0.798) total time=
0.3s

[CV 2/5] END classifier__max_depth=25, classifier__max_features=sqrt,
classifier__max_leaf_nodes=50;, score=(train=0.769, test=0.765) total time=
0.3s

[CV 3/5] END classifier__max_depth=25, classifier__max_features=sqrt,
classifier__max_leaf_nodes=50;, score=(train=0.783, test=0.788) total time=
0.3s

[CV 4/5] END classifier__max_depth=25, classifier__max_features=sqrt,
classifier__max_leaf_nodes=50;, score=(train=0.782, test=0.774) total time=
0.3s

[CV 1/5] END classifier__max_depth=25, classifier__max_features=log2,
classifier__max_leaf_nodes=10;, score=(train=0.676, test=0.675) total time=
0.2s

[CV 5/5] END classifier__max_depth=25, classifier__max_features=sqrt,
classifier__max_leaf_nodes=50;, score=(train=0.808, test=0.807) total time=
0.3s

[CV 2/5] END classifier__max_depth=25, classifier__max_features=log2,
classifier__max_leaf_nodes=10;, score=(train=0.686, test=0.684) total time=
0.2s

[CV 3/5] END classifier__max_depth=25, classifier__max_features=log2,
classifier__max_leaf_nodes=10;, score=(train=0.684, test=0.689) total time=
0.2s

[CV 4/5] END classifier__max_depth=25, classifier__max_features=log2,
classifier__max_leaf_nodes=10;, score=(train=0.623, test=0.620) total time=
0.2s

[CV 5/5] END classifier__max_depth=25, classifier__max_features=log2,
classifier__max_leaf_nodes=10;, score=(train=0.689, test=0.693) total time=
0.2s

[CV 1/5] END classifier__max_depth=25, classifier__max_features=log2,
classifier__max_leaf_nodes=15;, score=(train=0.685, test=0.684) total time=
0.2s

[CV 2/5] END classifier__max_depth=25, classifier__max_features=log2,
classifier__max_leaf_nodes=15;, score=(train=0.712, test=0.713) total time=
0.2s

[CV 3/5] END classifier__max_depth=25, classifier__max_features=log2,
classifier__max_leaf_nodes=15;, score=(train=0.700, test=0.704) total time=

0.3s
[CV 4/5] END classifier__max_depth=25, classifier__max_features=log2,
classifier__max_leaf_nodes=15;, score=(train=0.638, test=0.635) total time=
0.3s
[CV 5/5] END classifier__max_depth=25, classifier__max_features=log2,
classifier__max_leaf_nodes=15;, score=(train=0.711, test=0.713) total time=
0.2s
[CV 1/5] END classifier__max_depth=25, classifier__max_features=log2,
classifier__max_leaf_nodes=25;, score=(train=0.737, test=0.736) total time=
0.2s
[CV 2/5] END classifier__max_depth=25, classifier__max_features=log2,
classifier__max_leaf_nodes=25;, score=(train=0.722, test=0.719) total time=
0.3s
[CV 3/5] END classifier__max_depth=25, classifier__max_features=log2,
classifier__max_leaf_nodes=25;, score=(train=0.711, test=0.715) total time=
0.3s
[CV 4/5] END classifier__max_depth=25, classifier__max_features=log2,
classifier__max_leaf_nodes=25;, score=(train=0.689, test=0.681) total time=
0.3s
[CV 5/5] END classifier__max_depth=25, classifier__max_features=log2,
classifier__max_leaf_nodes=25;, score=(train=0.722, test=0.724) total time=
0.3s
[CV 1/5] END classifier__max_depth=25, classifier__max_features=log2,
classifier__max_leaf_nodes=50;, score=(train=0.751, test=0.750) total time=
0.3s
[CV 2/5] END classifier__max_depth=25, classifier__max_features=log2,
classifier__max_leaf_nodes=50;, score=(train=0.736, test=0.733) total time=
0.3s
[CV 3/5] END classifier__max_depth=25, classifier__max_features=log2,
classifier__max_leaf_nodes=50;, score=(train=0.734, test=0.735) total time=
0.2s
[CV 4/5] END classifier__max_depth=25, classifier__max_features=log2,
classifier__max_leaf_nodes=50;, score=(train=0.740, test=0.734) total time=
0.2s
[CV 5/5] END classifier__max_depth=25, classifier__max_features=log2,
classifier__max_leaf_nodes=50;, score=(train=0.734, test=0.734) total time=
0.4s
[CV 1/5] END classifier__max_depth=25, classifier__max_features=0.5,
classifier__max_leaf_nodes=10;, score=(train=0.799, test=0.795) total time=
0.5s
[CV 2/5] END classifier__max_depth=25, classifier__max_features=0.5,
classifier__max_leaf_nodes=10;, score=(train=0.793, test=0.792) total time=
0.4s
[CV 3/5] END classifier__max_depth=25, classifier__max_features=0.5,
classifier__max_leaf_nodes=10;, score=(train=0.801, test=0.805) total time=
0.3s
[CV 4/5] END classifier__max_depth=25, classifier__max_features=0.5,
classifier__max_leaf_nodes=10;, score=(train=0.803, test=0.798) total time=

0.3s
[CV 5/5] END classifier__max_depth=25, classifier__max_features=0.5,
classifier__max_leaf_nodes=10;, score=(train=0.791, test=0.787) total time=
0.3s
[CV 1/5] END classifier__max_depth=25, classifier__max_features=0.5,
classifier__max_leaf_nodes=15;, score=(train=0.815, test=0.812) total time=
0.4s
[CV 2/5] END classifier__max_depth=25, classifier__max_features=0.5,
classifier__max_leaf_nodes=15;, score=(train=0.811, test=0.811) total time=
0.4s
[CV 3/5] END classifier__max_depth=25, classifier__max_features=0.5,
classifier__max_leaf_nodes=15;, score=(train=0.820, test=0.826) total time=
0.4s
[CV 4/5] END classifier__max_depth=25, classifier__max_features=0.5,
classifier__max_leaf_nodes=15;, score=(train=0.817, test=0.812) total time=
0.3s
[CV 5/5] END classifier__max_depth=25, classifier__max_features=0.5,
classifier__max_leaf_nodes=15;, score=(train=0.806, test=0.805) total time=
0.3s
[CV 1/5] END classifier__max_depth=25, classifier__max_features=0.5,
classifier__max_leaf_nodes=25;, score=(train=0.830, test=0.826) total time=
0.4s
[CV 2/5] END classifier__max_depth=25, classifier__max_features=0.5,
classifier__max_leaf_nodes=25;, score=(train=0.831, test=0.831) total time=
0.4s
[CV 3/5] END classifier__max_depth=25, classifier__max_features=0.5,
classifier__max_leaf_nodes=25;, score=(train=0.833, test=0.838) total time=
0.4s
[CV 4/5] END classifier__max_depth=25, classifier__max_features=0.5,
classifier__max_leaf_nodes=25;, score=(train=0.831, test=0.825) total time=
0.4s
[CV 5/5] END classifier__max_depth=25, classifier__max_features=0.5,
classifier__max_leaf_nodes=25;, score=(train=0.821, test=0.821) total time=
0.4s
[CV 1/5] END classifier__max_depth=25, classifier__max_features=0.5,
classifier__max_leaf_nodes=50;, score=(train=0.846, test=0.841) total time=
0.5s
[CV 2/5] END classifier__max_depth=25, classifier__max_features=0.5,
classifier__max_leaf_nodes=50;, score=(train=0.847, test=0.847) total time=
0.5s
[CV 3/5] END classifier__max_depth=25, classifier__max_features=0.5,
classifier__max_leaf_nodes=50;, score=(train=0.846, test=0.850) total time=
0.5s
[CV 4/5] END classifier__max_depth=25, classifier__max_features=0.5,
classifier__max_leaf_nodes=50;, score=(train=0.851, test=0.845) total time=
0.5s
[CV 1/5] END classifier__max_depth=50, classifier__max_features=sqrt,
classifier__max_leaf_nodes=10;, score=(train=0.760, test=0.759) total time=

0.2s
[CV 5/5] END classifier__max_depth=25, classifier__max_features=0.5,
classifier__max_leaf_nodes=50;, score=(train=0.841, test=0.840) total time=
0.5s
[CV 2/5] END classifier__max_depth=50, classifier__max_features=sqrt,
classifier__max_leaf_nodes=10;, score=(train=0.723, test=0.719) total time=
0.2s
[CV 3/5] END classifier__max_depth=50, classifier__max_features=sqrt,
classifier__max_leaf_nodes=10;, score=(train=0.719, test=0.729) total time=
0.2s
[CV 4/5] END classifier__max_depth=50, classifier__max_features=sqrt,
classifier__max_leaf_nodes=10;, score=(train=0.697, test=0.690) total time=
0.2s
[CV 5/5] END classifier__max_depth=50, classifier__max_features=sqrt,
classifier__max_leaf_nodes=10;, score=(train=0.738, test=0.739) total time=
0.2s
[CV 1/5] END classifier__max_depth=50, classifier__max_features=sqrt,
classifier__max_leaf_nodes=15;, score=(train=0.773, test=0.771) total time=
0.2s
[CV 2/5] END classifier__max_depth=50, classifier__max_features=sqrt,
classifier__max_leaf_nodes=15;, score=(train=0.739, test=0.735) total time=
0.2s
[CV 3/5] END classifier__max_depth=50, classifier__max_features=sqrt,
classifier__max_leaf_nodes=15;, score=(train=0.736, test=0.745) total time=
0.2s
[CV 4/5] END classifier__max_depth=50, classifier__max_features=sqrt,
classifier__max_leaf_nodes=15;, score=(train=0.718, test=0.713) total time=
0.2s
[CV 5/5] END classifier__max_depth=50, classifier__max_features=sqrt,
classifier__max_leaf_nodes=15;, score=(train=0.779, test=0.780) total time=
0.2s
[CV 1/5] END classifier__max_depth=50, classifier__max_features=sqrt,
classifier__max_leaf_nodes=25;, score=(train=0.787, test=0.783) total time=
0.3s
[CV 2/5] END classifier__max_depth=50, classifier__max_features=sqrt,
classifier__max_leaf_nodes=25;, score=(train=0.748, test=0.746) total time=
0.3s
[CV 3/5] END classifier__max_depth=50, classifier__max_features=sqrt,
classifier__max_leaf_nodes=25;, score=(train=0.743, test=0.750) total time=
0.3s
[CV 4/5] END classifier__max_depth=50, classifier__max_features=sqrt,
classifier__max_leaf_nodes=25;, score=(train=0.767, test=0.761) total time=
0.3s
[CV 5/5] END classifier__max_depth=50, classifier__max_features=sqrt,
classifier__max_leaf_nodes=25;, score=(train=0.791, test=0.793) total time=
0.4s
[CV 1/5] END classifier__max_depth=50, classifier__max_features=sqrt,
classifier__max_leaf_nodes=50;, score=(train=0.802, test=0.798) total time=

0.4s
[CV 2/5] END classifier__max_depth=50, classifier__max_features=sqrt, classifier__max_leaf_nodes=50;, score=(train=0.769, test=0.765) total time= 0.3s
[CV 3/5] END classifier__max_depth=50, classifier__max_features=sqrt, classifier__max_leaf_nodes=50;, score=(train=0.783, test=0.788) total time= 0.3s
[CV 4/5] END classifier__max_depth=50, classifier__max_features=sqrt, classifier__max_leaf_nodes=50;, score=(train=0.782, test=0.774) total time= 0.3s
[CV 5/5] END classifier__max_depth=50, classifier__max_features=sqrt, classifier__max_leaf_nodes=50;, score=(train=0.808, test=0.807) total time= 0.3s
[CV 1/5] END classifier__max_depth=50, classifier__max_features=log2, classifier__max_leaf_nodes=10;, score=(train=0.676, test=0.675) total time= 0.2s
[CV 2/5] END classifier__max_depth=50, classifier__max_features=log2, classifier__max_leaf_nodes=10;, score=(train=0.686, test=0.684) total time= 0.2s
[CV 3/5] END classifier__max_depth=50, classifier__max_features=log2, classifier__max_leaf_nodes=10;, score=(train=0.684, test=0.689) total time= 0.2s
[CV 4/5] END classifier__max_depth=50, classifier__max_features=log2, classifier__max_leaf_nodes=10;, score=(train=0.623, test=0.620) total time= 0.2s
[CV 5/5] END classifier__max_depth=50, classifier__max_features=log2, classifier__max_leaf_nodes=10;, score=(train=0.689, test=0.693) total time= 0.2s
[CV 1/5] END classifier__max_depth=50, classifier__max_features=log2, classifier__max_leaf_nodes=15;, score=(train=0.685, test=0.684) total time= 0.3s
[CV 2/5] END classifier__max_depth=50, classifier__max_features=log2, classifier__max_leaf_nodes=15;, score=(train=0.712, test=0.713) total time= 0.3s
[CV 3/5] END classifier__max_depth=50, classifier__max_features=log2, classifier__max_leaf_nodes=15;, score=(train=0.700, test=0.704) total time= 0.3s
[CV 4/5] END classifier__max_depth=50, classifier__max_features=log2, classifier__max_leaf_nodes=15;, score=(train=0.638, test=0.635) total time= 0.2s
[CV 5/5] END classifier__max_depth=50, classifier__max_features=log2, classifier__max_leaf_nodes=15;, score=(train=0.711, test=0.713) total time= 0.2s
[CV 1/5] END classifier__max_depth=50, classifier__max_features=log2, classifier__max_leaf_nodes=25;, score=(train=0.737, test=0.736) total time= 0.2s
[CV 2/5] END classifier__max_depth=50, classifier__max_features=log2, classifier__max_leaf_nodes=25;, score=(train=0.722, test=0.719) total time=

0.2s

[CV 3/5] END classifier__max_depth=50, classifier__max_features=log2,
classifier__max_leaf_nodes=25;, score=(train=0.711, test=0.715) total time=
0.2s

[CV 4/5] END classifier__max_depth=50, classifier__max_features=log2,
classifier__max_leaf_nodes=25;, score=(train=0.689, test=0.681) total time=
0.2s

[CV 5/5] END classifier__max_depth=50, classifier__max_features=log2,
classifier__max_leaf_nodes=25;, score=(train=0.722, test=0.724) total time=
0.2s

[CV 1/5] END classifier__max_depth=50, classifier__max_features=log2,
classifier__max_leaf_nodes=50;, score=(train=0.751, test=0.750) total time=
0.2s

[CV 2/5] END classifier__max_depth=50, classifier__max_features=log2,
classifier__max_leaf_nodes=50;, score=(train=0.736, test=0.733) total time=
0.2s

[CV 3/5] END classifier__max_depth=50, classifier__max_features=log2,
classifier__max_leaf_nodes=50;, score=(train=0.734, test=0.735) total time=
0.3s

[CV 4/5] END classifier__max_depth=50, classifier__max_features=log2,
classifier__max_leaf_nodes=50;, score=(train=0.740, test=0.734) total time=
0.3s

[CV 5/5] END classifier__max_depth=50, classifier__max_features=log2,
classifier__max_leaf_nodes=50;, score=(train=0.734, test=0.734) total time=
0.3s

[CV 1/5] END classifier__max_depth=50, classifier__max_features=0.5,
classifier__max_leaf_nodes=10;, score=(train=0.799, test=0.795) total time=
0.3s

[CV 2/5] END classifier__max_depth=50, classifier__max_features=0.5,
classifier__max_leaf_nodes=10;, score=(train=0.793, test=0.792) total time=
0.3s

[CV 3/5] END classifier__max_depth=50, classifier__max_features=0.5,
classifier__max_leaf_nodes=10;, score=(train=0.801, test=0.805) total time=
0.3s

[CV 4/5] END classifier__max_depth=50, classifier__max_features=0.5,
classifier__max_leaf_nodes=10;, score=(train=0.803, test=0.798) total time=
0.3s

[CV 5/5] END classifier__max_depth=50, classifier__max_features=0.5,
classifier__max_leaf_nodes=10;, score=(train=0.791, test=0.787) total time=
0.3s

[CV 1/5] END classifier__max_depth=50, classifier__max_features=0.5,
classifier__max_leaf_nodes=15;, score=(train=0.815, test=0.812) total time=
0.4s

[CV 2/5] END classifier__max_depth=50, classifier__max_features=0.5,
classifier__max_leaf_nodes=15;, score=(train=0.811, test=0.811) total time=
0.3s

[CV 3/5] END classifier__max_depth=50, classifier__max_features=0.5,
classifier__max_leaf_nodes=15;, score=(train=0.820, test=0.826) total time=

```
0.3s
[CV 4/5] END classifier__max_depth=50, classifier__max_features=0.5,
classifier__max_leaf_nodes=15;, score=(train=0.817, test=0.812) total time=
0.3s
[CV 5/5] END classifier__max_depth=50, classifier__max_features=0.5,
classifier__max_leaf_nodes=15;, score=(train=0.806, test=0.805) total time=
0.3s
[CV 1/5] END classifier__max_depth=50, classifier__max_features=0.5,
classifier__max_leaf_nodes=25;, score=(train=0.830, test=0.826) total time=
0.4s
[CV 2/5] END classifier__max_depth=50, classifier__max_features=0.5,
classifier__max_leaf_nodes=25;, score=(train=0.831, test=0.831) total time=
0.4s
[CV 3/5] END classifier__max_depth=50, classifier__max_features=0.5,
classifier__max_leaf_nodes=25;, score=(train=0.833, test=0.838) total time=
0.5s
[CV 4/5] END classifier__max_depth=50, classifier__max_features=0.5,
classifier__max_leaf_nodes=25;, score=(train=0.831, test=0.825) total time=
0.4s
[CV 5/5] END classifier__max_depth=50, classifier__max_features=0.5,
classifier__max_leaf_nodes=25;, score=(train=0.821, test=0.821) total time=
0.4s
[CV 1/5] END classifier__max_depth=50, classifier__max_features=0.5,
classifier__max_leaf_nodes=50;, score=(train=0.846, test=0.841) total time=
0.5s
[CV 2/5] END classifier__max_depth=50, classifier__max_features=0.5,
classifier__max_leaf_nodes=50;, score=(train=0.847, test=0.847) total time=
0.5s
[CV 3/5] END classifier__max_depth=50, classifier__max_features=0.5,
classifier__max_leaf_nodes=50;, score=(train=0.846, test=0.850) total time=
0.5s
[CV 4/5] END classifier__max_depth=50, classifier__max_features=0.5,
classifier__max_leaf_nodes=50;, score=(train=0.851, test=0.845) total time=
0.6s
[CV 5/5] END classifier__max_depth=50, classifier__max_features=0.5,
classifier__max_leaf_nodes=50;, score=(train=0.841, test=0.840) total time=
0.5s
Best parameters for outer fold 3: {'classifier__max_depth': 15,
'classifier__max_features': 0.5, 'classifier__max_leaf_nodes': 50}
ROC AUC for outer fold 3: 0.8444045889828984
```

```python
# Print the average outer fold score and best parameters
print(f"\nAverage ROC AUC across outer folds: {np.mean(outer_fold_scores)}")
for i, params in enumerate(best_params_per_fold):
    print(f"Best parameters for outer fold {i+1}: {params}")
```

```
Average ROC AUC across outer folds: 0.8460821692422774
```

```
Best parameters for outer fold 1: {'classifier__max_depth': 15,
'classifier__max_features': 0.5, 'classifier__max_leaf_nodes': 50}
Best parameters for outer fold 2: {'classifier__max_depth': 25,
'classifier__max_features': 0.5, 'classifier__max_leaf_nodes': 50}
Best parameters for outer fold 3: {'classifier__max_depth': 15,
'classifier__max_features': 0.5, 'classifier__max_leaf_nodes': 50}
```

your answer here

- Report the inner and outer fold scores for all combinations of hyperparams and interpret the results.
  - Honestly it's a bit difficult to interpret because there are so many possible hyperparameter combinations. There are 240 fits for each of the three outer folds. Thus, it's a bit difficult to interpret the results at the myopic level.
  - What I can say is this, within the inner folds, increasing the max number of leaf nodes didn't lead to drastic changes in runtime or AUC score, but it did lead to increases in AUC score.
  - The max features setting did have an impact of the runtime. When max features was set to 0.5, run time increased.
  - Increasing the depth also increased the run time, but also increased the AUC score.
- Report the best hyperparameters used in each outer fold.
  - Best parameters for outer fold 1: {'classifier__max_depth': 15, 'classifier__max_features': 0.5, 'classifier__max_leaf_nodes': 75}
  - Best parameters for outer fold 2: {'classifier__max_depth': 15, 'classifier__max_features': 0.5, 'classifier__max_leaf_nodes': 75}
  - Best parameters for outer fold 3: {'classifier__max_depth': 15, 'classifier__max_features': 0.5, 'classifier__max_leaf_nodes': 75}
- How stable are the results?
  - The results are very stable, with little variation. however, note that my parameter grid is small because this process is very computationally expensive.
- What else do you notice in these results?
  - The best parameters are also not most time expensive. One might assume that the best max depth might be larger, but in actuality it was 15. This is likely due to the risk of over fitting at higher depth levels. However, the maximum number of leaf nodes and more time intensive max feature hyperparameter were chosen.
- To what extent do you think specific hyperparameters might lead to overfitting?
  - This makes me think that depth is the most at risk hyperparameter for overfitting. Changes in the other variables led to slight changes in run times and AUC score, but not as much as the depth.
  - There is probably also likely risk of overfitting from max_leaf_nodes, but I did not set my parameter grid such that overfitting was observable.
- How is run-time impacted by your choice of hyperparameters?
  - Similarly, when the max depth was 50, the run time was longest. Changes in the other hyperparameters didn't lead to as drastic of a change in terms of run time. However, in general, more complexity led to higher run times.
- Is hyperparameter optimization worth the trouble?
  - In my opinion, it matters because of the risk of overfitting in decision trees. It is quite easy to end up in an overfitting situation because of the susceptability of depth to overfitting. Thus, while computationallly expensive, the tuning process is still important.

1.3 Part III: ML pipeline for a random forest

1.3.1 3.1 Bare bones random forest

Just as you did for the classification tree, start by training a bare bones random forest using your training data. We will take care of the hyperparameter optimization later, but for the time being, use a maximum tree depth of 15. Hopefully is it clear by now why this is a good idea, since we are going to be training a bunch of trees. You should continue to use the same preprocessing step as before.

How many trees are in the forest? Which are the most important features? Compute the fraction of the trees that are splitting on age at their root node. Create a plot showing the 10 most important features and compare them to the results you obtained before. Explain the meaning of variable importance in the case of a random forest classifier.

```python
from sklearn.ensemble import RandomForestClassifier

# your code here

# Define the Random Forest classifier with a maximum depth of 15
rf_classifier = RandomForestClassifier(max_depth=15, random_state=0)

# Create the pipeline with the preprocessor and the classifier
rf_pipeline = Pipeline(steps=[('preprocessor', preprocessor),
                              ('classifier', rf_classifier)])

# Fit the model on your training data
rf_pipeline.fit(X_train, y_train)
```

```
Pipeline(steps=[('preprocessor',
                 ColumnTransformer(transformers=[('num', StandardScaler(),
                                                  ['AGEP', 'WKHP']),
                                                 ('cat',
                 OneHotEncoder(handle_unknown='ignore'),
                                                  ['COW', 'SCHL', 'MAR', 'POBP',
                                                   'RELP', 'SEX', 'RAC1P'])])),
                ('classifier',
                 RandomForestClassifier(max_depth=15, random_state=0))])
```

```python
# Assuming 'all_feature_names' is an ndarray, convert it to a list
all_feature_names_list = all_feature_names.tolist()

# Get feature importances
feature_importances = rf_pipeline.named_steps['classifier'].feature_importances_

# Assuming all_feature_names are defined as before, including one-hot encoded
# feature names
important_features = sorted(zip(all_feature_names, feature_importances),
  key=lambda x: x[1], reverse=True)
```

```python
num_trees = rf_pipeline.named_steps['classifier'].n_estimators
print(f"Number of trees in the forest: {num_trees}")

# Print the most important features
print("Top 10 variables by feature importance:")
for feature, importance in important_features[:10]:
    print(f"{feature}: {importance}")
```

```
Number of trees in the forest: 100
Top 10 variables by feature importance:
WKHP: 0.20836533734126528
AGEP: 0.11327772542539001
RELP_0.0: 0.06613620644989578
SCHL_22.0: 0.06143456871840788
MAR_5.0: 0.05668416939580639
SCHL_21.0: 0.053385767449082244
RELP_2.0: 0.04823722470786806
POBP_303.0: 0.04398696860067058
SCHL_16.0: 0.03759119393685339
MAR_1.0: 0.035151729828185437
```

```python
age_feature_index = np.where(all_feature_names == 'AGEP')[0][0]
# Correctly compute the fraction of trees splitting on 'age' at their root node
age_root_splits = sum(estimator.tree_.feature[0] == age_feature_index for
  ↪estimator in rf_classifier.estimators_) / num_trees
print(f"Fraction of trees splitting on age at their root node:␣
  ↪{age_root_splits}")
```

```
Fraction of trees splitting on age at their root node: 0.06
```

```python
# Extract the top 10 feature names and their importances
top_features, top_importances = zip(*important_features[:10])

plt.barh(range(len(top_features)), top_importances, align='center')
plt.yticks(range(len(top_features)), top_features)
plt.gca().invert_yaxis()  # Invert y-axis to have the most important at the top
plt.xlabel('Feature Importance')
plt.title('"Top 10 Variables by Feature Importance:')
plt.show()
```

"Top 10 Variables by Feature Importance:
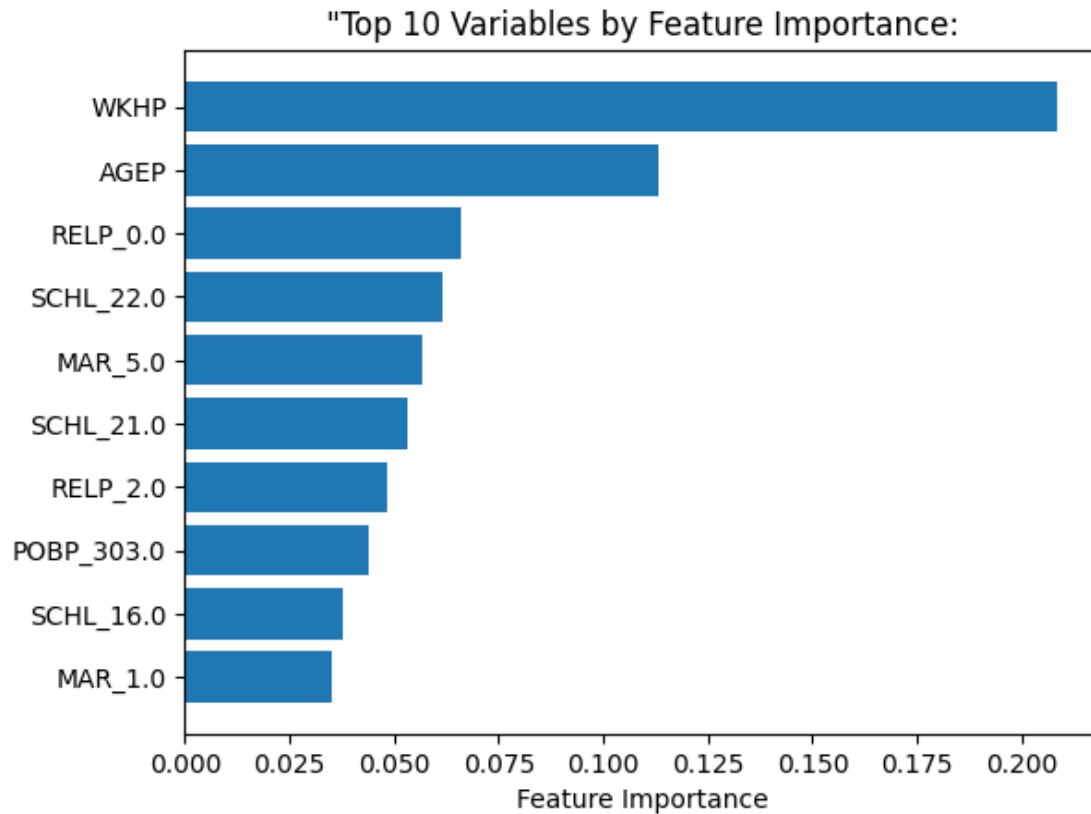
your answer here

- How many trees are in the forest?
  - There are `100` trees in the forest.
- Which are the most important features?
  - Top 10 variables by feature importance:
    * `WKHP`: 0.20836533734126528
    * `AGEP`: 0.11327772542539001
    * `RELP_0.0`: 0.06613620644989578
    * `SCHL_22.0`: 0.06143456871840788
    * `MAR_5.0`: 0.05668416939580639
    * `SCHL_21.0`: 0.053385767449082244
    * `RELP_2.0`: 0.04823722470786806
    * `POBP_303.0`: 0.04398696860067058
    * `SCHL_16.0`: 0.03759119393685339
    * `MAR_1.0`: 0.035151729828185437
- Compute the fraction of the trees that are splitting on age at their root node.
  - Fraction of trees splitting on age at their root node: `0.06`
- Create a plot showing the 10 most important features and compare them to the results you obtained before.
  - Now it's interesting to see that `WKHP` takes "first place" from `AGEP` even though they are still both the top two. `SCHL_22.0`, `SCHL_16.0`, `SCHL_21.0`, `POBP_303.0` still remain in

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the stop ten but in different and sometimes lower positions. Now marriage status shows up, when it was not present before. It seems like being single/never married and being married have higher feature importance under the random forest model.

- Explain the meaning of variable importance in the case of a random forest classifier.
    - Why might this be the case? In the decision tree case, the number of occurences in the tree and how high up in the tree are the intuitive metrics for importance. For the random forest classifier, number of trees where occuring is also considered. This leads to the different results seen above. For example, why did `WKHP` havee the highest feature importance in the randome forest where `AGEP` had the highest in the decision tree model? We can see only **6%** of decision trees in the random forest split on age at their root node. Even if age occurs frequently and high up, it does so in a smaller proprotion of trees, leading its importance to fall slightly in the random forest model.

1.3.2 3.2 Estimating AUC using K-fold CV

Calculate the 5-fold cross-validated AUC-ROC for the random forests pipeline. Report the score for each fold as well as the average across all folds.

Hint 1: sklearn.model_selection.cross_val_score is your friend. Setting the verbose option to 3 is useful.

```
[ ]: #your code here

     # Calculate 5-fold cross-validated AUC-ROC scores
     auc_scores = cross_val_score(rf_pipeline, X_train, y_train, cv=5,␣
       ↪scoring='roc_auc', verbose=3)

     # Report the scores for each fold
     print("AUC-ROC scores for each fold:", auc_scores)

     # Report the average AUC-ROC score across all folds
     print("Average AUC-ROC score:", auc_scores.mean())
```

```
[CV] END … score: (test=0.867) total time=  28.2s
[CV] END … score: (test=0.874) total time=  28.2s
[CV] END … score: (test=0.873) total time=  27.7s
[CV] END … score: (test=0.869) total time=  28.4s
[CV] END … score: (test=0.873) total time=  28.6s
AUC-ROC scores for each fold: [0.86670937 0.87376297 0.87250935 0.86941502
0.87331049]
Average AUC-ROC score: 0.8711414424295277
```

1.3.3 3.3 Estimating AUC using nested CV

Let's try to improve on the results of the random forest by tweaking its hyperparameters. Build a pipeline that computes the nested cv AUC-ROC. Include different values for "n_estimators", "max_samples","max_features", "max_depth" and "max_leaf_nodes" in your hyperparameter grid. Report the inner and outer fold scores for all combinations of hyperparams and interpret the results. Report the best hyperparams used in each outer fold.

What do you notice about these results? How are these results related to those from the decision tree pipeline? Is hyperparameter optimization worth the trouble?

Hint 1: The pipeline remains the same. You can acces the list of all the hyperparams in your pipeline with pipeline.get_params_keys(). Notice the naming convention.

Hint 2: GridSearchCV and cross_val_score are your friends. Specially if you run them with verbose = 3.

Hint 3: This gets computationally expensive quickly. Be intelligent about the hyperparam values you include in the grid.

```python
pipeline = Pipeline(steps=[('preprocessor', preprocessor),
                           ('classifier',
   RandomForestClassifier(random_state=0))])

# Set up the hyperparameter grid
param_grid = {
    'classifier__n_estimators': [50, 100],
    'classifier__max_samples': [0.5, None],
    'classifier__max_features': ['sqrt', 'log2', 0.5],
    'classifier__max_depth': [5, 15, 25],
    'classifier__max_leaf_nodes': [15, 50]
}


# Define cross-validation strategies
inner_cv = KFold(n_splits=5, shuffle=True, random_state=0)
outer_cv = KFold(n_splits=3, shuffle=True, random_state=0)

# Initialize lists to store results
outer_fold_scores = []
best_params_per_fold = []

# Manually iterate over outer folds
fold_count = 1
for train_index, test_index in outer_cv.split(X_train, y_train):
    print(f"\nStarting outer fold {fold_count}")
    X_train_fold, X_test_fold = X_train.iloc[train_index], X_train.
   iloc[test_index]
    y_train_fold, y_test_fold = y_train.iloc[train_index], y_train.
   iloc[test_index]

    # Initialize GridSearchCV with the inner fold strategy
    grid_search = GridSearchCV(estimator=pipeline,
                               param_grid=param_grid,
                               cv=inner_cv,
                               scoring='roc_auc',
                               verbose=3,
```

```
                          return_train_score=True,
                          n_jobs=3)  # To report inner fold scores
    grid_search.fit(X_train_fold, y_train_fold)

    # Evaluate on the outer fold's test set
    best_model = grid_search.best_estimator_
    y_pred_proba = best_model.predict_proba(X_test_fold)[:, 1]
    roc_auc = roc_auc_score(y_test_fold, y_pred_proba)
    outer_fold_scores.append(roc_auc)

    # Save and print the best parameters for this outer fold
    best_params = grid_search.best_params_
    best_params_per_fold.append(best_params)
    print(f"Best parameters for outer fold {fold_count}: {best_params}")
    print(f"ROC AUC for outer fold {fold_count}: {roc_auc}")

    fold_count += 1
```

```
Starting outer fold 1
Fitting 5 folds for each of 72 candidates, totalling 360 fits
[CV 2/5] END classifier__max_depth=5, classifier__max_features=sqrt,
classifier__max_leaf_nodes=15, classifier__max_samples=0.5,
classifier__n_estimators=50;, score=(train=0.850, test=0.852) total time=   1.6s
[CV 1/5] END classifier__max_depth=5, classifier__max_features=sqrt,
classifier__max_leaf_nodes=15, classifier__max_samples=0.5,
classifier__n_estimators=50;, score=(train=0.844, test=0.846) total time=   1.6s
[CV 3/5] END classifier__max_depth=5, classifier__max_features=sqrt,
classifier__max_leaf_nodes=15, classifier__max_samples=0.5,
classifier__n_estimators=50;, score=(train=0.849, test=0.847) total time=   1.6s
[CV 4/5] END classifier__max_depth=5, classifier__max_features=sqrt,
classifier__max_leaf_nodes=15, classifier__max_samples=0.5,
classifier__n_estimators=50;, score=(train=0.847, test=0.845) total time=   1.5s
[CV 5/5] END classifier__max_depth=5, classifier__max_features=sqrt,
classifier__max_leaf_nodes=15, classifier__max_samples=0.5,
classifier__n_estimators=50;, score=(train=0.843, test=0.837) total time=   1.5s
[CV 1/5] END classifier__max_depth=5, classifier__max_features=sqrt,
classifier__max_leaf_nodes=15, classifier__max_samples=0.5,
classifier__n_estimators=100;, score=(train=0.846, test=0.848) total time=
2.7s
[CV 2/5] END classifier__max_depth=5, classifier__max_features=sqrt,
classifier__max_leaf_nodes=15, classifier__max_samples=0.5,
classifier__n_estimators=100;, score=(train=0.853, test=0.855) total time=
2.8s
[CV 3/5] END classifier__max_depth=5, classifier__max_features=sqrt,
classifier__max_leaf_nodes=15, classifier__max_samples=0.5,
classifier__n_estimators=100;, score=(train=0.851, test=0.850) total time=
```

2.8s
[CV 4/5] END classifier__max_depth=5, classifier__max_features=sqrt,
classifier__max_leaf_nodes=15, classifier__max_samples=0.5,
classifier__n_estimators=100;, score=(train=0.851, test=0.848) total time=
2.7s
[CV 1/5] END classifier__max_depth=5, classifier__max_features=sqrt,
classifier__max_leaf_nodes=15, classifier__max_samples=None,
classifier__n_estimators=50;, score=(train=0.838, test=0.840) total time=   1.7s
[CV 5/5] END classifier__max_depth=5, classifier__max_features=sqrt,
classifier__max_leaf_nodes=15, classifier__max_samples=0.5,
classifier__n_estimators=100;, score=(train=0.850, test=0.845) total time=
2.8s
[CV 2/5] END classifier__max_depth=5, classifier__max_features=sqrt,
classifier__max_leaf_nodes=15, classifier__max_samples=None,
classifier__n_estimators=50;, score=(train=0.852, test=0.853) total time=   1.6s
[CV 3/5] END classifier__max_depth=5, classifier__max_features=sqrt,
classifier__max_leaf_nodes=15, classifier__max_samples=None,
classifier__n_estimators=50;, score=(train=0.843, test=0.841) total time=   1.7s
[CV 4/5] END classifier__max_depth=5, classifier__max_features=sqrt,
classifier__max_leaf_nodes=15, classifier__max_samples=None,
classifier__n_estimators=50;, score=(train=0.849, test=0.846) total time=   1.6s
[CV 5/5] END classifier__max_depth=5, classifier__max_features=sqrt,
classifier__max_leaf_nodes=15, classifier__max_samples=None,
classifier__n_estimators=50;, score=(train=0.841, test=0.836) total time=   1.7s
[CV 1/5] END classifier__max_depth=5, classifier__max_features=sqrt,
classifier__max_leaf_nodes=15, classifier__max_samples=None,
classifier__n_estimators=100;, score=(train=0.844, test=0.845) total time=
3.2s
[CV 2/5] END classifier__max_depth=5, classifier__max_features=sqrt,
classifier__max_leaf_nodes=15, classifier__max_samples=None,
classifier__n_estimators=100;, score=(train=0.851, test=0.853) total time=
3.2s
[CV 3/5] END classifier__max_depth=5, classifier__max_features=sqrt,
classifier__max_leaf_nodes=15, classifier__max_samples=None,
classifier__n_estimators=100;, score=(train=0.849, test=0.848) total time=
3.2s
[CV 1/5] END classifier__max_depth=5, classifier__max_features=sqrt,
classifier__max_leaf_nodes=50, classifier__max_samples=0.5,
classifier__n_estimators=50;, score=(train=0.845, test=0.847) total time=   1.6s
[CV 4/5] END classifier__max_depth=5, classifier__max_features=sqrt,
classifier__max_leaf_nodes=15, classifier__max_samples=None,
classifier__n_estimators=100;, score=(train=0.851, test=0.848) total time=
3.1s
[CV 5/5] END classifier__max_depth=5, classifier__max_features=sqrt,
classifier__max_leaf_nodes=15, classifier__max_samples=None,
classifier__n_estimators=100;, score=(train=0.847, test=0.843) total time=
3.2s
[CV 2/5] END classifier__max_depth=5, classifier__max_features=sqrt,

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classifier__max_leaf_nodes=50, classifier__max_samples=0.5,
classifier__n_estimators=50;, score=(train=0.850, test=0.851) total time=   1.7s
[CV 3/5] END classifier__max_depth=5, classifier__max_features=sqrt,
classifier__max_leaf_nodes=50, classifier__max_samples=0.5,
classifier__n_estimators=50;, score=(train=0.850, test=0.848) total time=   1.7s
[CV 4/5] END classifier__max_depth=5, classifier__max_features=sqrt,
classifier__max_leaf_nodes=50, classifier__max_samples=0.5,
classifier__n_estimators=50;, score=(train=0.848, test=0.846) total time=   1.7s
[CV 5/5] END classifier__max_depth=5, classifier__max_features=sqrt,
classifier__max_leaf_nodes=50, classifier__max_samples=0.5,
classifier__n_estimators=50;, score=(train=0.845, test=0.839) total time=   1.9s
[CV 1/5] END classifier__max_depth=5, classifier__max_features=sqrt,
classifier__max_leaf_nodes=50, classifier__max_samples=0.5,
classifier__n_estimators=100;, score=(train=0.847, test=0.849) total time=
3.7s
[CV 2/5] END classifier__max_depth=5, classifier__max_features=sqrt,
classifier__max_leaf_nodes=50, classifier__max_samples=0.5,
classifier__n_estimators=100;, score=(train=0.853, test=0.855) total time=
3.8s
[CV 3/5] END classifier__max_depth=5, classifier__max_features=sqrt,
classifier__max_leaf_nodes=50, classifier__max_samples=0.5,
classifier__n_estimators=100;, score=(train=0.852, test=0.851) total time=
3.4s
[CV 4/5] END classifier__max_depth=5, classifier__max_features=sqrt,
classifier__max_leaf_nodes=50, classifier__max_samples=0.5,
classifier__n_estimators=100;, score=(train=0.852, test=0.849) total time=
4.5s
[CV 1/5] END classifier__max_depth=5, classifier__max_features=sqrt,
classifier__max_leaf_nodes=50, classifier__max_samples=None,
classifier__n_estimators=50;, score=(train=0.839, test=0.840) total time=   2.2s
[CV 5/5] END classifier__max_depth=5, classifier__max_features=sqrt,
classifier__max_leaf_nodes=50, classifier__max_samples=0.5,
classifier__n_estimators=100;, score=(train=0.852, test=0.846) total time=
4.0s
[CV 2/5] END classifier__max_depth=5, classifier__max_features=sqrt,
classifier__max_leaf_nodes=50, classifier__max_samples=None,
classifier__n_estimators=50;, score=(train=0.852, test=0.854) total time=   1.7s
[CV 3/5] END classifier__max_depth=5, classifier__max_features=sqrt,
classifier__max_leaf_nodes=50, classifier__max_samples=None,
classifier__n_estimators=50;, score=(train=0.844, test=0.842) total time=   1.8s
[CV 4/5] END classifier__max_depth=5, classifier__max_features=sqrt,
classifier__max_leaf_nodes=50, classifier__max_samples=None,
classifier__n_estimators=50;, score=(train=0.850, test=0.847) total time=   1.8s
[CV 5/5] END classifier__max_depth=5, classifier__max_features=sqrt,
classifier__max_leaf_nodes=50, classifier__max_samples=None,
classifier__n_estimators=50;, score=(train=0.843, test=0.838) total time=   1.9s
[CV 1/5] END classifier__max_depth=5, classifier__max_features=sqrt,
classifier__max_leaf_nodes=50, classifier__max_samples=None,
```

classifier__n_estimators=100;, score=(train=0.845, test=0.846) total time=
3.4s
[CV 2/5] END classifier__max_depth=5, classifier__max_features=sqrt,
classifier__max_leaf_nodes=50, classifier__max_samples=None,
classifier__n_estimators=100;, score=(train=0.852, test=0.854) total time=
3.3s
[CV 3/5] END classifier__max_depth=5, classifier__max_features=sqrt,
classifier__max_leaf_nodes=50, classifier__max_samples=None,
classifier__n_estimators=100;, score=(train=0.850, test=0.849) total time=
3.4s
[CV 1/5] END classifier__max_depth=5, classifier__max_features=log2,
classifier__max_leaf_nodes=15, classifier__max_samples=0.5,
classifier__n_estimators=50;, score=(train=0.841, test=0.844) total time=   1.2s
[CV 4/5] END classifier__max_depth=5, classifier__max_features=sqrt,
classifier__max_leaf_nodes=50, classifier__max_samples=None,
classifier__n_estimators=100;, score=(train=0.852, test=0.849) total time=
4.2s
[CV 5/5] END classifier__max_depth=5, classifier__max_features=sqrt,
classifier__max_leaf_nodes=50, classifier__max_samples=None,
classifier__n_estimators=100;, score=(train=0.849, test=0.844) total time=
4.3s
[CV 2/5] END classifier__max_depth=5, classifier__max_features=log2,
classifier__max_leaf_nodes=15, classifier__max_samples=0.5,
classifier__n_estimators=50;, score=(train=0.849, test=0.850) total time=   1.9s
[CV 3/5] END classifier__max_depth=5, classifier__max_features=log2,
classifier__max_leaf_nodes=15, classifier__max_samples=0.5,
classifier__n_estimators=50;, score=(train=0.833, test=0.831) total time=   1.7s
[CV 4/5] END classifier__max_depth=5, classifier__max_features=log2,
classifier__max_leaf_nodes=15, classifier__max_samples=0.5,
classifier__n_estimators=50;, score=(train=0.842, test=0.839) total time=   1.7s
[CV 5/5] END classifier__max_depth=5, classifier__max_features=log2,
classifier__max_leaf_nodes=15, classifier__max_samples=0.5,
classifier__n_estimators=50;, score=(train=0.841, test=0.836) total time=   1.8s
[CV 1/5] END classifier__max_depth=5, classifier__max_features=log2,
classifier__max_leaf_nodes=15, classifier__max_samples=0.5,
classifier__n_estimators=100;, score=(train=0.843, test=0.844) total time=
2.6s
[CV 2/5] END classifier__max_depth=5, classifier__max_features=log2,
classifier__max_leaf_nodes=15, classifier__max_samples=0.5,
classifier__n_estimators=100;, score=(train=0.850, test=0.852) total time=
2.6s
[CV 3/5] END classifier__max_depth=5, classifier__max_features=log2,
classifier__max_leaf_nodes=15, classifier__max_samples=0.5,
classifier__n_estimators=100;, score=(train=0.844, test=0.843) total time=
2.8s
[CV 4/5] END classifier__max_depth=5, classifier__max_features=log2,
classifier__max_leaf_nodes=15, classifier__max_samples=0.5,
classifier__n_estimators=100;, score=(train=0.840, test=0.838) total time=

3.2s

[CV 1/5] END classifier__max_depth=5, classifier__max_features=log2,
classifier__max_leaf_nodes=15, classifier__max_samples=None,
classifier__n_estimators=50;, score=(train=0.841, test=0.843) total time=   1.5s
[CV 5/5] END classifier__max_depth=5, classifier__max_features=log2,
classifier__max_leaf_nodes=15, classifier__max_samples=0.5,
classifier__n_estimators=100;, score=(train=0.845, test=0.840) total time=
2.4s
[CV 3/5] END classifier__max_depth=5, classifier__max_features=log2,
classifier__max_leaf_nodes=15, classifier__max_samples=None,
classifier__n_estimators=50;, score=(train=0.845, test=0.843) total time=   1.6s
[CV 2/5] END classifier__max_depth=5, classifier__max_features=log2,
classifier__max_leaf_nodes=15, classifier__max_samples=None,
classifier__n_estimators=50;, score=(train=0.847, test=0.850) total time=   1.7s
[CV 4/5] END classifier__max_depth=5, classifier__max_features=log2,
classifier__max_leaf_nodes=15, classifier__max_samples=None,
classifier__n_estimators=50;, score=(train=0.847, test=0.844) total time=   1.7s
[CV 5/5] END classifier__max_depth=5, classifier__max_features=log2,
classifier__max_leaf_nodes=15, classifier__max_samples=None,
classifier__n_estimators=50;, score=(train=0.841, test=0.838) total time=   1.5s
[CV 1/5] END classifier__max_depth=5, classifier__max_features=log2,
classifier__max_leaf_nodes=15, classifier__max_samples=None,
classifier__n_estimators=100;, score=(train=0.844, test=0.846) total time=
2.6s
[CV 2/5] END classifier__max_depth=5, classifier__max_features=log2,
classifier__max_leaf_nodes=15, classifier__max_samples=None,
classifier__n_estimators=100;, score=(train=0.848, test=0.851) total time=
2.5s
[CV 3/5] END classifier__max_depth=5, classifier__max_features=log2,
classifier__max_leaf_nodes=15, classifier__max_samples=None,
classifier__n_estimators=100;, score=(train=0.846, test=0.845) total time=
2.4s
[CV 4/5] END classifier__max_depth=5, classifier__max_features=log2,
classifier__max_leaf_nodes=15, classifier__max_samples=None,
classifier__n_estimators=100;, score=(train=0.848, test=0.845) total time=
2.5s
[CV 1/5] END classifier__max_depth=5, classifier__max_features=log2,
classifier__max_leaf_nodes=50, classifier__max_samples=0.5,
classifier__n_estimators=50;, score=(train=0.843, test=0.846) total time=   1.5s
[CV 5/5] END classifier__max_depth=5, classifier__max_features=log2,
classifier__max_leaf_nodes=15, classifier__max_samples=None,
classifier__n_estimators=100;, score=(train=0.845, test=0.841) total time=
3.0s
[CV 2/5] END classifier__max_depth=5, classifier__max_features=log2,
classifier__max_leaf_nodes=50, classifier__max_samples=0.5,
classifier__n_estimators=50;, score=(train=0.849, test=0.850) total time=   1.5s
[CV 3/5] END classifier__max_depth=5, classifier__max_features=log2,
classifier__max_leaf_nodes=50, classifier__max_samples=0.5,

classifier__n_estimators=50;, score=(train=0.833, test=0.831) total time=   1.3s
[CV 4/5] END classifier__max_depth=5, classifier__max_features=log2,
classifier__max_leaf_nodes=50, classifier__max_samples=0.5,
classifier__n_estimators=50;, score=(train=0.843, test=0.840) total time=   1.8s
[CV 5/5] END classifier__max_depth=5, classifier__max_features=log2,
classifier__max_leaf_nodes=50, classifier__max_samples=0.5,
classifier__n_estimators=50;, score=(train=0.841, test=0.836) total time=   2.7s
[CV 1/5] END classifier__max_depth=5, classifier__max_features=log2,
classifier__max_leaf_nodes=50, classifier__max_samples=0.5,
classifier__n_estimators=100;, score=(train=0.845, test=0.846) total time=
4.2s
[CV 2/5] END classifier__max_depth=5, classifier__max_features=log2,
classifier__max_leaf_nodes=50, classifier__max_samples=0.5,
classifier__n_estimators=100;, score=(train=0.850, test=0.852) total time=
3.3s
[CV 3/5] END classifier__max_depth=5, classifier__max_features=log2,
classifier__max_leaf_nodes=50, classifier__max_samples=0.5,
classifier__n_estimators=100;, score=(train=0.844, test=0.843) total time=
2.8s
[CV 4/5] END classifier__max_depth=5, classifier__max_features=log2,
classifier__max_leaf_nodes=50, classifier__max_samples=0.5,
classifier__n_estimators=100;, score=(train=0.841, test=0.838) total time=
2.4s
[CV 1/5] END classifier__max_depth=5, classifier__max_features=log2,
classifier__max_leaf_nodes=50, classifier__max_samples=None,
classifier__n_estimators=50;, score=(train=0.841, test=0.842) total time=   1.3s
[CV 5/5] END classifier__max_depth=5, classifier__max_features=log2,
classifier__max_leaf_nodes=50, classifier__max_samples=0.5,
classifier__n_estimators=100;, score=(train=0.845, test=0.840) total time=
2.3s
[CV 2/5] END classifier__max_depth=5, classifier__max_features=log2,
classifier__max_leaf_nodes=50, classifier__max_samples=None,
classifier__n_estimators=50;, score=(train=0.848, test=0.850) total time=   1.7s
[CV 3/5] END classifier__max_depth=5, classifier__max_features=log2,
classifier__max_leaf_nodes=50, classifier__max_samples=None,
classifier__n_estimators=50;, score=(train=0.846, test=0.843) total time=   1.6s
[CV 4/5] END classifier__max_depth=5, classifier__max_features=log2,
classifier__max_leaf_nodes=50, classifier__max_samples=None,
classifier__n_estimators=50;, score=(train=0.847, test=0.844) total time=   1.7s
[CV 5/5] END classifier__max_depth=5, classifier__max_features=log2,
classifier__max_leaf_nodes=50, classifier__max_samples=None,
classifier__n_estimators=50;, score=(train=0.841, test=0.838) total time=   2.0s
[CV 1/5] END classifier__max_depth=5, classifier__max_features=log2,
classifier__max_leaf_nodes=50, classifier__max_samples=None,
classifier__n_estimators=100;, score=(train=0.844, test=0.845) total time=
3.7s
[CV 2/5] END classifier__max_depth=5, classifier__max_features=log2,
classifier__max_leaf_nodes=50, classifier__max_samples=None,

classifier__n_estimators=100;, score=(train=0.849, test=0.851) total time=
3.4s
[CV 3/5] END classifier__max_depth=5, classifier__max_features=log2,
classifier__max_leaf_nodes=50, classifier__max_samples=None,
classifier__n_estimators=100;, score=(train=0.847, test=0.846) total time=
2.9s
[CV 4/5] END classifier__max_depth=5, classifier__max_features=log2,
classifier__max_leaf_nodes=50, classifier__max_samples=None,
classifier__n_estimators=100;, score=(train=0.848, test=0.845) total time=
2.6s
[CV 5/5] END classifier__max_depth=5, classifier__max_features=log2,
classifier__max_leaf_nodes=50, classifier__max_samples=None,
classifier__n_estimators=100;, score=(train=0.845, test=0.841) total time=
2.6s
[CV 1/5] END classifier__max_depth=5, classifier__max_features=0.5,
classifier__max_leaf_nodes=15, classifier__max_samples=0.5,
classifier__n_estimators=50;, score=(train=0.846, test=0.850) total time=   4.4s
[CV 2/5] END classifier__max_depth=5, classifier__max_features=0.5,
classifier__max_leaf_nodes=15, classifier__max_samples=0.5,
classifier__n_estimators=50;, score=(train=0.845, test=0.846) total time=   4.3s
[CV 3/5] END classifier__max_depth=5, classifier__max_features=0.5,
classifier__max_leaf_nodes=15, classifier__max_samples=0.5,
classifier__n_estimators=50;, score=(train=0.845, test=0.847) total time=   4.5s
[CV 4/5] END classifier__max_depth=5, classifier__max_features=0.5,
classifier__max_leaf_nodes=15, classifier__max_samples=0.5,
classifier__n_estimators=50;, score=(train=0.844, test=0.840) total time=   4.5s
[CV 5/5] END classifier__max_depth=5, classifier__max_features=0.5,
classifier__max_leaf_nodes=15, classifier__max_samples=0.5,
classifier__n_estimators=50;, score=(train=0.847, test=0.841) total time=   4.3s
[CV 1/5] END classifier__max_depth=5, classifier__max_features=0.5,
classifier__max_leaf_nodes=15, classifier__max_samples=0.5,
classifier__n_estimators=100;, score=(train=0.846, test=0.850) total time=
8.6s
[CV 2/5] END classifier__max_depth=5, classifier__max_features=0.5,
classifier__max_leaf_nodes=15, classifier__max_samples=0.5,
classifier__n_estimators=100;, score=(train=0.845, test=0.846) total time=
8.7s
[CV 3/5] END classifier__max_depth=5, classifier__max_features=0.5,
classifier__max_leaf_nodes=15, classifier__max_samples=0.5,
classifier__n_estimators=100;, score=(train=0.846, test=0.848) total time=
8.8s
[CV 4/5] END classifier__max_depth=5, classifier__max_features=0.5,
classifier__max_leaf_nodes=15, classifier__max_samples=0.5,
classifier__n_estimators=100;, score=(train=0.845, test=0.841) total time=
8.9s
[CV 1/5] END classifier__max_depth=5, classifier__max_features=0.5,
classifier__max_leaf_nodes=15, classifier__max_samples=None,
classifier__n_estimators=50;, score=(train=0.846, test=0.849) total time=   5.7s

[CV 5/5] END classifier__max_depth=5, classifier__max_features=0.5,
classifier__max_leaf_nodes=15, classifier__max_samples=0.5,
classifier__n_estimators=100;, score=(train=0.846, test=0.840) total time=
9.2s
[CV 2/5] END classifier__max_depth=5, classifier__max_features=0.5,
classifier__max_leaf_nodes=15, classifier__max_samples=None,
classifier__n_estimators=50;, score=(train=0.847, test=0.848) total time=   7.5s
[CV 3/5] END classifier__max_depth=5, classifier__max_features=0.5,
classifier__max_leaf_nodes=15, classifier__max_samples=None,
classifier__n_estimators=50;, score=(train=0.844, test=0.846) total time=   7.4s
[CV 4/5] END classifier__max_depth=5, classifier__max_features=0.5,
classifier__max_leaf_nodes=15, classifier__max_samples=None,
classifier__n_estimators=50;, score=(train=0.844, test=0.840) total time=   6.7s
[CV 5/5] END classifier__max_depth=5, classifier__max_features=0.5,
classifier__max_leaf_nodes=15, classifier__max_samples=None,
classifier__n_estimators=50;, score=(train=0.844, test=0.838) total time=   6.3s
[CV 1/5] END classifier__max_depth=5, classifier__max_features=0.5,
classifier__max_leaf_nodes=15, classifier__max_samples=None,
classifier__n_estimators=100;, score=(train=0.845, test=0.848) total time=
12.3s
[CV 2/5] END classifier__max_depth=5, classifier__max_features=0.5,
classifier__max_leaf_nodes=15, classifier__max_samples=None,
classifier__n_estimators=100;, score=(train=0.846, test=0.847) total time=
12.1s
[CV 3/5] END classifier__max_depth=5, classifier__max_features=0.5,
classifier__max_leaf_nodes=15, classifier__max_samples=None,
classifier__n_estimators=100;, score=(train=0.845, test=0.846) total time=
12.1s
[CV 1/5] END classifier__max_depth=5, classifier__max_features=0.5,
classifier__max_leaf_nodes=50, classifier__max_samples=0.5,
classifier__n_estimators=50;, score=(train=0.850, test=0.853) total time=   5.5s
[CV 4/5] END classifier__max_depth=5, classifier__max_features=0.5,
classifier__max_leaf_nodes=15, classifier__max_samples=None,
classifier__n_estimators=100;, score=(train=0.845, test=0.841) total time=
12.1s
[CV 5/5] END classifier__max_depth=5, classifier__max_features=0.5,
classifier__max_leaf_nodes=15, classifier__max_samples=None,
classifier__n_estimators=100;, score=(train=0.845, test=0.838) total time=
12.1s
[CV 2/5] END classifier__max_depth=5, classifier__max_features=0.5,
classifier__max_leaf_nodes=50, classifier__max_samples=0.5,
classifier__n_estimators=50;, score=(train=0.849, test=0.849) total time=   5.9s
[CV 3/5] END classifier__max_depth=5, classifier__max_features=0.5,
classifier__max_leaf_nodes=50, classifier__max_samples=0.5,
classifier__n_estimators=50;, score=(train=0.850, test=0.851) total time=   6.1s
[CV 4/5] END classifier__max_depth=5, classifier__max_features=0.5,
classifier__max_leaf_nodes=50, classifier__max_samples=0.5,
classifier__n_estimators=50;, score=(train=0.849, test=0.844) total time=   6.0s

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[CV 5/5] END classifier__max_depth=5, classifier__max_features=0.5,
classifier__max_leaf_nodes=50, classifier__max_samples=0.5,
classifier__n_estimators=50;, score=(train=0.852, test=0.845) total time=    5.6s
[CV 1/5] END classifier__max_depth=5, classifier__max_features=0.5,
classifier__max_leaf_nodes=50, classifier__max_samples=0.5,
classifier__n_estimators=100;, score=(train=0.851, test=0.853) total time=
11.2s
[CV 2/5] END classifier__max_depth=5, classifier__max_features=0.5,
classifier__max_leaf_nodes=50, classifier__max_samples=0.5,
classifier__n_estimators=100;, score=(train=0.849, test=0.850) total time=
11.2s
[CV 3/5] END classifier__max_depth=5, classifier__max_features=0.5,
classifier__max_leaf_nodes=50, classifier__max_samples=0.5,
classifier__n_estimators=100;, score=(train=0.851, test=0.852) total time=
11.6s
[CV 4/5] END classifier__max_depth=5, classifier__max_features=0.5,
classifier__max_leaf_nodes=50, classifier__max_samples=0.5,
classifier__n_estimators=100;, score=(train=0.850, test=0.845) total time=
11.7s
[CV 1/5] END classifier__max_depth=5, classifier__max_features=0.5,
classifier__max_leaf_nodes=50, classifier__max_samples=None,
classifier__n_estimators=50;, score=(train=0.850, test=0.853) total time=    7.2s
[CV 5/5] END classifier__max_depth=5, classifier__max_features=0.5,
classifier__max_leaf_nodes=50, classifier__max_samples=0.5,
classifier__n_estimators=100;, score=(train=0.851, test=0.844) total time=
11.1s
[CV 2/5] END classifier__max_depth=5, classifier__max_features=0.5,
classifier__max_leaf_nodes=50, classifier__max_samples=None,
classifier__n_estimators=50;, score=(train=0.851, test=0.851) total time=    7.5s
[CV 3/5] END classifier__max_depth=5, classifier__max_features=0.5,
classifier__max_leaf_nodes=50, classifier__max_samples=None,
classifier__n_estimators=50;, score=(train=0.849, test=0.850) total time=    7.5s
[CV 4/5] END classifier__max_depth=5, classifier__max_features=0.5,
classifier__max_leaf_nodes=50, classifier__max_samples=None,
classifier__n_estimators=50;, score=(train=0.849, test=0.844) total time=    7.5s
[CV 5/5] END classifier__max_depth=5, classifier__max_features=0.5,
classifier__max_leaf_nodes=50, classifier__max_samples=None,
classifier__n_estimators=50;, score=(train=0.849, test=0.842) total time=    7.3s
[CV 1/5] END classifier__max_depth=5, classifier__max_features=0.5,
classifier__max_leaf_nodes=50, classifier__max_samples=None,
classifier__n_estimators=100;, score=(train=0.849, test=0.852) total time=
14.7s
[CV 2/5] END classifier__max_depth=5, classifier__max_features=0.5,
classifier__max_leaf_nodes=50, classifier__max_samples=None,
classifier__n_estimators=100;, score=(train=0.850, test=0.850) total time=
15.1s
[CV 3/5] END classifier__max_depth=5, classifier__max_features=0.5,
classifier__max_leaf_nodes=50, classifier__max_samples=None,
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classifier__n_estimators=100;, score=(train=0.849, test=0.850) total time=
15.2s
[CV 1/5] END classifier__max_depth=15, classifier__max_features=sqrt,
classifier__max_leaf_nodes=15, classifier__max_samples=0.5,
classifier__n_estimators=50;, score=(train=0.846, test=0.848) total time=   2.0s
[CV 2/5] END classifier__max_depth=15, classifier__max_features=sqrt,
classifier__max_leaf_nodes=15, classifier__max_samples=0.5,
classifier__n_estimators=50;, score=(train=0.853, test=0.855) total time=   1.9s
[CV 3/5] END classifier__max_depth=15, classifier__max_features=sqrt,
classifier__max_leaf_nodes=15, classifier__max_samples=0.5,
classifier__n_estimators=50;, score=(train=0.855, test=0.854) total time=   1.7s
[CV 4/5] END classifier__max_depth=5, classifier__max_features=0.5,
classifier__max_leaf_nodes=50, classifier__max_samples=None,
classifier__n_estimators=100;, score=(train=0.850, test=0.845) total time=
14.7s
[CV 5/5] END classifier__max_depth=5, classifier__max_features=0.5,
classifier__max_leaf_nodes=50, classifier__max_samples=None,
classifier__n_estimators=100;, score=(train=0.850, test=0.843) total time=
14.7s
[CV 4/5] END classifier__max_depth=15, classifier__max_features=sqrt,
classifier__max_leaf_nodes=15, classifier__max_samples=0.5,
classifier__n_estimators=50;, score=(train=0.851, test=0.849) total time=   1.7s
[CV 5/5] END classifier__max_depth=15, classifier__max_features=sqrt,
classifier__max_leaf_nodes=15, classifier__max_samples=0.5,
classifier__n_estimators=50;, score=(train=0.851, test=0.845) total time=   1.7s
[CV 1/5] END classifier__max_depth=15, classifier__max_features=sqrt,
classifier__max_leaf_nodes=15, classifier__max_samples=0.5,
classifier__n_estimators=100;, score=(train=0.849, test=0.851) total time=
3.2s
[CV 2/5] END classifier__max_depth=15, classifier__max_features=sqrt,
classifier__max_leaf_nodes=15, classifier__max_samples=0.5,
classifier__n_estimators=100;, score=(train=0.855, test=0.857) total time=
3.2s
[CV 3/5] END classifier__max_depth=15, classifier__max_features=sqrt,
classifier__max_leaf_nodes=15, classifier__max_samples=0.5,
classifier__n_estimators=100;, score=(train=0.856, test=0.856) total time=
3.1s
[CV 1/5] END classifier__max_depth=15, classifier__max_features=sqrt,
classifier__max_leaf_nodes=15, classifier__max_samples=None,
classifier__n_estimators=50;, score=(train=0.848, test=0.849) total time=   2.1s
[CV 4/5] END classifier__max_depth=15, classifier__max_features=sqrt,
classifier__max_leaf_nodes=15, classifier__max_samples=0.5,
classifier__n_estimators=100;, score=(train=0.854, test=0.852) total time=
3.2s
[CV 5/5] END classifier__max_depth=15, classifier__max_features=sqrt,
classifier__max_leaf_nodes=15, classifier__max_samples=0.5,
classifier__n_estimators=100;, score=(train=0.855, test=0.850) total time=
3.1s
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[CV 2/5] END classifier__max_depth=15, classifier__max_features=sqrt,
classifier__max_leaf_nodes=15, classifier__max_samples=None,
classifier__n_estimators=50;, score=(train=0.852, test=0.854) total time=   2.0s
[CV 3/5] END classifier__max_depth=15, classifier__max_features=sqrt,
classifier__max_leaf_nodes=15, classifier__max_samples=None,
classifier__n_estimators=50;, score=(train=0.848, test=0.847) total time=   2.0s
[CV 4/5] END classifier__max_depth=15, classifier__max_features=sqrt,
classifier__max_leaf_nodes=15, classifier__max_samples=None,
classifier__n_estimators=50;, score=(train=0.852, test=0.850) total time=   2.0s
[CV 5/5] END classifier__max_depth=15, classifier__max_features=sqrt,
classifier__max_leaf_nodes=15, classifier__max_samples=None,
classifier__n_estimators=50;, score=(train=0.849, test=0.844) total time=   2.0s
[CV 1/5] END classifier__max_depth=15, classifier__max_features=sqrt,
classifier__max_leaf_nodes=15, classifier__max_samples=None,
classifier__n_estimators=100;, score=(train=0.850, test=0.852) total time=
4.0s
[CV 2/5] END classifier__max_depth=15, classifier__max_features=sqrt,
classifier__max_leaf_nodes=15, classifier__max_samples=None,
classifier__n_estimators=100;, score=(train=0.853, test=0.855) total time=
4.0s
[CV 3/5] END classifier__max_depth=15, classifier__max_features=sqrt,
classifier__max_leaf_nodes=15, classifier__max_samples=None,
classifier__n_estimators=100;, score=(train=0.854, test=0.854) total time=
3.8s
[CV 4/5] END classifier__max_depth=15, classifier__max_features=sqrt,
classifier__max_leaf_nodes=15, classifier__max_samples=None,
classifier__n_estimators=100;, score=(train=0.856, test=0.853) total time=
3.8s
[CV 5/5] END classifier__max_depth=15, classifier__max_features=sqrt,
classifier__max_leaf_nodes=15, classifier__max_samples=None,
classifier__n_estimators=100;, score=(train=0.852, test=0.848) total time=
3.9s
[CV 1/5] END classifier__max_depth=15, classifier__max_features=sqrt,
classifier__max_leaf_nodes=50, classifier__max_samples=0.5,
classifier__n_estimators=50;, score=(train=0.861, test=0.862) total time=   2.7s
[CV 2/5] END classifier__max_depth=15, classifier__max_features=sqrt,
classifier__max_leaf_nodes=50, classifier__max_samples=0.5,
classifier__n_estimators=50;, score=(train=0.863, test=0.863) total time=   3.0s
[CV 3/5] END classifier__max_depth=15, classifier__max_features=sqrt,
classifier__max_leaf_nodes=50, classifier__max_samples=0.5,
classifier__n_estimators=50;, score=(train=0.863, test=0.862) total time=   2.8s
[CV 4/5] END classifier__max_depth=15, classifier__max_features=sqrt,
classifier__max_leaf_nodes=50, classifier__max_samples=0.5,
classifier__n_estimators=50;, score=(train=0.862, test=0.858) total time=   2.8s
[CV 5/5] END classifier__max_depth=15, classifier__max_features=sqrt,
classifier__max_leaf_nodes=50, classifier__max_samples=0.5,
classifier__n_estimators=50;, score=(train=0.864, test=0.857) total time=   2.8s
[CV 1/5] END classifier__max_depth=15, classifier__max_features=sqrt,
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classifier__max_leaf_nodes=50, classifier__max_samples=0.5,
classifier__n_estimators=100;, score=(train=0.862, test=0.863) total time=
5.1s
[CV 2/5] END classifier__max_depth=15, classifier__max_features=sqrt,
classifier__max_leaf_nodes=50, classifier__max_samples=0.5,
classifier__n_estimators=100;, score=(train=0.865, test=0.865) total time=
5.1s
[CV 3/5] END classifier__max_depth=15, classifier__max_features=sqrt,
classifier__max_leaf_nodes=50, classifier__max_samples=0.5,
classifier__n_estimators=100;, score=(train=0.864, test=0.863) total time=
5.2s
[CV 4/5] END classifier__max_depth=15, classifier__max_features=sqrt,
classifier__max_leaf_nodes=50, classifier__max_samples=0.5,
classifier__n_estimators=100;, score=(train=0.864, test=0.860) total time=
5.2s
[CV 5/5] END classifier__max_depth=15, classifier__max_features=sqrt,
classifier__max_leaf_nodes=50, classifier__max_samples=0.5,
classifier__n_estimators=100;, score=(train=0.866, test=0.860) total time=
5.3s
[CV 1/5] END classifier__max_depth=15, classifier__max_features=sqrt,
classifier__max_leaf_nodes=50, classifier__max_samples=None,
classifier__n_estimators=50;, score=(train=0.862, test=0.862) total time=   3.3s
[CV 2/5] END classifier__max_depth=15, classifier__max_features=sqrt,
classifier__max_leaf_nodes=50, classifier__max_samples=None,
classifier__n_estimators=50;, score=(train=0.862, test=0.862) total time=   3.3s
[CV 3/5] END classifier__max_depth=15, classifier__max_features=sqrt,
classifier__max_leaf_nodes=50, classifier__max_samples=None,
classifier__n_estimators=50;, score=(train=0.860, test=0.859) total time=   3.3s
[CV 4/5] END classifier__max_depth=15, classifier__max_features=sqrt,
classifier__max_leaf_nodes=50, classifier__max_samples=None,
classifier__n_estimators=50;, score=(train=0.864, test=0.860) total time=   3.2s
[CV 5/5] END classifier__max_depth=15, classifier__max_features=sqrt,
classifier__max_leaf_nodes=50, classifier__max_samples=None,
classifier__n_estimators=50;, score=(train=0.861, test=0.855) total time=   3.4s
[CV 1/5] END classifier__max_depth=15, classifier__max_features=sqrt,
classifier__max_leaf_nodes=50, classifier__max_samples=None,
classifier__n_estimators=100;, score=(train=0.863, test=0.864) total time=
6.5s
[CV 2/5] END classifier__max_depth=15, classifier__max_features=sqrt,
classifier__max_leaf_nodes=50, classifier__max_samples=None,
classifier__n_estimators=100;, score=(train=0.863, test=0.863) total time=
6.6s
[CV 3/5] END classifier__max_depth=15, classifier__max_features=sqrt,
classifier__max_leaf_nodes=50, classifier__max_samples=None,
classifier__n_estimators=100;, score=(train=0.863, test=0.863) total time=
6.4s
[CV 1/5] END classifier__max_depth=15, classifier__max_features=log2,
classifier__max_leaf_nodes=15, classifier__max_samples=0.5,

classifier__n_estimators=50;, score=(train=0.850, test=0.853) total time=   1.5s
[CV 4/5] END classifier__max_depth=15, classifier__max_features=sqrt,
classifier__max_leaf_nodes=50, classifier__max_samples=None,
classifier__n_estimators=100;, score=(train=0.866, test=0.862) total time=
6.2s
[CV 5/5] END classifier__max_depth=15, classifier__max_features=sqrt,
classifier__max_leaf_nodes=50, classifier__max_samples=None,
classifier__n_estimators=100;, score=(train=0.863, test=0.858) total time=
6.3s
[CV 2/5] END classifier__max_depth=15, classifier__max_features=log2,
classifier__max_leaf_nodes=15, classifier__max_samples=0.5,
classifier__n_estimators=50;, score=(train=0.851, test=0.853) total time=   1.4s
[CV 3/5] END classifier__max_depth=15, classifier__max_features=log2,
classifier__max_leaf_nodes=15, classifier__max_samples=0.5,
classifier__n_estimators=50;, score=(train=0.841, test=0.840) total time=   1.5s
[CV 4/5] END classifier__max_depth=15, classifier__max_features=log2,
classifier__max_leaf_nodes=15, classifier__max_samples=0.5,
classifier__n_estimators=50;, score=(train=0.850, test=0.847) total time=   1.4s
[CV 5/5] END classifier__max_depth=15, classifier__max_features=log2,
classifier__max_leaf_nodes=15, classifier__max_samples=0.5,
classifier__n_estimators=50;, score=(train=0.841, test=0.835) total time=   1.5s
[CV 1/5] END classifier__max_depth=15, classifier__max_features=log2,
classifier__max_leaf_nodes=15, classifier__max_samples=0.5,
classifier__n_estimators=100;, score=(train=0.846, test=0.848) total time=
2.7s
[CV 2/5] END classifier__max_depth=15, classifier__max_features=log2,
classifier__max_leaf_nodes=15, classifier__max_samples=0.5,
classifier__n_estimators=100;, score=(train=0.854, test=0.856) total time=
2.7s
[CV 3/5] END classifier__max_depth=15, classifier__max_features=log2,
classifier__max_leaf_nodes=15, classifier__max_samples=0.5,
classifier__n_estimators=100;, score=(train=0.848, test=0.848) total time=
2.7s
[CV 1/5] END classifier__max_depth=15, classifier__max_features=log2,
classifier__max_leaf_nodes=15, classifier__max_samples=None,
classifier__n_estimators=50;, score=(train=0.847, test=0.849) total time=   1.6s
[CV 4/5] END classifier__max_depth=15, classifier__max_features=log2,
classifier__max_leaf_nodes=15, classifier__max_samples=0.5,
classifier__n_estimators=100;, score=(train=0.848, test=0.845) total time=
2.6s
[CV 5/5] END classifier__max_depth=15, classifier__max_features=log2,
classifier__max_leaf_nodes=15, classifier__max_samples=0.5,
classifier__n_estimators=100;, score=(train=0.848, test=0.844) total time=
2.6s
[CV 2/5] END classifier__max_depth=15, classifier__max_features=log2,
classifier__max_leaf_nodes=15, classifier__max_samples=None,
classifier__n_estimators=50;, score=(train=0.855, test=0.857) total time=   1.6s
[CV 3/5] END classifier__max_depth=15, classifier__max_features=log2,

classifier__max_leaf_nodes=15, classifier__max_samples=None,
classifier__n_estimators=50;, score=(train=0.847, test=0.846) total time=   1.5s
[CV 4/5] END classifier__max_depth=15, classifier__max_features=log2,
classifier__max_leaf_nodes=15, classifier__max_samples=None,
classifier__n_estimators=50;, score=(train=0.851, test=0.848) total time=   1.7s
[CV 5/5] END classifier__max_depth=15, classifier__max_features=log2,
classifier__max_leaf_nodes=15, classifier__max_samples=None,
classifier__n_estimators=50;, score=(train=0.844, test=0.841) total time=   1.9s
[CV 1/5] END classifier__max_depth=15, classifier__max_features=log2,
classifier__max_leaf_nodes=15, classifier__max_samples=None,
classifier__n_estimators=100;, score=(train=0.848, test=0.850) total time=
3.3s
[CV 2/5] END classifier__max_depth=15, classifier__max_features=log2,
classifier__max_leaf_nodes=15, classifier__max_samples=None,
classifier__n_estimators=100;, score=(train=0.855, test=0.856) total time=
3.3s
[CV 3/5] END classifier__max_depth=15, classifier__max_features=log2,
classifier__max_leaf_nodes=15, classifier__max_samples=None,
classifier__n_estimators=100;, score=(train=0.848, test=0.848) total time=
3.4s
[CV 4/5] END classifier__max_depth=15, classifier__max_features=log2,
classifier__max_leaf_nodes=15, classifier__max_samples=None,
classifier__n_estimators=100;, score=(train=0.851, test=0.848) total time=
3.8s
[CV 1/5] END classifier__max_depth=15, classifier__max_features=log2,
classifier__max_leaf_nodes=50, classifier__max_samples=0.5,
classifier__n_estimators=50;, score=(train=0.861, test=0.862) total time=   2.1s
[CV 5/5] END classifier__max_depth=15, classifier__max_features=log2,
classifier__max_leaf_nodes=15, classifier__max_samples=None,
classifier__n_estimators=100;, score=(train=0.848, test=0.845) total time=
3.7s
[CV 2/5] END classifier__max_depth=15, classifier__max_features=log2,
classifier__max_leaf_nodes=50, classifier__max_samples=0.5,
classifier__n_estimators=50;, score=(train=0.858, test=0.859) total time=   2.0s
[CV 3/5] END classifier__max_depth=15, classifier__max_features=log2,
classifier__max_leaf_nodes=50, classifier__max_samples=0.5,
classifier__n_estimators=50;, score=(train=0.850, test=0.849) total time=   2.0s
[CV 4/5] END classifier__max_depth=15, classifier__max_features=log2,
classifier__max_leaf_nodes=50, classifier__max_samples=0.5,
classifier__n_estimators=50;, score=(train=0.858, test=0.854) total time=   2.2s
[CV 5/5] END classifier__max_depth=15, classifier__max_features=log2,
classifier__max_leaf_nodes=50, classifier__max_samples=0.5,
classifier__n_estimators=50;, score=(train=0.857, test=0.851) total time=   2.1s
[CV 1/5] END classifier__max_depth=15, classifier__max_features=log2,
classifier__max_leaf_nodes=50, classifier__max_samples=0.5,
classifier__n_estimators=100;, score=(train=0.859, test=0.860) total time=
4.2s
[CV 2/5] END classifier__max_depth=15, classifier__max_features=log2,

classifier__max_leaf_nodes=50, classifier__max_samples=0.5,
classifier__n_estimators=100;, score=(train=0.859, test=0.860) total time=
4.2s
[CV 3/5] END classifier__max_depth=15, classifier__max_features=log2,
classifier__max_leaf_nodes=50, classifier__max_samples=0.5,
classifier__n_estimators=100;, score=(train=0.856, test=0.856) total time=
3.6s
[CV 4/5] END classifier__max_depth=15, classifier__max_features=log2,
classifier__max_leaf_nodes=50, classifier__max_samples=0.5,
classifier__n_estimators=100;, score=(train=0.859, test=0.854) total time=
4.1s
[CV 5/5] END classifier__max_depth=15, classifier__max_features=log2,
classifier__max_leaf_nodes=50, classifier__max_samples=0.5,
classifier__n_estimators=100;, score=(train=0.861, test=0.856) total time=
4.0s
[CV 1/5] END classifier__max_depth=15, classifier__max_features=log2,
classifier__max_leaf_nodes=50, classifier__max_samples=None,
classifier__n_estimators=50;, score=(train=0.858, test=0.860) total time=   2.7s
[CV 2/5] END classifier__max_depth=15, classifier__max_features=log2,
classifier__max_leaf_nodes=50, classifier__max_samples=None,
classifier__n_estimators=50;, score=(train=0.862, test=0.862) total time=   2.7s
[CV 3/5] END classifier__max_depth=15, classifier__max_features=log2,
classifier__max_leaf_nodes=50, classifier__max_samples=None,
classifier__n_estimators=50;, score=(train=0.857, test=0.856) total time=   2.6s
[CV 4/5] END classifier__max_depth=15, classifier__max_features=log2,
classifier__max_leaf_nodes=50, classifier__max_samples=None,
classifier__n_estimators=50;, score=(train=0.859, test=0.855) total time=   2.5s
[CV 5/5] END classifier__max_depth=15, classifier__max_features=log2,
classifier__max_leaf_nodes=50, classifier__max_samples=None,
classifier__n_estimators=50;, score=(train=0.856, test=0.851) total time=   2.5s
[CV 1/5] END classifier__max_depth=15, classifier__max_features=log2,
classifier__max_leaf_nodes=50, classifier__max_samples=None,
classifier__n_estimators=100;, score=(train=0.861, test=0.861) total time=
5.3s
[CV 2/5] END classifier__max_depth=15, classifier__max_features=log2,
classifier__max_leaf_nodes=50, classifier__max_samples=None,
classifier__n_estimators=100;, score=(train=0.862, test=0.863) total time=
5.4s
[CV 3/5] END classifier__max_depth=15, classifier__max_features=log2,
classifier__max_leaf_nodes=50, classifier__max_samples=None,
classifier__n_estimators=100;, score=(train=0.859, test=0.859) total time=
5.0s
[CV 4/5] END classifier__max_depth=15, classifier__max_features=log2,
classifier__max_leaf_nodes=50, classifier__max_samples=None,
classifier__n_estimators=100;, score=(train=0.859, test=0.855) total time=
4.5s
[CV 5/5] END classifier__max_depth=15, classifier__max_features=log2,
classifier__max_leaf_nodes=50, classifier__max_samples=None,

classifier__n_estimators=100;, score=(train=0.857, test=0.852) total time=
4.6s
[CV 1/5] END classifier__max_depth=15, classifier__max_features=0.5,
classifier__max_leaf_nodes=15, classifier__max_samples=0.5,
classifier__n_estimators=50;, score=(train=0.850, test=0.854) total time=   6.1s
[CV 2/5] END classifier__max_depth=15, classifier__max_features=0.5,
classifier__max_leaf_nodes=15, classifier__max_samples=0.5,
classifier__n_estimators=50;, score=(train=0.849, test=0.850) total time=   6.0s
[CV 3/5] END classifier__max_depth=15, classifier__max_features=0.5,
classifier__max_leaf_nodes=15, classifier__max_samples=0.5,
classifier__n_estimators=50;, score=(train=0.848, test=0.850) total time=   6.1s
[CV 4/5] END classifier__max_depth=15, classifier__max_features=0.5,
classifier__max_leaf_nodes=15, classifier__max_samples=0.5,
classifier__n_estimators=50;, score=(train=0.848, test=0.844) total time=   5.8s
[CV 5/5] END classifier__max_depth=15, classifier__max_features=0.5,
classifier__max_leaf_nodes=15, classifier__max_samples=0.5,
classifier__n_estimators=50;, score=(train=0.850, test=0.843) total time=   5.6s
[CV 1/5] END classifier__max_depth=15, classifier__max_features=0.5,
classifier__max_leaf_nodes=15, classifier__max_samples=0.5,
classifier__n_estimators=100;, score=(train=0.850, test=0.854) total time=
11.0s
[CV 2/5] END classifier__max_depth=15, classifier__max_features=0.5,
classifier__max_leaf_nodes=15, classifier__max_samples=0.5,
classifier__n_estimators=100;, score=(train=0.849, test=0.850) total time=
11.0s
[CV 3/5] END classifier__max_depth=15, classifier__max_features=0.5,
classifier__max_leaf_nodes=15, classifier__max_samples=0.5,
classifier__n_estimators=100;, score=(train=0.849, test=0.851) total time=
11.1s
[CV 4/5] END classifier__max_depth=15, classifier__max_features=0.5,
classifier__max_leaf_nodes=15, classifier__max_samples=0.5,
classifier__n_estimators=100;, score=(train=0.848, test=0.844) total time=
11.2s
[CV 1/5] END classifier__max_depth=15, classifier__max_features=0.5,
classifier__max_leaf_nodes=15, classifier__max_samples=None,
classifier__n_estimators=50;, score=(train=0.851, test=0.854) total time=   7.3s
[CV 5/5] END classifier__max_depth=15, classifier__max_features=0.5,
classifier__max_leaf_nodes=15, classifier__max_samples=0.5,
classifier__n_estimators=100;, score=(train=0.850, test=0.843) total time=
11.1s
[CV 2/5] END classifier__max_depth=15, classifier__max_features=0.5,
classifier__max_leaf_nodes=15, classifier__max_samples=None,
classifier__n_estimators=50;, score=(train=0.849, test=0.850) total time=   8.6s
[CV 3/5] END classifier__max_depth=15, classifier__max_features=0.5,
classifier__max_leaf_nodes=15, classifier__max_samples=None,
classifier__n_estimators=50;, score=(train=0.847, test=0.848) total time=   8.9s
[CV 4/5] END classifier__max_depth=15, classifier__max_features=0.5,
classifier__max_leaf_nodes=15, classifier__max_samples=None,

classifier__n_estimators=50;, score=(train=0.848, test=0.844) total time=   9.2s
[CV 5/5] END classifier__max_depth=15, classifier__max_features=0.5,
classifier__max_leaf_nodes=15, classifier__max_samples=None,
classifier__n_estimators=50;, score=(train=0.849, test=0.842) total time=   7.9s
[CV 1/5] END classifier__max_depth=15, classifier__max_features=0.5,
classifier__max_leaf_nodes=15, classifier__max_samples=None,
classifier__n_estimators=100;, score=(train=0.850, test=0.853) total time=
15.0s
[CV 2/5] END classifier__max_depth=15, classifier__max_features=0.5,
classifier__max_leaf_nodes=15, classifier__max_samples=None,
classifier__n_estimators=100;, score=(train=0.848, test=0.850) total time=
15.1s
[CV 3/5] END classifier__max_depth=15, classifier__max_features=0.5,
classifier__max_leaf_nodes=15, classifier__max_samples=None,
classifier__n_estimators=100;, score=(train=0.848, test=0.850) total time=
15.2s
[CV 4/5] END classifier__max_depth=15, classifier__max_features=0.5,
classifier__max_leaf_nodes=15, classifier__max_samples=None,
classifier__n_estimators=100;, score=(train=0.849, test=0.845) total time=
14.9s
[CV 5/5] END classifier__max_depth=15, classifier__max_features=0.5,
classifier__max_leaf_nodes=15, classifier__max_samples=None,
classifier__n_estimators=100;, score=(train=0.849, test=0.843) total time=
14.8s
[CV 1/5] END classifier__max_depth=15, classifier__max_features=0.5,
classifier__max_leaf_nodes=50, classifier__max_samples=0.5,
classifier__n_estimators=50;, score=(train=0.866, test=0.868) total time= 11.8s
[CV 2/5] END classifier__max_depth=15, classifier__max_features=0.5,
classifier__max_leaf_nodes=50, classifier__max_samples=0.5,
classifier__n_estimators=50;, score=(train=0.866, test=0.866) total time= 12.4s
[CV 3/5] END classifier__max_depth=15, classifier__max_features=0.5,
classifier__max_leaf_nodes=50, classifier__max_samples=0.5,
classifier__n_estimators=50;, score=(train=0.866, test=0.866) total time= 12.5s
[CV 4/5] END classifier__max_depth=15, classifier__max_features=0.5,
classifier__max_leaf_nodes=50, classifier__max_samples=0.5,
classifier__n_estimators=50;, score=(train=0.866, test=0.861) total time= 12.4s
[CV 5/5] END classifier__max_depth=15, classifier__max_features=0.5,
classifier__max_leaf_nodes=50, classifier__max_samples=0.5,
classifier__n_estimators=50;, score=(train=0.867, test=0.860) total time= 12.6s
[CV 1/5] END classifier__max_depth=15, classifier__max_features=0.5,
classifier__max_leaf_nodes=50, classifier__max_samples=0.5,
classifier__n_estimators=100;, score=(train=0.866, test=0.868) total time=
24.9s
[CV 2/5] END classifier__max_depth=15, classifier__max_features=0.5,
classifier__max_leaf_nodes=50, classifier__max_samples=0.5,
classifier__n_estimators=100;, score=(train=0.866, test=0.866) total time=
24.7s
[CV 3/5] END classifier__max_depth=15, classifier__max_features=0.5,

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classifier__max_leaf_nodes=50, classifier__max_samples=0.5,
classifier__n_estimators=100;, score=(train=0.866, test=0.867) total time=
24.4s
[CV 4/5] END classifier__max_depth=15, classifier__max_features=0.5,
classifier__max_leaf_nodes=50, classifier__max_samples=0.5,
classifier__n_estimators=100;, score=(train=0.867, test=0.861) total time=
23.6s
[CV 5/5] END classifier__max_depth=15, classifier__max_features=0.5,
classifier__max_leaf_nodes=50, classifier__max_samples=0.5,
classifier__n_estimators=100;, score=(train=0.867, test=0.860) total time=
23.5s
[CV 1/5] END classifier__max_depth=15, classifier__max_features=0.5,
classifier__max_leaf_nodes=50, classifier__max_samples=None,
classifier__n_estimators=50;, score=(train=0.866, test=0.868) total time=  15.9s
[CV 2/5] END classifier__max_depth=15, classifier__max_features=0.5,
classifier__max_leaf_nodes=50, classifier__max_samples=None,
classifier__n_estimators=50;, score=(train=0.866, test=0.865) total time=  15.8s
[CV 3/5] END classifier__max_depth=15, classifier__max_features=0.5,
classifier__max_leaf_nodes=50, classifier__max_samples=None,
classifier__n_estimators=50;, score=(train=0.865, test=0.865) total time=  16.0s
[CV 4/5] END classifier__max_depth=15, classifier__max_features=0.5,
classifier__max_leaf_nodes=50, classifier__max_samples=None,
classifier__n_estimators=50;, score=(train=0.866, test=0.860) total time=  16.0s
[CV 5/5] END classifier__max_depth=15, classifier__max_features=0.5,
classifier__max_leaf_nodes=50, classifier__max_samples=None,
classifier__n_estimators=50;, score=(train=0.866, test=0.859) total time=  16.9s
[CV 1/5] END classifier__max_depth=15, classifier__max_features=0.5,
classifier__max_leaf_nodes=50, classifier__max_samples=None,
classifier__n_estimators=100;, score=(train=0.866, test=0.868) total time=
33.8s
[CV 2/5] END classifier__max_depth=15, classifier__max_features=0.5,
classifier__max_leaf_nodes=50, classifier__max_samples=None,
classifier__n_estimators=100;, score=(train=0.866, test=0.865) total time=
34.0s
[CV 3/5] END classifier__max_depth=15, classifier__max_features=0.5,
classifier__max_leaf_nodes=50, classifier__max_samples=None,
classifier__n_estimators=100;, score=(train=0.865, test=0.866) total time=
33.8s
[CV 1/5] END classifier__max_depth=25, classifier__max_features=sqrt,
classifier__max_leaf_nodes=15, classifier__max_samples=0.5,
classifier__n_estimators=50;, score=(train=0.846, test=0.848) total time=   1.9s
[CV 2/5] END classifier__max_depth=25, classifier__max_features=sqrt,
classifier__max_leaf_nodes=15, classifier__max_samples=0.5,
classifier__n_estimators=50;, score=(train=0.853, test=0.855) total time=   1.8s
[CV 3/5] END classifier__max_depth=25, classifier__max_features=sqrt,
classifier__max_leaf_nodes=15, classifier__max_samples=0.5,
classifier__n_estimators=50;, score=(train=0.855, test=0.854) total time=   1.7s
[CV 4/5] END classifier__max_depth=25, classifier__max_features=sqrt,
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classifier__max_leaf_nodes=15, classifier__max_samples=0.5,
classifier__n_estimators=50;, score=(train=0.851, test=0.849) total time=   1.8s
[CV 5/5] END classifier__max_depth=25, classifier__max_features=sqrt,
classifier__max_leaf_nodes=15, classifier__max_samples=0.5,
classifier__n_estimators=50;, score=(train=0.851, test=0.845) total time=   1.7s
[CV 1/5] END classifier__max_depth=25, classifier__max_features=sqrt,
classifier__max_leaf_nodes=15, classifier__max_samples=0.5,
classifier__n_estimators=100;, score=(train=0.849, test=0.851) total time=
3.2s
[CV 4/5] END classifier__max_depth=15, classifier__max_features=0.5,
classifier__max_leaf_nodes=50, classifier__max_samples=None,
classifier__n_estimators=100;, score=(train=0.866, test=0.861) total time=
32.4s
[CV 5/5] END classifier__max_depth=15, classifier__max_features=0.5,
classifier__max_leaf_nodes=50, classifier__max_samples=None,
classifier__n_estimators=100;, score=(train=0.866, test=0.859) total time=
32.5s
[CV 2/5] END classifier__max_depth=25, classifier__max_features=sqrt,
classifier__max_leaf_nodes=15, classifier__max_samples=0.5,
classifier__n_estimators=100;, score=(train=0.855, test=0.857) total time=
3.1s
[CV 3/5] END classifier__max_depth=25, classifier__max_features=sqrt,
classifier__max_leaf_nodes=15, classifier__max_samples=0.5,
classifier__n_estimators=100;, score=(train=0.856, test=0.856) total time=
3.2s
[CV 4/5] END classifier__max_depth=25, classifier__max_features=sqrt,
classifier__max_leaf_nodes=15, classifier__max_samples=0.5,
classifier__n_estimators=100;, score=(train=0.854, test=0.852) total time=
3.1s
[CV 5/5] END classifier__max_depth=25, classifier__max_features=sqrt,
classifier__max_leaf_nodes=15, classifier__max_samples=0.5,
classifier__n_estimators=100;, score=(train=0.855, test=0.850) total time=
3.2s
[CV 1/5] END classifier__max_depth=25, classifier__max_features=sqrt,
classifier__max_leaf_nodes=15, classifier__max_samples=None,
classifier__n_estimators=50;, score=(train=0.848, test=0.849) total time=   2.1s
[CV 2/5] END classifier__max_depth=25, classifier__max_features=sqrt,
classifier__max_leaf_nodes=15, classifier__max_samples=None,
classifier__n_estimators=50;, score=(train=0.852, test=0.854) total time=   2.3s
[CV 3/5] END classifier__max_depth=25, classifier__max_features=sqrt,
classifier__max_leaf_nodes=15, classifier__max_samples=None,
classifier__n_estimators=50;, score=(train=0.848, test=0.847) total time=   2.2s
[CV 4/5] END classifier__max_depth=25, classifier__max_features=sqrt,
classifier__max_leaf_nodes=15, classifier__max_samples=None,
classifier__n_estimators=50;, score=(train=0.852, test=0.850) total time=   2.1s
[CV 5/5] END classifier__max_depth=25, classifier__max_features=sqrt,
classifier__max_leaf_nodes=15, classifier__max_samples=None,
classifier__n_estimators=50;, score=(train=0.849, test=0.844) total time=   2.0s
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[CV 1/5] END classifier__max_depth=25, classifier__max_features=sqrt,
classifier__max_leaf_nodes=15, classifier__max_samples=None,
classifier__n_estimators=100;, score=(train=0.850, test=0.852) total time=
3.7s
[CV 2/5] END classifier__max_depth=25, classifier__max_features=sqrt,
classifier__max_leaf_nodes=15, classifier__max_samples=None,
classifier__n_estimators=100;, score=(train=0.853, test=0.855) total time=
3.8s
[CV 3/5] END classifier__max_depth=25, classifier__max_features=sqrt,
classifier__max_leaf_nodes=15, classifier__max_samples=None,
classifier__n_estimators=100;, score=(train=0.854, test=0.854) total time=
3.7s
[CV 4/5] END classifier__max_depth=25, classifier__max_features=sqrt,
classifier__max_leaf_nodes=15, classifier__max_samples=None,
classifier__n_estimators=100;, score=(train=0.856, test=0.853) total time=
3.9s
[CV 5/5] END classifier__max_depth=25, classifier__max_features=sqrt,
classifier__max_leaf_nodes=15, classifier__max_samples=None,
classifier__n_estimators=100;, score=(train=0.852, test=0.848) total time=
3.8s
[CV 1/5] END classifier__max_depth=25, classifier__max_features=sqrt,
classifier__max_leaf_nodes=50, classifier__max_samples=0.5,
classifier__n_estimators=50;, score=(train=0.860, test=0.861) total time=   2.8s
[CV 2/5] END classifier__max_depth=25, classifier__max_features=sqrt,
classifier__max_leaf_nodes=50, classifier__max_samples=0.5,
classifier__n_estimators=50;, score=(train=0.864, test=0.865) total time=   2.8s
[CV 3/5] END classifier__max_depth=25, classifier__max_features=sqrt,
classifier__max_leaf_nodes=50, classifier__max_samples=0.5,
classifier__n_estimators=50;, score=(train=0.864, test=0.863) total time=   2.7s
[CV 4/5] END classifier__max_depth=25, classifier__max_features=sqrt,
classifier__max_leaf_nodes=50, classifier__max_samples=0.5,
classifier__n_estimators=50;, score=(train=0.863, test=0.859) total time=   2.8s
[CV 5/5] END classifier__max_depth=25, classifier__max_features=sqrt,
classifier__max_leaf_nodes=50, classifier__max_samples=0.5,
classifier__n_estimators=50;, score=(train=0.864, test=0.858) total time=   2.8s
[CV 1/5] END classifier__max_depth=25, classifier__max_features=sqrt,
classifier__max_leaf_nodes=50, classifier__max_samples=0.5,
classifier__n_estimators=100;, score=(train=0.862, test=0.863) total time=
5.4s
[CV 2/5] END classifier__max_depth=25, classifier__max_features=sqrt,
classifier__max_leaf_nodes=50, classifier__max_samples=0.5,
classifier__n_estimators=100;, score=(train=0.866, test=0.867) total time=
5.3s
[CV 3/5] END classifier__max_depth=25, classifier__max_features=sqrt,
classifier__max_leaf_nodes=50, classifier__max_samples=0.5,
classifier__n_estimators=100;, score=(train=0.864, test=0.864) total time=
5.3s
[CV 4/5] END classifier__max_depth=25, classifier__max_features=sqrt,

classifier__max_leaf_nodes=50, classifier__max_samples=0.5,
classifier__n_estimators=100;, score=(train=0.864, test=0.861) total time=
5.8s
[CV 5/5] END classifier__max_depth=25, classifier__max_features=sqrt,
classifier__max_leaf_nodes=50, classifier__max_samples=0.5,
classifier__n_estimators=100;, score=(train=0.866, test=0.860) total time=
5.9s
[CV 1/5] END classifier__max_depth=25, classifier__max_features=sqrt,
classifier__max_leaf_nodes=50, classifier__max_samples=None,
classifier__n_estimators=50;, score=(train=0.863, test=0.863) total time=   3.9s
[CV 2/5] END classifier__max_depth=25, classifier__max_features=sqrt,
classifier__max_leaf_nodes=50, classifier__max_samples=None,
classifier__n_estimators=50;, score=(train=0.863, test=0.863) total time=   3.5s
[CV 4/5] END classifier__max_depth=25, classifier__max_features=sqrt,
classifier__max_leaf_nodes=50, classifier__max_samples=None,
classifier__n_estimators=50;, score=(train=0.863, test=0.859) total time=   3.4s
[CV 3/5] END classifier__max_depth=25, classifier__max_features=sqrt,
classifier__max_leaf_nodes=50, classifier__max_samples=None,
classifier__n_estimators=50;, score=(train=0.860, test=0.859) total time=   3.6s
[CV 5/5] END classifier__max_depth=25, classifier__max_features=sqrt,
classifier__max_leaf_nodes=50, classifier__max_samples=None,
classifier__n_estimators=50;, score=(train=0.861, test=0.855) total time=   3.9s
[CV 2/5] END classifier__max_depth=25, classifier__max_features=sqrt,
classifier__max_leaf_nodes=50, classifier__max_samples=None,
classifier__n_estimators=100;, score=(train=0.864, test=0.864) total time=
7.0s
[CV 1/5] END classifier__max_depth=25, classifier__max_features=sqrt,
classifier__max_leaf_nodes=50, classifier__max_samples=None,
classifier__n_estimators=100;, score=(train=0.863, test=0.864) total time=
7.0s
[CV 3/5] END classifier__max_depth=25, classifier__max_features=sqrt,
classifier__max_leaf_nodes=50, classifier__max_samples=None,
classifier__n_estimators=100;, score=(train=0.863, test=0.863) total time=
6.6s
[CV 1/5] END classifier__max_depth=25, classifier__max_features=log2,
classifier__max_leaf_nodes=15, classifier__max_samples=0.5,
classifier__n_estimators=50;, score=(train=0.850, test=0.853) total time=   1.7s
[CV 4/5] END classifier__max_depth=25, classifier__max_features=sqrt,
classifier__max_leaf_nodes=50, classifier__max_samples=None,
classifier__n_estimators=100;, score=(train=0.866, test=0.862) total time=
6.7s
[CV 2/5] END classifier__max_depth=25, classifier__max_features=log2,
classifier__max_leaf_nodes=15, classifier__max_samples=0.5,
classifier__n_estimators=50;, score=(train=0.851, test=0.853) total time=   1.4s
[CV 5/5] END classifier__max_depth=25, classifier__max_features=sqrt,
classifier__max_leaf_nodes=50, classifier__max_samples=None,
classifier__n_estimators=100;, score=(train=0.864, test=0.858) total time=
6.8s

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[CV 3/5] END classifier__max_depth=25, classifier__max_features=log2,
classifier__max_leaf_nodes=15, classifier__max_samples=0.5,
classifier__n_estimators=50;, score=(train=0.841, test=0.840) total time=    1.4s
[CV 4/5] END classifier__max_depth=25, classifier__max_features=log2,
classifier__max_leaf_nodes=15, classifier__max_samples=0.5,
classifier__n_estimators=50;, score=(train=0.850, test=0.847) total time=    1.4s
[CV 5/5] END classifier__max_depth=25, classifier__max_features=log2,
classifier__max_leaf_nodes=15, classifier__max_samples=0.5,
classifier__n_estimators=50;, score=(train=0.841, test=0.835) total time=    1.4s
[CV 1/5] END classifier__max_depth=25, classifier__max_features=log2,
classifier__max_leaf_nodes=15, classifier__max_samples=0.5,
classifier__n_estimators=100;, score=(train=0.846, test=0.848) total time=
2.4s
[CV 2/5] END classifier__max_depth=25, classifier__max_features=log2,
classifier__max_leaf_nodes=15, classifier__max_samples=0.5,
classifier__n_estimators=100;, score=(train=0.854, test=0.856) total time=
2.5s
[CV 3/5] END classifier__max_depth=25, classifier__max_features=log2,
classifier__max_leaf_nodes=15, classifier__max_samples=0.5,
classifier__n_estimators=100;, score=(train=0.848, test=0.848) total time=
2.5s
[CV 1/5] END classifier__max_depth=25, classifier__max_features=log2,
classifier__max_leaf_nodes=15, classifier__max_samples=None,
classifier__n_estimators=50;, score=(train=0.847, test=0.849) total time=    1.6s
[CV 4/5] END classifier__max_depth=25, classifier__max_features=log2,
classifier__max_leaf_nodes=15, classifier__max_samples=0.5,
classifier__n_estimators=100;, score=(train=0.848, test=0.845) total time=
2.5s
[CV 5/5] END classifier__max_depth=25, classifier__max_features=log2,
classifier__max_leaf_nodes=15, classifier__max_samples=0.5,
classifier__n_estimators=100;, score=(train=0.848, test=0.844) total time=
2.6s
[CV 2/5] END classifier__max_depth=25, classifier__max_features=log2,
classifier__max_leaf_nodes=15, classifier__max_samples=None,
classifier__n_estimators=50;, score=(train=0.855, test=0.857) total time=    1.7s
[CV 3/5] END classifier__max_depth=25, classifier__max_features=log2,
classifier__max_leaf_nodes=15, classifier__max_samples=None,
classifier__n_estimators=50;, score=(train=0.847, test=0.846) total time=    1.6s
[CV 4/5] END classifier__max_depth=25, classifier__max_features=log2,
classifier__max_leaf_nodes=15, classifier__max_samples=None,
classifier__n_estimators=50;, score=(train=0.851, test=0.848) total time=    1.5s
[CV 5/5] END classifier__max_depth=25, classifier__max_features=log2,
classifier__max_leaf_nodes=15, classifier__max_samples=None,
classifier__n_estimators=50;, score=(train=0.844, test=0.841) total time=    1.5s
[CV 1/5] END classifier__max_depth=25, classifier__max_features=log2,
classifier__max_leaf_nodes=15, classifier__max_samples=None,
classifier__n_estimators=100;, score=(train=0.848, test=0.850) total time=
2.9s
```

[CV 2/5] END classifier__max_depth=25, classifier__max_features=log2, classifier__max_leaf_nodes=15, classifier__max_samples=None, classifier__n_estimators=100;, score=(train=0.855, test=0.856) total time= 2.9s
[CV 3/5] END classifier__max_depth=25, classifier__max_features=log2, classifier__max_leaf_nodes=15, classifier__max_samples=None, classifier__n_estimators=100;, score=(train=0.848, test=0.848) total time= 2.9s
[CV 1/5] END classifier__max_depth=25, classifier__max_features=log2, classifier__max_leaf_nodes=50, classifier__max_samples=0.5, classifier__n_estimators=50;, score=(train=0.860, test=0.861) total time=   2.0s
[CV 4/5] END classifier__max_depth=25, classifier__max_features=log2, classifier__max_leaf_nodes=15, classifier__max_samples=None, classifier__n_estimators=100;, score=(train=0.851, test=0.848) total time= 3.0s
[CV 5/5] END classifier__max_depth=25, classifier__max_features=log2, classifier__max_leaf_nodes=15, classifier__max_samples=None, classifier__n_estimators=100;, score=(train=0.848, test=0.845) total time= 3.0s
[CV 2/5] END classifier__max_depth=25, classifier__max_features=log2, classifier__max_leaf_nodes=50, classifier__max_samples=0.5, classifier__n_estimators=50;, score=(train=0.860, test=0.861) total time=   1.9s
[CV 3/5] END classifier__max_depth=25, classifier__max_features=log2, classifier__max_leaf_nodes=50, classifier__max_samples=0.5, classifier__n_estimators=50;, score=(train=0.852, test=0.852) total time=   1.9s
[CV 4/5] END classifier__max_depth=25, classifier__max_features=log2, classifier__max_leaf_nodes=50, classifier__max_samples=0.5, classifier__n_estimators=50;, score=(train=0.858, test=0.854) total time=   2.0s
[CV 5/5] END classifier__max_depth=25, classifier__max_features=log2, classifier__max_leaf_nodes=50, classifier__max_samples=0.5, classifier__n_estimators=50;, score=(train=0.856, test=0.850) total time=   1.9s
[CV 1/5] END classifier__max_depth=25, classifier__max_features=log2, classifier__max_leaf_nodes=50, classifier__max_samples=0.5, classifier__n_estimators=100;, score=(train=0.858, test=0.859) total time= 3.8s
[CV 2/5] END classifier__max_depth=25, classifier__max_features=log2, classifier__max_leaf_nodes=50, classifier__max_samples=0.5, classifier__n_estimators=100;, score=(train=0.861, test=0.862) total time= 3.8s
[CV 3/5] END classifier__max_depth=25, classifier__max_features=log2, classifier__max_leaf_nodes=50, classifier__max_samples=0.5, classifier__n_estimators=100;, score=(train=0.857, test=0.857) total time= 3.8s
[CV 4/5] END classifier__max_depth=25, classifier__max_features=log2, classifier__max_leaf_nodes=50, classifier__max_samples=0.5, classifier__n_estimators=100;, score=(train=0.859, test=0.855) total time= 3.9s
[CV 5/5] END classifier__max_depth=25, classifier__max_features=log2,

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classifier__max_leaf_nodes=50, classifier__max_samples=0.5,
classifier__n_estimators=100;, score=(train=0.861, test=0.856) total time=
3.9s
[CV 1/5] END classifier__max_depth=25, classifier__max_features=log2,
classifier__max_leaf_nodes=50, classifier__max_samples=None,
classifier__n_estimators=50;, score=(train=0.859, test=0.860) total time=   2.6s
[CV 2/5] END classifier__max_depth=25, classifier__max_features=log2,
classifier__max_leaf_nodes=50, classifier__max_samples=None,
classifier__n_estimators=50;, score=(train=0.861, test=0.862) total time=   2.7s
[CV 3/5] END classifier__max_depth=25, classifier__max_features=log2,
classifier__max_leaf_nodes=50, classifier__max_samples=None,
classifier__n_estimators=50;, score=(train=0.857, test=0.856) total time=   2.6s
[CV 4/5] END classifier__max_depth=25, classifier__max_features=log2,
classifier__max_leaf_nodes=50, classifier__max_samples=None,
classifier__n_estimators=50;, score=(train=0.864, test=0.860) total time=   2.5s
[CV 5/5] END classifier__max_depth=25, classifier__max_features=log2,
classifier__max_leaf_nodes=50, classifier__max_samples=None,
classifier__n_estimators=50;, score=(train=0.856, test=0.851) total time=   2.4s
[CV 1/5] END classifier__max_depth=25, classifier__max_features=log2,
classifier__max_leaf_nodes=50, classifier__max_samples=None,
classifier__n_estimators=100;, score=(train=0.861, test=0.862) total time=
5.0s
[CV 2/5] END classifier__max_depth=25, classifier__max_features=log2,
classifier__max_leaf_nodes=50, classifier__max_samples=None,
classifier__n_estimators=100;, score=(train=0.861, test=0.862) total time=
5.0s
[CV 3/5] END classifier__max_depth=25, classifier__max_features=log2,
classifier__max_leaf_nodes=50, classifier__max_samples=None,
classifier__n_estimators=100;, score=(train=0.859, test=0.859) total time=
5.3s
[CV 4/5] END classifier__max_depth=25, classifier__max_features=log2,
classifier__max_leaf_nodes=50, classifier__max_samples=None,
classifier__n_estimators=100;, score=(train=0.862, test=0.858) total time=
5.0s
[CV 5/5] END classifier__max_depth=25, classifier__max_features=log2,
classifier__max_leaf_nodes=50, classifier__max_samples=None,
classifier__n_estimators=100;, score=(train=0.858, test=0.853) total time=
4.9s
[CV 1/5] END classifier__max_depth=25, classifier__max_features=0.5,
classifier__max_leaf_nodes=15, classifier__max_samples=0.5,
classifier__n_estimators=50;, score=(train=0.850, test=0.854) total time=   5.7s
[CV 2/5] END classifier__max_depth=25, classifier__max_features=0.5,
classifier__max_leaf_nodes=15, classifier__max_samples=0.5,
classifier__n_estimators=50;, score=(train=0.849, test=0.850) total time=   6.1s
[CV 3/5] END classifier__max_depth=25, classifier__max_features=0.5,
classifier__max_leaf_nodes=15, classifier__max_samples=0.5,
classifier__n_estimators=50;, score=(train=0.848, test=0.850) total time=   6.1s
[CV 4/5] END classifier__max_depth=25, classifier__max_features=0.5,
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classifier__max_leaf_nodes=15, classifier__max_samples=0.5,
classifier__n_estimators=50;, score=(train=0.848, test=0.844) total time=   6.1s
[CV 5/5] END classifier__max_depth=25, classifier__max_features=0.5,
classifier__max_leaf_nodes=15, classifier__max_samples=0.5,
classifier__n_estimators=50;, score=(train=0.850, test=0.843) total time=   5.9s
[CV 1/5] END classifier__max_depth=25, classifier__max_features=0.5,
classifier__max_leaf_nodes=15, classifier__max_samples=0.5,
classifier__n_estimators=100;, score=(train=0.850, test=0.854) total time=
11.8s
[CV 2/5] END classifier__max_depth=25, classifier__max_features=0.5,
classifier__max_leaf_nodes=15, classifier__max_samples=0.5,
classifier__n_estimators=100;, score=(train=0.849, test=0.850) total time=
11.7s
[CV 3/5] END classifier__max_depth=25, classifier__max_features=0.5,
classifier__max_leaf_nodes=15, classifier__max_samples=0.5,
classifier__n_estimators=100;, score=(train=0.849, test=0.851) total time=
12.0s
[CV 4/5] END classifier__max_depth=25, classifier__max_features=0.5,
classifier__max_leaf_nodes=15, classifier__max_samples=0.5,
classifier__n_estimators=100;, score=(train=0.848, test=0.844) total time=
11.7s
[CV 1/5] END classifier__max_depth=25, classifier__max_features=0.5,
classifier__max_leaf_nodes=15, classifier__max_samples=None,
classifier__n_estimators=50;, score=(train=0.851, test=0.854) total time=   7.6s
[CV 5/5] END classifier__max_depth=25, classifier__max_features=0.5,
classifier__max_leaf_nodes=15, classifier__max_samples=0.5,
classifier__n_estimators=100;, score=(train=0.850, test=0.843) total time=
11.6s
[CV 2/5] END classifier__max_depth=25, classifier__max_features=0.5,
classifier__max_leaf_nodes=15, classifier__max_samples=None,
classifier__n_estimators=50;, score=(train=0.849, test=0.850) total time=   8.4s
[CV 3/5] END classifier__max_depth=25, classifier__max_features=0.5,
classifier__max_leaf_nodes=15, classifier__max_samples=None,
classifier__n_estimators=50;, score=(train=0.847, test=0.848) total time=   8.3s
[CV 4/5] END classifier__max_depth=25, classifier__max_features=0.5,
classifier__max_leaf_nodes=15, classifier__max_samples=None,
classifier__n_estimators=50;, score=(train=0.848, test=0.844) total time=   8.7s
[CV 5/5] END classifier__max_depth=25, classifier__max_features=0.5,
classifier__max_leaf_nodes=15, classifier__max_samples=None,
classifier__n_estimators=50;, score=(train=0.849, test=0.842) total time=   7.8s
[CV 1/5] END classifier__max_depth=25, classifier__max_features=0.5,
classifier__max_leaf_nodes=15, classifier__max_samples=None,
classifier__n_estimators=100;, score=(train=0.850, test=0.853) total time=
14.9s
[CV 2/5] END classifier__max_depth=25, classifier__max_features=0.5,
classifier__max_leaf_nodes=15, classifier__max_samples=None,
classifier__n_estimators=100;, score=(train=0.848, test=0.850) total time=
14.9s

[CV 3/5] END classifier__max_depth=25, classifier__max_features=0.5,
classifier__max_leaf_nodes=15, classifier__max_samples=None,
classifier__n_estimators=100;, score=(train=0.848, test=0.850) total time=
14.8s
[CV 4/5] END classifier__max_depth=25, classifier__max_features=0.5,
classifier__max_leaf_nodes=15, classifier__max_samples=None,
classifier__n_estimators=100;, score=(train=0.849, test=0.845) total time=
14.9s
[CV 5/5] END classifier__max_depth=25, classifier__max_features=0.5,
classifier__max_leaf_nodes=15, classifier__max_samples=None,
classifier__n_estimators=100;, score=(train=0.849, test=0.843) total time=
15.1s
[CV 1/5] END classifier__max_depth=25, classifier__max_features=0.5,
classifier__max_leaf_nodes=50, classifier__max_samples=0.5,
classifier__n_estimators=50;, score=(train=0.866, test=0.868) total time= 12.7s
[CV 2/5] END classifier__max_depth=25, classifier__max_features=0.5,
classifier__max_leaf_nodes=50, classifier__max_samples=0.5,
classifier__n_estimators=50;, score=(train=0.866, test=0.866) total time= 13.5s
[CV 3/5] END classifier__max_depth=25, classifier__max_features=0.5,
classifier__max_leaf_nodes=50, classifier__max_samples=0.5,
classifier__n_estimators=50;, score=(train=0.866, test=0.866) total time= 13.6s
[CV 4/5] END classifier__max_depth=25, classifier__max_features=0.5,
classifier__max_leaf_nodes=50, classifier__max_samples=0.5,
classifier__n_estimators=50;, score=(train=0.866, test=0.861) total time= 13.5s
[CV 5/5] END classifier__max_depth=25, classifier__max_features=0.5,
classifier__max_leaf_nodes=50, classifier__max_samples=0.5,
classifier__n_estimators=50;, score=(train=0.867, test=0.860) total time= 12.4s
[CV 1/5] END classifier__max_depth=25, classifier__max_features=0.5,
classifier__max_leaf_nodes=50, classifier__max_samples=0.5,
classifier__n_estimators=100;, score=(train=0.866, test=0.868) total time=
23.5s
[CV 2/5] END classifier__max_depth=25, classifier__max_features=0.5,
classifier__max_leaf_nodes=50, classifier__max_samples=0.5,
classifier__n_estimators=100;, score=(train=0.866, test=0.866) total time=
23.4s
[CV 3/5] END classifier__max_depth=25, classifier__max_features=0.5,
classifier__max_leaf_nodes=50, classifier__max_samples=0.5,
classifier__n_estimators=100;, score=(train=0.866, test=0.867) total time=
23.3s
[CV 4/5] END classifier__max_depth=25, classifier__max_features=0.5,
classifier__max_leaf_nodes=50, classifier__max_samples=0.5,
classifier__n_estimators=100;, score=(train=0.867, test=0.861) total time=
24.6s
[CV 5/5] END classifier__max_depth=25, classifier__max_features=0.5,
classifier__max_leaf_nodes=50, classifier__max_samples=0.5,
classifier__n_estimators=100;, score=(train=0.867, test=0.860) total time=
24.8s
[CV 1/5] END classifier__max_depth=25, classifier__max_features=0.5,

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classifier__max_leaf_nodes=50, classifier__max_samples=None,
classifier__n_estimators=50;, score=(train=0.866, test=0.868) total time=  17.3s
[CV 2/5] END classifier__max_depth=25, classifier__max_features=0.5,
classifier__max_leaf_nodes=50, classifier__max_samples=None,
classifier__n_estimators=50;, score=(train=0.866, test=0.865) total time=  17.2s
[CV 3/5] END classifier__max_depth=25, classifier__max_features=0.5,
classifier__max_leaf_nodes=50, classifier__max_samples=None,
classifier__n_estimators=50;, score=(train=0.865, test=0.865) total time=  17.1s
[CV 4/5] END classifier__max_depth=25, classifier__max_features=0.5,
classifier__max_leaf_nodes=50, classifier__max_samples=None,
classifier__n_estimators=50;, score=(train=0.866, test=0.860) total time=  17.4s
[CV 5/5] END classifier__max_depth=25, classifier__max_features=0.5,
classifier__max_leaf_nodes=50, classifier__max_samples=None,
classifier__n_estimators=50;, score=(train=0.866, test=0.859) total time=  17.5s
[CV 1/5] END classifier__max_depth=25, classifier__max_features=0.5,
classifier__max_leaf_nodes=50, classifier__max_samples=None,
classifier__n_estimators=100;, score=(train=0.866, test=0.868) total time=
32.4s
[CV 2/5] END classifier__max_depth=25, classifier__max_features=0.5,
classifier__max_leaf_nodes=50, classifier__max_samples=None,
classifier__n_estimators=100;, score=(train=0.866, test=0.865) total time=
32.4s
[CV 3/5] END classifier__max_depth=25, classifier__max_features=0.5,
classifier__max_leaf_nodes=50, classifier__max_samples=None,
classifier__n_estimators=100;, score=(train=0.865, test=0.866) total time=
30.8s
[CV 4/5] END classifier__max_depth=25, classifier__max_features=0.5,
classifier__max_leaf_nodes=50, classifier__max_samples=None,
classifier__n_estimators=100;, score=(train=0.866, test=0.861) total time=
30.0s
[CV 5/5] END classifier__max_depth=25, classifier__max_features=0.5,
classifier__max_leaf_nodes=50, classifier__max_samples=None,
classifier__n_estimators=100;, score=(train=0.866, test=0.859) total time=
30.0s
Best parameters for outer fold 1: {'classifier__max_depth': 25,
'classifier__max_features': 0.5, 'classifier__max_leaf_nodes': 50,
'classifier__max_samples': 0.5, 'classifier__n_estimators': 100}
ROC AUC for outer fold 1: 0.8649742066608637

Starting outer fold 2
Fitting 5 folds for each of 72 candidates, totalling 360 fits
[CV 1/5] END classifier__max_depth=5, classifier__max_features=sqrt,
classifier__max_leaf_nodes=15, classifier__max_samples=0.5,
classifier__n_estimators=50;, score=(train=0.846, test=0.845) total time=   1.6s
[CV 2/5] END classifier__max_depth=5, classifier__max_features=sqrt,
classifier__max_leaf_nodes=15, classifier__max_samples=0.5,
classifier__n_estimators=50;, score=(train=0.849, test=0.846) total time=   1.5s
[CV 3/5] END classifier__max_depth=5, classifier__max_features=sqrt,
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classifier__max_leaf_nodes=15, classifier__max_samples=0.5,
classifier__n_estimators=50;, score=(train=0.845, test=0.844) total time=   1.5s
[CV 4/5] END classifier__max_depth=5, classifier__max_features=sqrt,
classifier__max_leaf_nodes=15, classifier__max_samples=0.5,
classifier__n_estimators=50;, score=(train=0.850, test=0.850) total time=   1.5s
[CV 5/5] END classifier__max_depth=5, classifier__max_features=sqrt,
classifier__max_leaf_nodes=15, classifier__max_samples=0.5,
classifier__n_estimators=50;, score=(train=0.847, test=0.849) total time=   1.6s
[CV 1/5] END classifier__max_depth=5, classifier__max_features=sqrt,
classifier__max_leaf_nodes=15, classifier__max_samples=0.5,
classifier__n_estimators=100;, score=(train=0.852, test=0.852) total time=
2.8s
[CV 2/5] END classifier__max_depth=5, classifier__max_features=sqrt,
classifier__max_leaf_nodes=15, classifier__max_samples=0.5,
classifier__n_estimators=100;, score=(train=0.849, test=0.845) total time=
2.6s
[CV 3/5] END classifier__max_depth=5, classifier__max_features=sqrt,
classifier__max_leaf_nodes=15, classifier__max_samples=0.5,
classifier__n_estimators=100;, score=(train=0.844, test=0.843) total time=
2.6s
[CV 4/5] END classifier__max_depth=5, classifier__max_features=sqrt,
classifier__max_leaf_nodes=15, classifier__max_samples=0.5,
classifier__n_estimators=100;, score=(train=0.850, test=0.850) total time=
2.7s
[CV 1/5] END classifier__max_depth=5, classifier__max_features=sqrt,
classifier__max_leaf_nodes=15, classifier__max_samples=None,
classifier__n_estimators=50;, score=(train=0.844, test=0.843) total time=   1.6s
[CV 5/5] END classifier__max_depth=5, classifier__max_features=sqrt,
classifier__max_leaf_nodes=15, classifier__max_samples=0.5,
classifier__n_estimators=100;, score=(train=0.845, test=0.847) total time=
2.6s
[CV 2/5] END classifier__max_depth=5, classifier__max_features=sqrt,
classifier__max_leaf_nodes=15, classifier__max_samples=None,
classifier__n_estimators=50;, score=(train=0.847, test=0.843) total time=   1.6s
[CV 3/5] END classifier__max_depth=5, classifier__max_features=sqrt,
classifier__max_leaf_nodes=15, classifier__max_samples=None,
classifier__n_estimators=50;, score=(train=0.839, test=0.837) total time=   1.7s
[CV 4/5] END classifier__max_depth=5, classifier__max_features=sqrt,
classifier__max_leaf_nodes=15, classifier__max_samples=None,
classifier__n_estimators=50;, score=(train=0.849, test=0.849) total time=   1.7s
[CV 5/5] END classifier__max_depth=5, classifier__max_features=sqrt,
classifier__max_leaf_nodes=15, classifier__max_samples=None,
classifier__n_estimators=50;, score=(train=0.851, test=0.853) total time=   1.6s
[CV 1/5] END classifier__max_depth=5, classifier__max_features=sqrt,
classifier__max_leaf_nodes=15, classifier__max_samples=None,
classifier__n_estimators=100;, score=(train=0.850, test=0.850) total time=
3.2s
[CV 2/5] END classifier__max_depth=5, classifier__max_features=sqrt,

classifier__max_leaf_nodes=15, classifier__max_samples=None,
classifier__n_estimators=100;, score=(train=0.847, test=0.843) total time=
3.3s
[CV 3/5] END classifier__max_depth=5, classifier__max_features=sqrt,
classifier__max_leaf_nodes=15, classifier__max_samples=None,
classifier__n_estimators=100;, score=(train=0.847, test=0.845) total time=
3.2s
[CV 1/5] END classifier__max_depth=5, classifier__max_features=sqrt,
classifier__max_leaf_nodes=50, classifier__max_samples=0.5,
classifier__n_estimators=50;, score=(train=0.847, test=0.847) total time=   1.6s
[CV 4/5] END classifier__max_depth=5, classifier__max_features=sqrt,
classifier__max_leaf_nodes=15, classifier__max_samples=None,
classifier__n_estimators=100;, score=(train=0.847, test=0.847) total time=
3.2s
[CV 5/5] END classifier__max_depth=5, classifier__max_features=sqrt,
classifier__max_leaf_nodes=15, classifier__max_samples=None,
classifier__n_estimators=100;, score=(train=0.851, test=0.853) total time=
3.3s
[CV 2/5] END classifier__max_depth=5, classifier__max_features=sqrt,
classifier__max_leaf_nodes=50, classifier__max_samples=0.5,
classifier__n_estimators=50;, score=(train=0.851, test=0.847) total time=   1.4s
[CV 3/5] END classifier__max_depth=5, classifier__max_features=sqrt,
classifier__max_leaf_nodes=50, classifier__max_samples=0.5,
classifier__n_estimators=50;, score=(train=0.846, test=0.845) total time=   1.5s
[CV 4/5] END classifier__max_depth=5, classifier__max_features=sqrt,
classifier__max_leaf_nodes=50, classifier__max_samples=0.5,
classifier__n_estimators=50;, score=(train=0.851, test=0.850) total time=   1.4s
[CV 5/5] END classifier__max_depth=5, classifier__max_features=sqrt,
classifier__max_leaf_nodes=50, classifier__max_samples=0.5,
classifier__n_estimators=50;, score=(train=0.848, test=0.849) total time=   1.5s
[CV 1/5] END classifier__max_depth=5, classifier__max_features=sqrt,
classifier__max_leaf_nodes=50, classifier__max_samples=0.5,
classifier__n_estimators=100;, score=(train=0.854, test=0.853) total time=
2.7s
[CV 2/5] END classifier__max_depth=5, classifier__max_features=sqrt,
classifier__max_leaf_nodes=50, classifier__max_samples=0.5,
classifier__n_estimators=100;, score=(train=0.850, test=0.846) total time=
2.8s
[CV 3/5] END classifier__max_depth=5, classifier__max_features=sqrt,
classifier__max_leaf_nodes=50, classifier__max_samples=0.5,
classifier__n_estimators=100;, score=(train=0.845, test=0.844) total time=
2.8s
[CV 4/5] END classifier__max_depth=5, classifier__max_features=sqrt,
classifier__max_leaf_nodes=50, classifier__max_samples=0.5,
classifier__n_estimators=100;, score=(train=0.851, test=0.850) total time=
2.9s
[CV 1/5] END classifier__max_depth=5, classifier__max_features=sqrt,
classifier__max_leaf_nodes=50, classifier__max_samples=None,

classifier__n_estimators=50;, score=(train=0.845, test=0.844) total time=   1.9s
[CV 5/5] END classifier__max_depth=5, classifier__max_features=sqrt,
classifier__max_leaf_nodes=50, classifier__max_samples=0.5,
classifier__n_estimators=100;, score=(train=0.846, test=0.848) total time=
2.9s
[CV 2/5] END classifier__max_depth=5, classifier__max_features=sqrt,
classifier__max_leaf_nodes=50, classifier__max_samples=None,
classifier__n_estimators=50;, score=(train=0.848, test=0.843) total time=   1.7s
[CV 3/5] END classifier__max_depth=5, classifier__max_features=sqrt,
classifier__max_leaf_nodes=50, classifier__max_samples=None,
classifier__n_estimators=50;, score=(train=0.840, test=0.838) total time=   1.7s
[CV 4/5] END classifier__max_depth=5, classifier__max_features=sqrt,
classifier__max_leaf_nodes=50, classifier__max_samples=None,
classifier__n_estimators=50;, score=(train=0.850, test=0.850) total time=   1.7s
[CV 5/5] END classifier__max_depth=5, classifier__max_features=sqrt,
classifier__max_leaf_nodes=50, classifier__max_samples=None,
classifier__n_estimators=50;, score=(train=0.852, test=0.854) total time=   1.7s
[CV 1/5] END classifier__max_depth=5, classifier__max_features=sqrt,
classifier__max_leaf_nodes=50, classifier__max_samples=None,
classifier__n_estimators=100;, score=(train=0.851, test=0.850) total time=
3.1s
[CV 2/5] END classifier__max_depth=5, classifier__max_features=sqrt,
classifier__max_leaf_nodes=50, classifier__max_samples=None,
classifier__n_estimators=100;, score=(train=0.848, test=0.844) total time=
3.1s
[CV 3/5] END classifier__max_depth=5, classifier__max_features=sqrt,
classifier__max_leaf_nodes=50, classifier__max_samples=None,
classifier__n_estimators=100;, score=(train=0.847, test=0.846) total time=
3.2s
[CV 1/5] END classifier__max_depth=5, classifier__max_features=log2,
classifier__max_leaf_nodes=15, classifier__max_samples=0.5,
classifier__n_estimators=50;, score=(train=0.843, test=0.842) total time=   1.2s
[CV 4/5] END classifier__max_depth=5, classifier__max_features=sqrt,
classifier__max_leaf_nodes=50, classifier__max_samples=None,
classifier__n_estimators=100;, score=(train=0.848, test=0.847) total time=
3.1s
[CV 5/5] END classifier__max_depth=5, classifier__max_features=sqrt,
classifier__max_leaf_nodes=50, classifier__max_samples=None,
classifier__n_estimators=100;, score=(train=0.852, test=0.853) total time=
3.2s
[CV 2/5] END classifier__max_depth=5, classifier__max_features=log2,
classifier__max_leaf_nodes=15, classifier__max_samples=0.5,
classifier__n_estimators=50;, score=(train=0.843, test=0.840) total time=   1.2s
[CV 3/5] END classifier__max_depth=5, classifier__max_features=log2,
classifier__max_leaf_nodes=15, classifier__max_samples=0.5,
classifier__n_estimators=50;, score=(train=0.849, test=0.847) total time=   1.2s
[CV 4/5] END classifier__max_depth=5, classifier__max_features=log2,
classifier__max_leaf_nodes=15, classifier__max_samples=0.5,

classifier__n_estimators=50;, score=(train=0.846, test=0.844) total time=   1.2s
[CV 5/5] END classifier__max_depth=5, classifier__max_features=log2,
classifier__max_leaf_nodes=15, classifier__max_samples=0.5,
classifier__n_estimators=50;, score=(train=0.838, test=0.840) total time=   1.2s
[CV 1/5] END classifier__max_depth=5, classifier__max_features=log2,
classifier__max_leaf_nodes=15, classifier__max_samples=0.5,
classifier__n_estimators=100;, score=(train=0.850, test=0.850) total time=
2.4s
[CV 2/5] END classifier__max_depth=5, classifier__max_features=log2,
classifier__max_leaf_nodes=15, classifier__max_samples=0.5,
classifier__n_estimators=100;, score=(train=0.831, test=0.828) total time=
2.7s
[CV 3/5] END classifier__max_depth=5, classifier__max_features=log2,
classifier__max_leaf_nodes=15, classifier__max_samples=0.5,
classifier__n_estimators=100;, score=(train=0.845, test=0.844) total time=
2.6s
[CV 4/5] END classifier__max_depth=5, classifier__max_features=log2,
classifier__max_leaf_nodes=15, classifier__max_samples=0.5,
classifier__n_estimators=100;, score=(train=0.843, test=0.842) total time=
2.5s
[CV 1/5] END classifier__max_depth=5, classifier__max_features=log2,
classifier__max_leaf_nodes=15, classifier__max_samples=None,
classifier__n_estimators=50;, score=(train=0.835, test=0.836) total time=   1.8s
[CV 5/5] END classifier__max_depth=5, classifier__max_features=log2,
classifier__max_leaf_nodes=15, classifier__max_samples=0.5,
classifier__n_estimators=100;, score=(train=0.842, test=0.844) total time=
2.8s
[CV 2/5] END classifier__max_depth=5, classifier__max_features=log2,
classifier__max_leaf_nodes=15, classifier__max_samples=None,
classifier__n_estimators=50;, score=(train=0.849, test=0.845) total time=   1.3s
[CV 3/5] END classifier__max_depth=5, classifier__max_features=log2,
classifier__max_leaf_nodes=15, classifier__max_samples=None,
classifier__n_estimators=50;, score=(train=0.838, test=0.837) total time=   1.3s
[CV 4/5] END classifier__max_depth=5, classifier__max_features=log2,
classifier__max_leaf_nodes=15, classifier__max_samples=None,
classifier__n_estimators=50;, score=(train=0.844, test=0.843) total time=   1.3s
[CV 5/5] END classifier__max_depth=5, classifier__max_features=log2,
classifier__max_leaf_nodes=15, classifier__max_samples=None,
classifier__n_estimators=50;, score=(train=0.844, test=0.846) total time=   1.3s
[CV 1/5] END classifier__max_depth=5, classifier__max_features=log2,
classifier__max_leaf_nodes=15, classifier__max_samples=None,
classifier__n_estimators=100;, score=(train=0.845, test=0.845) total time=
2.3s
[CV 2/5] END classifier__max_depth=5, classifier__max_features=log2,
classifier__max_leaf_nodes=15, classifier__max_samples=None,
classifier__n_estimators=100;, score=(train=0.847, test=0.843) total time=
2.4s
[CV 3/5] END classifier__max_depth=5, classifier__max_features=log2,

classifier__max_leaf_nodes=15, classifier__max_samples=None,
classifier__n_estimators=100;, score=(train=0.840, test=0.839) total time=
2.4s
[CV 4/5] END classifier__max_depth=5, classifier__max_features=log2,
classifier__max_leaf_nodes=15, classifier__max_samples=None,
classifier__n_estimators=100;, score=(train=0.847, test=0.845) total time=
2.4s
[CV 1/5] END classifier__max_depth=5, classifier__max_features=log2,
classifier__max_leaf_nodes=50, classifier__max_samples=0.5,
classifier__n_estimators=50;, score=(train=0.844, test=0.843) total time=   1.4s
[CV 5/5] END classifier__max_depth=5, classifier__max_features=log2,
classifier__max_leaf_nodes=15, classifier__max_samples=None,
classifier__n_estimators=100;, score=(train=0.847, test=0.849) total time=
2.6s
[CV 2/5] END classifier__max_depth=5, classifier__max_features=log2,
classifier__max_leaf_nodes=50, classifier__max_samples=0.5,
classifier__n_estimators=50;, score=(train=0.843, test=0.840) total time=   1.2s
[CV 3/5] END classifier__max_depth=5, classifier__max_features=log2,
classifier__max_leaf_nodes=50, classifier__max_samples=0.5,
classifier__n_estimators=50;, score=(train=0.850, test=0.848) total time=   1.2s
[CV 4/5] END classifier__max_depth=5, classifier__max_features=log2,
classifier__max_leaf_nodes=50, classifier__max_samples=0.5,
classifier__n_estimators=50;, score=(train=0.847, test=0.846) total time=   1.2s
[CV 5/5] END classifier__max_depth=5, classifier__max_features=log2,
classifier__max_leaf_nodes=50, classifier__max_samples=0.5,
classifier__n_estimators=50;, score=(train=0.839, test=0.841) total time=   1.5s
[CV 1/5] END classifier__max_depth=5, classifier__max_features=log2,
classifier__max_leaf_nodes=50, classifier__max_samples=0.5,
classifier__n_estimators=100;, score=(train=0.851, test=0.850) total time=
2.7s
[CV 2/5] END classifier__max_depth=5, classifier__max_features=log2,
classifier__max_leaf_nodes=50, classifier__max_samples=0.5,
classifier__n_estimators=100;, score=(train=0.832, test=0.828) total time=
3.0s
[CV 3/5] END classifier__max_depth=5, classifier__max_features=log2,
classifier__max_leaf_nodes=50, classifier__max_samples=0.5,
classifier__n_estimators=100;, score=(train=0.846, test=0.844) total time=
2.8s
[CV 4/5] END classifier__max_depth=5, classifier__max_features=log2,
classifier__max_leaf_nodes=50, classifier__max_samples=0.5,
classifier__n_estimators=100;, score=(train=0.844, test=0.843) total time=
2.2s
[CV 1/5] END classifier__max_depth=5, classifier__max_features=log2,
classifier__max_leaf_nodes=50, classifier__max_samples=None,
classifier__n_estimators=50;, score=(train=0.836, test=0.836) total time=   1.5s
[CV 5/5] END classifier__max_depth=5, classifier__max_features=log2,
classifier__max_leaf_nodes=50, classifier__max_samples=0.5,
classifier__n_estimators=100;, score=(train=0.843, test=0.845) total time=

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2.3s
[CV 2/5] END classifier__max_depth=5, classifier__max_features=log2,
classifier__max_leaf_nodes=50, classifier__max_samples=None,
classifier__n_estimators=50;, score=(train=0.850, test=0.845) total time=   1.2s
[CV 3/5] END classifier__max_depth=5, classifier__max_features=log2,
classifier__max_leaf_nodes=50, classifier__max_samples=None,
classifier__n_estimators=50;, score=(train=0.841, test=0.840) total time=   1.3s
[CV 4/5] END classifier__max_depth=5, classifier__max_features=log2,
classifier__max_leaf_nodes=50, classifier__max_samples=None,
classifier__n_estimators=50;, score=(train=0.844, test=0.843) total time=   1.3s
[CV 5/5] END classifier__max_depth=5, classifier__max_features=log2,
classifier__max_leaf_nodes=50, classifier__max_samples=None,
classifier__n_estimators=50;, score=(train=0.844, test=0.846) total time=   1.3s
[CV 2/5] END classifier__max_depth=5, classifier__max_features=log2,
classifier__max_leaf_nodes=50, classifier__max_samples=None,
classifier__n_estimators=100;, score=(train=0.848, test=0.843) total time=
2.7s
[CV 1/5] END classifier__max_depth=5, classifier__max_features=log2,
classifier__max_leaf_nodes=50, classifier__max_samples=None,
classifier__n_estimators=100;, score=(train=0.846, test=0.846) total time=
2.8s
[CV 3/5] END classifier__max_depth=5, classifier__max_features=log2,
classifier__max_leaf_nodes=50, classifier__max_samples=None,
classifier__n_estimators=100;, score=(train=0.842, test=0.841) total time=
2.6s
[CV 4/5] END classifier__max_depth=5, classifier__max_features=log2,
classifier__max_leaf_nodes=50, classifier__max_samples=None,
classifier__n_estimators=100;, score=(train=0.847, test=0.845) total time=
2.3s
[CV 5/5] END classifier__max_depth=5, classifier__max_features=log2,
classifier__max_leaf_nodes=50, classifier__max_samples=None,
classifier__n_estimators=100;, score=(train=0.847, test=0.849) total time=
2.4s
[CV 1/5] END classifier__max_depth=5, classifier__max_features=0.5,
classifier__max_leaf_nodes=15, classifier__max_samples=0.5,
classifier__n_estimators=50;, score=(train=0.846, test=0.843) total time=   4.6s
[CV 2/5] END classifier__max_depth=5, classifier__max_features=0.5,
classifier__max_leaf_nodes=15, classifier__max_samples=0.5,
classifier__n_estimators=50;, score=(train=0.844, test=0.841) total time=   4.6s
[CV 3/5] END classifier__max_depth=5, classifier__max_features=0.5,
classifier__max_leaf_nodes=15, classifier__max_samples=0.5,
classifier__n_estimators=50;, score=(train=0.843, test=0.844) total time=   4.6s
[CV 4/5] END classifier__max_depth=5, classifier__max_features=0.5,
classifier__max_leaf_nodes=15, classifier__max_samples=0.5,
classifier__n_estimators=50;, score=(train=0.844, test=0.842) total time=   4.6s
[CV 5/5] END classifier__max_depth=5, classifier__max_features=0.5,
classifier__max_leaf_nodes=15, classifier__max_samples=0.5,
classifier__n_estimators=50;, score=(train=0.844, test=0.847) total time=   4.6s
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[CV 1/5] END classifier__max_depth=5, classifier__max_features=0.5,
classifier__max_leaf_nodes=15, classifier__max_samples=0.5,
classifier__n_estimators=100;, score=(train=0.846, test=0.843) total time=
9.0s
[CV 2/5] END classifier__max_depth=5, classifier__max_features=0.5,
classifier__max_leaf_nodes=15, classifier__max_samples=0.5,
classifier__n_estimators=100;, score=(train=0.844, test=0.841) total time=
9.4s
[CV 3/5] END classifier__max_depth=5, classifier__max_features=0.5,
classifier__max_leaf_nodes=15, classifier__max_samples=0.5,
classifier__n_estimators=100;, score=(train=0.843, test=0.845) total time=
9.7s
[CV 4/5] END classifier__max_depth=5, classifier__max_features=0.5,
classifier__max_leaf_nodes=15, classifier__max_samples=0.5,
classifier__n_estimators=100;, score=(train=0.845, test=0.842) total time=
10.6s
[CV 1/5] END classifier__max_depth=5, classifier__max_features=0.5,
classifier__max_leaf_nodes=15, classifier__max_samples=None,
classifier__n_estimators=50;, score=(train=0.844, test=0.841) total time=   7.0s
[CV 5/5] END classifier__max_depth=5, classifier__max_features=0.5,
classifier__max_leaf_nodes=15, classifier__max_samples=0.5,
classifier__n_estimators=100;, score=(train=0.844, test=0.848) total time=
10.9s
[CV 2/5] END classifier__max_depth=5, classifier__max_features=0.5,
classifier__max_leaf_nodes=15, classifier__max_samples=None,
classifier__n_estimators=50;, score=(train=0.846, test=0.843) total time=   6.2s
[CV 3/5] END classifier__max_depth=5, classifier__max_features=0.5,
classifier__max_leaf_nodes=15, classifier__max_samples=None,
classifier__n_estimators=50;, score=(train=0.844, test=0.845) total time=   5.9s
[CV 4/5] END classifier__max_depth=5, classifier__max_features=0.5,
classifier__max_leaf_nodes=15, classifier__max_samples=None,
classifier__n_estimators=50;, score=(train=0.843, test=0.840) total time=   6.0s
[CV 5/5] END classifier__max_depth=5, classifier__max_features=0.5,
classifier__max_leaf_nodes=15, classifier__max_samples=None,
classifier__n_estimators=50;, score=(train=0.843, test=0.847) total time=   5.9s
[CV 1/5] END classifier__max_depth=5, classifier__max_features=0.5,
classifier__max_leaf_nodes=15, classifier__max_samples=None,
classifier__n_estimators=100;, score=(train=0.845, test=0.841) total time=
11.4s
[CV 2/5] END classifier__max_depth=5, classifier__max_features=0.5,
classifier__max_leaf_nodes=15, classifier__max_samples=None,
classifier__n_estimators=100;, score=(train=0.845, test=0.842) total time=
11.5s
[CV 3/5] END classifier__max_depth=5, classifier__max_features=0.5,
classifier__max_leaf_nodes=15, classifier__max_samples=None,
classifier__n_estimators=100;, score=(train=0.844, test=0.845) total time=
11.3s
[CV 1/5] END classifier__max_depth=5, classifier__max_features=0.5,
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classifier__max_leaf_nodes=50, classifier__max_samples=0.5,
classifier__n_estimators=50;, score=(train=0.850, test=0.847) total time=   5.5s
[CV 4/5] END classifier__max_depth=5, classifier__max_features=0.5,
classifier__max_leaf_nodes=15, classifier__max_samples=None,
classifier__n_estimators=100;, score=(train=0.845, test=0.841) total time=
11.6s
[CV 5/5] END classifier__max_depth=5, classifier__max_features=0.5,
classifier__max_leaf_nodes=15, classifier__max_samples=None,
classifier__n_estimators=100;, score=(train=0.843, test=0.848) total time=
11.5s
[CV 2/5] END classifier__max_depth=5, classifier__max_features=0.5,
classifier__max_leaf_nodes=50, classifier__max_samples=0.5,
classifier__n_estimators=50;, score=(train=0.848, test=0.845) total time=   5.5s
[CV 3/5] END classifier__max_depth=5, classifier__max_features=0.5,
classifier__max_leaf_nodes=50, classifier__max_samples=0.5,
classifier__n_estimators=50;, score=(train=0.847, test=0.849) total time=   5.4s
[CV 4/5] END classifier__max_depth=5, classifier__max_features=0.5,
classifier__max_leaf_nodes=50, classifier__max_samples=0.5,
classifier__n_estimators=50;, score=(train=0.849, test=0.845) total time=   5.4s
[CV 5/5] END classifier__max_depth=5, classifier__max_features=0.5,
classifier__max_leaf_nodes=50, classifier__max_samples=0.5,
classifier__n_estimators=50;, score=(train=0.848, test=0.851) total time=   5.5s
[CV 1/5] END classifier__max_depth=5, classifier__max_features=0.5,
classifier__max_leaf_nodes=50, classifier__max_samples=0.5,
classifier__n_estimators=100;, score=(train=0.850, test=0.847) total time=
10.7s
[CV 2/5] END classifier__max_depth=5, classifier__max_features=0.5,
classifier__max_leaf_nodes=50, classifier__max_samples=0.5,
classifier__n_estimators=100;, score=(train=0.848, test=0.845) total time=
10.6s
[CV 3/5] END classifier__max_depth=5, classifier__max_features=0.5,
classifier__max_leaf_nodes=50, classifier__max_samples=0.5,
classifier__n_estimators=100;, score=(train=0.848, test=0.849) total time=
10.6s
[CV 4/5] END classifier__max_depth=5, classifier__max_features=0.5,
classifier__max_leaf_nodes=50, classifier__max_samples=0.5,
classifier__n_estimators=100;, score=(train=0.849, test=0.845) total time=
10.5s
[CV 1/5] END classifier__max_depth=5, classifier__max_features=0.5,
classifier__max_leaf_nodes=50, classifier__max_samples=None,
classifier__n_estimators=50;, score=(train=0.848, test=0.845) total time=   6.8s
[CV 5/5] END classifier__max_depth=5, classifier__max_features=0.5,
classifier__max_leaf_nodes=50, classifier__max_samples=0.5,
classifier__n_estimators=100;, score=(train=0.849, test=0.852) total time=
10.6s
[CV 2/5] END classifier__max_depth=5, classifier__max_features=0.5,
classifier__max_leaf_nodes=50, classifier__max_samples=None,
classifier__n_estimators=50;, score=(train=0.851, test=0.847) total time=   6.8s

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[CV 3/5] END classifier__max_depth=5, classifier__max_features=0.5,
classifier__max_leaf_nodes=50, classifier__max_samples=None,
classifier__n_estimators=50;, score=(train=0.848, test=0.848) total time=    6.7s
[CV 4/5] END classifier__max_depth=5, classifier__max_features=0.5,
classifier__max_leaf_nodes=50, classifier__max_samples=None,
classifier__n_estimators=50;, score=(train=0.848, test=0.843) total time=    6.7s
[CV 5/5] END classifier__max_depth=5, classifier__max_features=0.5,
classifier__max_leaf_nodes=50, classifier__max_samples=None,
classifier__n_estimators=50;, score=(train=0.847, test=0.850) total time=    6.8s
[CV 1/5] END classifier__max_depth=5, classifier__max_features=0.5,
classifier__max_leaf_nodes=50, classifier__max_samples=None,
classifier__n_estimators=100;, score=(train=0.849, test=0.845) total time=
13.5s
[CV 2/5] END classifier__max_depth=5, classifier__max_features=0.5,
classifier__max_leaf_nodes=50, classifier__max_samples=None,
classifier__n_estimators=100;, score=(train=0.849, test=0.846) total time=
13.6s
[CV 3/5] END classifier__max_depth=5, classifier__max_features=0.5,
classifier__max_leaf_nodes=50, classifier__max_samples=None,
classifier__n_estimators=100;, score=(train=0.848, test=0.849) total time=
13.7s
[CV 1/5] END classifier__max_depth=15, classifier__max_features=sqrt,
classifier__max_leaf_nodes=15, classifier__max_samples=0.5,
classifier__n_estimators=50;, score=(train=0.846, test=0.847) total time=    1.8s
[CV 2/5] END classifier__max_depth=15, classifier__max_features=sqrt,
classifier__max_leaf_nodes=15, classifier__max_samples=0.5,
classifier__n_estimators=50;, score=(train=0.852, test=0.849) total time=    1.7s
[CV 3/5] END classifier__max_depth=15, classifier__max_features=sqrt,
classifier__max_leaf_nodes=15, classifier__max_samples=0.5,
classifier__n_estimators=50;, score=(train=0.849, test=0.848) total time=    1.8s
[CV 4/5] END classifier__max_depth=5, classifier__max_features=0.5,
classifier__max_leaf_nodes=50, classifier__max_samples=None,
classifier__n_estimators=100;, score=(train=0.849, test=0.844) total time=
13.8s
[CV 4/5] END classifier__max_depth=15, classifier__max_features=sqrt,
classifier__max_leaf_nodes=15, classifier__max_samples=0.5,
classifier__n_estimators=50;, score=(train=0.855, test=0.855) total time=    1.7s
[CV 5/5] END classifier__max_depth=5, classifier__max_features=0.5,
classifier__max_leaf_nodes=50, classifier__max_samples=None,
classifier__n_estimators=100;, score=(train=0.848, test=0.851) total time=
13.5s
[CV 5/5] END classifier__max_depth=15, classifier__max_features=sqrt,
classifier__max_leaf_nodes=15, classifier__max_samples=0.5,
classifier__n_estimators=50;, score=(train=0.848, test=0.851) total time=    1.8s
[CV 1/5] END classifier__max_depth=15, classifier__max_features=sqrt,
classifier__max_leaf_nodes=15, classifier__max_samples=0.5,
classifier__n_estimators=100;, score=(train=0.856, test=0.856) total time=
3.2s
```

[CV 2/5] END classifier__max_depth=15, classifier__max_features=sqrt,
classifier__max_leaf_nodes=15, classifier__max_samples=0.5,
classifier__n_estimators=100;, score=(train=0.854, test=0.850) total time=
3.2s
[CV 3/5] END classifier__max_depth=15, classifier__max_features=sqrt,
classifier__max_leaf_nodes=15, classifier__max_samples=0.5,
classifier__n_estimators=100;, score=(train=0.850, test=0.849) total time=
3.2s
[CV 1/5] END classifier__max_depth=15, classifier__max_features=sqrt,
classifier__max_leaf_nodes=15, classifier__max_samples=None,
classifier__n_estimators=50;, score=(train=0.851, test=0.850) total time=   2.1s
[CV 4/5] END classifier__max_depth=15, classifier__max_features=sqrt,
classifier__max_leaf_nodes=15, classifier__max_samples=0.5,
classifier__n_estimators=100;, score=(train=0.856, test=0.856) total time=
3.2s
[CV 5/5] END classifier__max_depth=15, classifier__max_features=sqrt,
classifier__max_leaf_nodes=15, classifier__max_samples=0.5,
classifier__n_estimators=100;, score=(train=0.850, test=0.852) total time=
3.2s
[CV 2/5] END classifier__max_depth=15, classifier__max_features=sqrt,
classifier__max_leaf_nodes=15, classifier__max_samples=None,
classifier__n_estimators=50;, score=(train=0.851, test=0.847) total time=   2.0s
[CV 3/5] END classifier__max_depth=15, classifier__max_features=sqrt,
classifier__max_leaf_nodes=15, classifier__max_samples=None,
classifier__n_estimators=50;, score=(train=0.845, test=0.843) total time=   2.1s
[CV 4/5] END classifier__max_depth=15, classifier__max_features=sqrt,
classifier__max_leaf_nodes=15, classifier__max_samples=None,
classifier__n_estimators=50;, score=(train=0.853, test=0.854) total time=   2.1s
[CV 5/5] END classifier__max_depth=15, classifier__max_features=sqrt,
classifier__max_leaf_nodes=15, classifier__max_samples=None,
classifier__n_estimators=50;, score=(train=0.852, test=0.855) total time=   2.0s
[CV 1/5] END classifier__max_depth=15, classifier__max_features=sqrt,
classifier__max_leaf_nodes=15, classifier__max_samples=None,
classifier__n_estimators=100;, score=(train=0.854, test=0.853) total time=
4.0s
[CV 2/5] END classifier__max_depth=15, classifier__max_features=sqrt,
classifier__max_leaf_nodes=15, classifier__max_samples=None,
classifier__n_estimators=100;, score=(train=0.853, test=0.849) total time=
4.0s
[CV 3/5] END classifier__max_depth=15, classifier__max_features=sqrt,
classifier__max_leaf_nodes=15, classifier__max_samples=None,
classifier__n_estimators=100;, score=(train=0.851, test=0.850) total time=
3.8s
[CV 4/5] END classifier__max_depth=15, classifier__max_features=sqrt,
classifier__max_leaf_nodes=15, classifier__max_samples=None,
classifier__n_estimators=100;, score=(train=0.854, test=0.853) total time=
3.9s
[CV 1/5] END classifier__max_depth=15, classifier__max_features=sqrt,

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classifier__max_leaf_nodes=50, classifier__max_samples=0.5,
classifier__n_estimators=50;, score=(train=0.859, test=0.858) total time=   2.6s
[CV 5/5] END classifier__max_depth=15, classifier__max_features=sqrt,
classifier__max_leaf_nodes=15, classifier__max_samples=None,
classifier__n_estimators=100;, score=(train=0.854, test=0.856) total time=
3.9s
[CV 2/5] END classifier__max_depth=15, classifier__max_features=sqrt,
classifier__max_leaf_nodes=50, classifier__max_samples=0.5,
classifier__n_estimators=50;, score=(train=0.863, test=0.858) total time=   2.7s
[CV 3/5] END classifier__max_depth=15, classifier__max_features=sqrt,
classifier__max_leaf_nodes=50, classifier__max_samples=0.5,
classifier__n_estimators=50;, score=(train=0.862, test=0.861) total time=   2.7s
[CV 4/5] END classifier__max_depth=15, classifier__max_features=sqrt,
classifier__max_leaf_nodes=50, classifier__max_samples=0.5,
classifier__n_estimators=50;, score=(train=0.864, test=0.863) total time=   2.7s
[CV 5/5] END classifier__max_depth=15, classifier__max_features=sqrt,
classifier__max_leaf_nodes=50, classifier__max_samples=0.5,
classifier__n_estimators=50;, score=(train=0.862, test=0.863) total time=   2.6s
[CV 1/5] END classifier__max_depth=15, classifier__max_features=sqrt,
classifier__max_leaf_nodes=50, classifier__max_samples=0.5,
classifier__n_estimators=100;, score=(train=0.864, test=0.864) total time=
5.1s
[CV 2/5] END classifier__max_depth=15, classifier__max_features=sqrt,
classifier__max_leaf_nodes=50, classifier__max_samples=0.5,
classifier__n_estimators=100;, score=(train=0.865, test=0.861) total time=
5.0s
[CV 3/5] END classifier__max_depth=15, classifier__max_features=sqrt,
classifier__max_leaf_nodes=50, classifier__max_samples=0.5,
classifier__n_estimators=100;, score=(train=0.863, test=0.861) total time=
5.1s
[CV 4/5] END classifier__max_depth=15, classifier__max_features=sqrt,
classifier__max_leaf_nodes=50, classifier__max_samples=0.5,
classifier__n_estimators=100;, score=(train=0.866, test=0.864) total time=
5.1s
[CV 5/5] END classifier__max_depth=15, classifier__max_features=sqrt,
classifier__max_leaf_nodes=50, classifier__max_samples=0.5,
classifier__n_estimators=100;, score=(train=0.863, test=0.864) total time=
5.1s
[CV 1/5] END classifier__max_depth=15, classifier__max_features=sqrt,
classifier__max_leaf_nodes=50, classifier__max_samples=None,
classifier__n_estimators=50;, score=(train=0.861, test=0.860) total time=   3.2s
[CV 3/5] END classifier__max_depth=15, classifier__max_features=sqrt,
classifier__max_leaf_nodes=50, classifier__max_samples=None,
classifier__n_estimators=50;, score=(train=0.858, test=0.855) total time=   3.3s
[CV 2/5] END classifier__max_depth=15, classifier__max_features=sqrt,
classifier__max_leaf_nodes=50, classifier__max_samples=None,
classifier__n_estimators=50;, score=(train=0.862, test=0.858) total time=   3.4s
[CV 4/5] END classifier__max_depth=15, classifier__max_features=sqrt,

classifier__max_leaf_nodes=50, classifier__max_samples=None,
classifier__n_estimators=50;, score=(train=0.864, test=0.863) total time=   3.2s
[CV 5/5] END classifier__max_depth=15, classifier__max_features=sqrt,
classifier__max_leaf_nodes=50, classifier__max_samples=None,
classifier__n_estimators=50;, score=(train=0.861, test=0.863) total time=   3.3s
[CV 1/5] END classifier__max_depth=15, classifier__max_features=sqrt,
classifier__max_leaf_nodes=50, classifier__max_samples=None,
classifier__n_estimators=100;, score=(train=0.864, test=0.862) total time=
6.4s
[CV 2/5] END classifier__max_depth=15, classifier__max_features=sqrt,
classifier__max_leaf_nodes=50, classifier__max_samples=None,
classifier__n_estimators=100;, score=(train=0.864, test=0.860) total time=
6.5s
[CV 3/5] END classifier__max_depth=15, classifier__max_features=sqrt,
classifier__max_leaf_nodes=50, classifier__max_samples=None,
classifier__n_estimators=100;, score=(train=0.862, test=0.860) total time=
6.4s
[CV 1/5] END classifier__max_depth=15, classifier__max_features=log2,
classifier__max_leaf_nodes=15, classifier__max_samples=0.5,
classifier__n_estimators=50;, score=(train=0.847, test=0.847) total time=   1.5s
[CV 4/5] END classifier__max_depth=15, classifier__max_features=sqrt,
classifier__max_leaf_nodes=50, classifier__max_samples=None,
classifier__n_estimators=100;, score=(train=0.865, test=0.863) total time=
6.4s
[CV 2/5] END classifier__max_depth=15, classifier__max_features=log2,
classifier__max_leaf_nodes=15, classifier__max_samples=0.5,
classifier__n_estimators=50;, score=(train=0.851, test=0.849) total time=   1.4s
[CV 5/5] END classifier__max_depth=15, classifier__max_features=sqrt,
classifier__max_leaf_nodes=50, classifier__max_samples=None,
classifier__n_estimators=100;, score=(train=0.863, test=0.864) total time=
6.4s
[CV 3/5] END classifier__max_depth=15, classifier__max_features=log2,
classifier__max_leaf_nodes=15, classifier__max_samples=0.5,
classifier__n_estimators=50;, score=(train=0.850, test=0.849) total time=   1.4s
[CV 4/5] END classifier__max_depth=15, classifier__max_features=log2,
classifier__max_leaf_nodes=15, classifier__max_samples=0.5,
classifier__n_estimators=50;, score=(train=0.847, test=0.846) total time=   1.4s
[CV 5/5] END classifier__max_depth=15, classifier__max_features=log2,
classifier__max_leaf_nodes=15, classifier__max_samples=0.5,
classifier__n_estimators=50;, score=(train=0.841, test=0.842) total time=   1.4s
[CV 1/5] END classifier__max_depth=15, classifier__max_features=log2,
classifier__max_leaf_nodes=15, classifier__max_samples=0.5,
classifier__n_estimators=100;, score=(train=0.855, test=0.854) total time=
2.7s
[CV 2/5] END classifier__max_depth=15, classifier__max_features=log2,
classifier__max_leaf_nodes=15, classifier__max_samples=0.5,
classifier__n_estimators=100;, score=(train=0.847, test=0.844) total time=
2.7s

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[CV 3/5] END classifier__max_depth=15, classifier__max_features=log2,
classifier__max_leaf_nodes=15, classifier__max_samples=0.5,
classifier__n_estimators=100;, score=(train=0.850, test=0.849) total time=
2.7s
[CV 1/5] END classifier__max_depth=15, classifier__max_features=log2,
classifier__max_leaf_nodes=15, classifier__max_samples=None,
classifier__n_estimators=50;, score=(train=0.841, test=0.842) total time=   1.7s
[CV 4/5] END classifier__max_depth=15, classifier__max_features=log2,
classifier__max_leaf_nodes=15, classifier__max_samples=0.5,
classifier__n_estimators=100;, score=(train=0.850, test=0.850) total time=
2.6s
[CV 5/5] END classifier__max_depth=15, classifier__max_features=log2,
classifier__max_leaf_nodes=15, classifier__max_samples=0.5,
classifier__n_estimators=100;, score=(train=0.849, test=0.851) total time=
2.6s
[CV 2/5] END classifier__max_depth=15, classifier__max_features=log2,
classifier__max_leaf_nodes=15, classifier__max_samples=None,
classifier__n_estimators=50;, score=(train=0.853, test=0.850) total time=   1.6s
[CV 3/5] END classifier__max_depth=15, classifier__max_features=log2,
classifier__max_leaf_nodes=15, classifier__max_samples=None,
classifier__n_estimators=50;, score=(train=0.851, test=0.850) total time=   1.6s
[CV 4/5] END classifier__max_depth=15, classifier__max_features=log2,
classifier__max_leaf_nodes=15, classifier__max_samples=None,
classifier__n_estimators=50;, score=(train=0.853, test=0.852) total time=   1.6s
[CV 5/5] END classifier__max_depth=15, classifier__max_features=log2,
classifier__max_leaf_nodes=15, classifier__max_samples=None,
classifier__n_estimators=50;, score=(train=0.841, test=0.843) total time=   1.6s
[CV 1/5] END classifier__max_depth=15, classifier__max_features=log2,
classifier__max_leaf_nodes=15, classifier__max_samples=None,
classifier__n_estimators=100;, score=(train=0.848, test=0.848) total time=
3.1s
[CV 2/5] END classifier__max_depth=15, classifier__max_features=log2,
classifier__max_leaf_nodes=15, classifier__max_samples=None,
classifier__n_estimators=100;, score=(train=0.852, test=0.848) total time=
3.1s
[CV 3/5] END classifier__max_depth=15, classifier__max_features=log2,
classifier__max_leaf_nodes=15, classifier__max_samples=None,
classifier__n_estimators=100;, score=(train=0.848, test=0.846) total time=
3.0s
[CV 4/5] END classifier__max_depth=15, classifier__max_features=log2,
classifier__max_leaf_nodes=15, classifier__max_samples=None,
classifier__n_estimators=100;, score=(train=0.855, test=0.854) total time=
3.1s
[CV 1/5] END classifier__max_depth=15, classifier__max_features=log2,
classifier__max_leaf_nodes=50, classifier__max_samples=0.5,
classifier__n_estimators=50;, score=(train=0.857, test=0.855) total time=   2.1s
[CV 5/5] END classifier__max_depth=15, classifier__max_features=log2,
classifier__max_leaf_nodes=15, classifier__max_samples=None,
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classifier__n_estimators=100;, score=(train=0.847, test=0.848) total time=
3.1s
[CV 2/5] END classifier__max_depth=15, classifier__max_features=log2,
classifier__max_leaf_nodes=50, classifier__max_samples=0.5,
classifier__n_estimators=50;, score=(train=0.861, test=0.857) total time=   1.9s
[CV 3/5] END classifier__max_depth=15, classifier__max_features=log2,
classifier__max_leaf_nodes=50, classifier__max_samples=0.5,
classifier__n_estimators=50;, score=(train=0.863, test=0.860) total time=   1.9s
[CV 4/5] END classifier__max_depth=15, classifier__max_features=log2,
classifier__max_leaf_nodes=50, classifier__max_samples=0.5,
classifier__n_estimators=50;, score=(train=0.856, test=0.855) total time=   1.9s
[CV 5/5] END classifier__max_depth=15, classifier__max_features=log2,
classifier__max_leaf_nodes=50, classifier__max_samples=0.5,
classifier__n_estimators=50;, score=(train=0.856, test=0.856) total time=   1.9s
[CV 1/5] END classifier__max_depth=15, classifier__max_features=log2,
classifier__max_leaf_nodes=50, classifier__max_samples=0.5,
classifier__n_estimators=100;, score=(train=0.860, test=0.859) total time=
3.5s
[CV 2/5] END classifier__max_depth=15, classifier__max_features=log2,
classifier__max_leaf_nodes=50, classifier__max_samples=0.5,
classifier__n_estimators=100;, score=(train=0.859, test=0.855) total time=
3.5s
[CV 3/5] END classifier__max_depth=15, classifier__max_features=log2,
classifier__max_leaf_nodes=50, classifier__max_samples=0.5,
classifier__n_estimators=100;, score=(train=0.861, test=0.858) total time=
3.5s
[CV 4/5] END classifier__max_depth=15, classifier__max_features=log2,
classifier__max_leaf_nodes=50, classifier__max_samples=0.5,
classifier__n_estimators=100;, score=(train=0.860, test=0.858) total time=
3.6s
[CV 5/5] END classifier__max_depth=15, classifier__max_features=log2,
classifier__max_leaf_nodes=50, classifier__max_samples=0.5,
classifier__n_estimators=100;, score=(train=0.859, test=0.859) total time=
3.6s
[CV 1/5] END classifier__max_depth=15, classifier__max_features=log2,
classifier__max_leaf_nodes=50, classifier__max_samples=None,
classifier__n_estimators=50;, score=(train=0.857, test=0.856) total time=   2.3s
[CV 2/5] END classifier__max_depth=15, classifier__max_features=log2,
classifier__max_leaf_nodes=50, classifier__max_samples=None,
classifier__n_estimators=50;, score=(train=0.863, test=0.859) total time=   2.3s
[CV 3/5] END classifier__max_depth=15, classifier__max_features=log2,
classifier__max_leaf_nodes=50, classifier__max_samples=None,
classifier__n_estimators=50;, score=(train=0.856, test=0.853) total time=   2.3s
[CV 4/5] END classifier__max_depth=15, classifier__max_features=log2,
classifier__max_leaf_nodes=50, classifier__max_samples=None,
classifier__n_estimators=50;, score=(train=0.860, test=0.857) total time=   2.3s
[CV 5/5] END classifier__max_depth=15, classifier__max_features=log2,
classifier__max_leaf_nodes=50, classifier__max_samples=None,

classifier__n_estimators=50;, score=(train=0.854, test=0.855) total time=   2.3s
[CV 1/5] END classifier__max_depth=15, classifier__max_features=log2,
classifier__max_leaf_nodes=50, classifier__max_samples=None,
classifier__n_estimators=100;, score=(train=0.859, test=0.858) total time=
4.5s
[CV 2/5] END classifier__max_depth=15, classifier__max_features=log2,
classifier__max_leaf_nodes=50, classifier__max_samples=None,
classifier__n_estimators=100;, score=(train=0.862, test=0.857) total time=
4.5s
[CV 3/5] END classifier__max_depth=15, classifier__max_features=log2,
classifier__max_leaf_nodes=50, classifier__max_samples=None,
classifier__n_estimators=100;, score=(train=0.857, test=0.854) total time=
4.3s
[CV 4/5] END classifier__max_depth=15, classifier__max_features=log2,
classifier__max_leaf_nodes=50, classifier__max_samples=None,
classifier__n_estimators=100;, score=(train=0.863, test=0.860) total time=
4.4s
[CV 5/5] END classifier__max_depth=15, classifier__max_features=log2,
classifier__max_leaf_nodes=50, classifier__max_samples=None,
classifier__n_estimators=100;, score=(train=0.858, test=0.859) total time=
4.4s
[CV 1/5] END classifier__max_depth=15, classifier__max_features=0.5,
classifier__max_leaf_nodes=15, classifier__max_samples=0.5,
classifier__n_estimators=50;, score=(train=0.850, test=0.847) total time=   5.7s
[CV 2/5] END classifier__max_depth=15, classifier__max_features=0.5,
classifier__max_leaf_nodes=15, classifier__max_samples=0.5,
classifier__n_estimators=50;, score=(train=0.850, test=0.848) total time=   5.7s
[CV 3/5] END classifier__max_depth=15, classifier__max_features=0.5,
classifier__max_leaf_nodes=15, classifier__max_samples=0.5,
classifier__n_estimators=50;, score=(train=0.847, test=0.848) total time=   5.7s
[CV 4/5] END classifier__max_depth=15, classifier__max_features=0.5,
classifier__max_leaf_nodes=15, classifier__max_samples=0.5,
classifier__n_estimators=50;, score=(train=0.848, test=0.845) total time=   5.6s
[CV 5/5] END classifier__max_depth=15, classifier__max_features=0.5,
classifier__max_leaf_nodes=15, classifier__max_samples=0.5,
classifier__n_estimators=50;, score=(train=0.849, test=0.852) total time=   5.6s
[CV 1/5] END classifier__max_depth=15, classifier__max_features=0.5,
classifier__max_leaf_nodes=15, classifier__max_samples=0.5,
classifier__n_estimators=100;, score=(train=0.849, test=0.847) total time=
11.0s
[CV 2/5] END classifier__max_depth=15, classifier__max_features=0.5,
classifier__max_leaf_nodes=15, classifier__max_samples=0.5,
classifier__n_estimators=100;, score=(train=0.849, test=0.847) total time=
10.9s
[CV 3/5] END classifier__max_depth=15, classifier__max_features=0.5,
classifier__max_leaf_nodes=15, classifier__max_samples=0.5,
classifier__n_estimators=100;, score=(train=0.848, test=0.848) total time=
11.2s

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[CV 4/5] END classifier__max_depth=15, classifier__max_features=0.5,
classifier__max_leaf_nodes=15, classifier__max_samples=0.5,
classifier__n_estimators=100;, score=(train=0.850, test=0.847) total time=
11.4s
[CV 1/5] END classifier__max_depth=15, classifier__max_features=0.5,
classifier__max_leaf_nodes=15, classifier__max_samples=None,
classifier__n_estimators=50;, score=(train=0.848, test=0.845) total time=   7.3s
[CV 5/5] END classifier__max_depth=15, classifier__max_features=0.5,
classifier__max_leaf_nodes=15, classifier__max_samples=0.5,
classifier__n_estimators=100;, score=(train=0.849, test=0.853) total time=
11.1s
[CV 2/5] END classifier__max_depth=15, classifier__max_features=0.5,
classifier__max_leaf_nodes=15, classifier__max_samples=None,
classifier__n_estimators=50;, score=(train=0.850, test=0.849) total time=   7.8s
[CV 3/5] END classifier__max_depth=15, classifier__max_features=0.5,
classifier__max_leaf_nodes=15, classifier__max_samples=None,
classifier__n_estimators=50;, score=(train=0.848, test=0.849) total time=   7.6s
[CV 4/5] END classifier__max_depth=15, classifier__max_features=0.5,
classifier__max_leaf_nodes=15, classifier__max_samples=None,
classifier__n_estimators=50;, score=(train=0.849, test=0.845) total time=   7.8s
[CV 5/5] END classifier__max_depth=15, classifier__max_features=0.5,
classifier__max_leaf_nodes=15, classifier__max_samples=None,
classifier__n_estimators=50;, score=(train=0.849, test=0.853) total time=   7.7s
[CV 1/5] END classifier__max_depth=15, classifier__max_features=0.5,
classifier__max_leaf_nodes=15, classifier__max_samples=None,
classifier__n_estimators=100;, score=(train=0.849, test=0.845) total time=
14.8s
[CV 2/5] END classifier__max_depth=15, classifier__max_features=0.5,
classifier__max_leaf_nodes=15, classifier__max_samples=None,
classifier__n_estimators=100;, score=(train=0.849, test=0.847) total time=
14.8s
[CV 3/5] END classifier__max_depth=15, classifier__max_features=0.5,
classifier__max_leaf_nodes=15, classifier__max_samples=None,
classifier__n_estimators=100;, score=(train=0.847, test=0.848) total time=
14.5s
[CV 4/5] END classifier__max_depth=15, classifier__max_features=0.5,
classifier__max_leaf_nodes=15, classifier__max_samples=None,
classifier__n_estimators=100;, score=(train=0.850, test=0.846) total time=
14.4s
[CV 5/5] END classifier__max_depth=15, classifier__max_features=0.5,
classifier__max_leaf_nodes=15, classifier__max_samples=None,
classifier__n_estimators=100;, score=(train=0.848, test=0.853) total time=
14.2s
[CV 1/5] END classifier__max_depth=15, classifier__max_features=0.5,
classifier__max_leaf_nodes=50, classifier__max_samples=0.5,
classifier__n_estimators=50;, score=(train=0.867, test=0.865) total time=  11.8s
[CV 2/5] END classifier__max_depth=15, classifier__max_features=0.5,
classifier__max_leaf_nodes=50, classifier__max_samples=0.5,
```

classifier__n_estimators=50;, score=(train=0.867, test=0.864) total time= 11.5s
[CV 3/5] END classifier__max_depth=15, classifier__max_features=0.5,
classifier__max_leaf_nodes=50, classifier__max_samples=0.5,
classifier__n_estimators=50;, score=(train=0.866, test=0.865) total time= 11.5s
[CV 4/5] END classifier__max_depth=15, classifier__max_features=0.5,
classifier__max_leaf_nodes=50, classifier__max_samples=0.5,
classifier__n_estimators=50;, score=(train=0.867, test=0.861) total time= 11.6s
[CV 5/5] END classifier__max_depth=15, classifier__max_features=0.5,
classifier__max_leaf_nodes=50, classifier__max_samples=0.5,
classifier__n_estimators=50;, score=(train=0.867, test=0.869) total time= 11.6s
[CV 1/5] END classifier__max_depth=15, classifier__max_features=0.5,
classifier__max_leaf_nodes=50, classifier__max_samples=0.5,
classifier__n_estimators=100;, score=(train=0.867, test=0.865) total time=
23.1s
[CV 2/5] END classifier__max_depth=15, classifier__max_features=0.5,
classifier__max_leaf_nodes=50, classifier__max_samples=0.5,
classifier__n_estimators=100;, score=(train=0.867, test=0.864) total time=
22.8s
[CV 3/5] END classifier__max_depth=15, classifier__max_features=0.5,
classifier__max_leaf_nodes=50, classifier__max_samples=0.5,
classifier__n_estimators=100;, score=(train=0.866, test=0.865) total time=
22.6s
[CV 4/5] END classifier__max_depth=15, classifier__max_features=0.5,
classifier__max_leaf_nodes=50, classifier__max_samples=0.5,
classifier__n_estimators=100;, score=(train=0.868, test=0.862) total time=
21.8s
[CV 5/5] END classifier__max_depth=15, classifier__max_features=0.5,
classifier__max_leaf_nodes=50, classifier__max_samples=0.5,
classifier__n_estimators=100;, score=(train=0.867, test=0.869) total time=
21.2s
[CV 1/5] END classifier__max_depth=15, classifier__max_features=0.5,
classifier__max_leaf_nodes=50, classifier__max_samples=None,
classifier__n_estimators=50;, score=(train=0.866, test=0.863) total time= 13.7s
[CV 2/5] END classifier__max_depth=15, classifier__max_features=0.5,
classifier__max_leaf_nodes=50, classifier__max_samples=None,
classifier__n_estimators=50;, score=(train=0.867, test=0.864) total time= 14.9s
[CV 3/5] END classifier__max_depth=15, classifier__max_features=0.5,
classifier__max_leaf_nodes=50, classifier__max_samples=None,
classifier__n_estimators=50;, score=(train=0.866, test=0.865) total time= 15.4s
[CV 4/5] END classifier__max_depth=15, classifier__max_features=0.5,
classifier__max_leaf_nodes=50, classifier__max_samples=None,
classifier__n_estimators=50;, score=(train=0.867, test=0.860) total time= 15.6s
[CV 5/5] END classifier__max_depth=15, classifier__max_features=0.5,
classifier__max_leaf_nodes=50, classifier__max_samples=None,
classifier__n_estimators=50;, score=(train=0.866, test=0.868) total time= 15.5s
[CV 1/5] END classifier__max_depth=15, classifier__max_features=0.5,
classifier__max_leaf_nodes=50, classifier__max_samples=None,
classifier__n_estimators=100;, score=(train=0.866, test=0.864) total time=

30.6s
[CV 2/5] END classifier__max_depth=15, classifier__max_features=0.5,
classifier__max_leaf_nodes=50, classifier__max_samples=None,
classifier__n_estimators=100;, score=(train=0.867, test=0.864) total time=
30.6s
[CV 3/5] END classifier__max_depth=15, classifier__max_features=0.5,
classifier__max_leaf_nodes=50, classifier__max_samples=None,
classifier__n_estimators=100;, score=(train=0.866, test=0.865) total time=
30.5s
[CV 1/5] END classifier__max_depth=25, classifier__max_features=sqrt,
classifier__max_leaf_nodes=15, classifier__max_samples=0.5,
classifier__n_estimators=50;, score=(train=0.846, test=0.847) total time=   1.6s
[CV 2/5] END classifier__max_depth=25, classifier__max_features=sqrt,
classifier__max_leaf_nodes=15, classifier__max_samples=0.5,
classifier__n_estimators=50;, score=(train=0.852, test=0.849) total time=   1.7s
[CV 3/5] END classifier__max_depth=25, classifier__max_features=sqrt,
classifier__max_leaf_nodes=15, classifier__max_samples=0.5,
classifier__n_estimators=50;, score=(train=0.849, test=0.848) total time=   1.6s
[CV 4/5] END classifier__max_depth=25, classifier__max_features=sqrt,
classifier__max_leaf_nodes=15, classifier__max_samples=0.5,
classifier__n_estimators=50;, score=(train=0.855, test=0.855) total time=   1.7s
[CV 5/5] END classifier__max_depth=25, classifier__max_features=sqrt,
classifier__max_leaf_nodes=15, classifier__max_samples=0.5,
classifier__n_estimators=50;, score=(train=0.848, test=0.851) total time=   1.7s
[CV 1/5] END classifier__max_depth=25, classifier__max_features=sqrt,
classifier__max_leaf_nodes=15, classifier__max_samples=0.5,
classifier__n_estimators=100;, score=(train=0.856, test=0.856) total time=
3.1s
[CV 4/5] END classifier__max_depth=15, classifier__max_features=0.5,
classifier__max_leaf_nodes=50, classifier__max_samples=None,
classifier__n_estimators=100;, score=(train=0.868, test=0.861) total time=
31.3s
[CV 2/5] END classifier__max_depth=25, classifier__max_features=sqrt,
classifier__max_leaf_nodes=15, classifier__max_samples=0.5,
classifier__n_estimators=100;, score=(train=0.854, test=0.850) total time=
3.3s
[CV 5/5] END classifier__max_depth=15, classifier__max_features=0.5,
classifier__max_leaf_nodes=50, classifier__max_samples=None,
classifier__n_estimators=100;, score=(train=0.866, test=0.868) total time=
31.3s
[CV 3/5] END classifier__max_depth=25, classifier__max_features=sqrt,
classifier__max_leaf_nodes=15, classifier__max_samples=0.5,
classifier__n_estimators=100;, score=(train=0.850, test=0.849) total time=
3.2s
[CV 4/5] END classifier__max_depth=25, classifier__max_features=sqrt,
classifier__max_leaf_nodes=15, classifier__max_samples=0.5,
classifier__n_estimators=100;, score=(train=0.856, test=0.856) total time=
3.2s

[CV 5/5] END classifier__max_depth=25, classifier__max_features=sqrt, classifier__max_leaf_nodes=15, classifier__max_samples=0.5, classifier__n_estimators=100;, score=(train=0.850, test=0.852) total time= 3.1s
[CV 1/5] END classifier__max_depth=25, classifier__max_features=sqrt, classifier__max_leaf_nodes=15, classifier__max_samples=None, classifier__n_estimators=50;, score=(train=0.851, test=0.850) total time=   1.9s
[CV 2/5] END classifier__max_depth=25, classifier__max_features=sqrt, classifier__max_leaf_nodes=15, classifier__max_samples=None, classifier__n_estimators=50;, score=(train=0.851, test=0.847) total time=   2.1s
[CV 3/5] END classifier__max_depth=25, classifier__max_features=sqrt, classifier__max_leaf_nodes=15, classifier__max_samples=None, classifier__n_estimators=50;, score=(train=0.845, test=0.843) total time=   2.0s
[CV 4/5] END classifier__max_depth=25, classifier__max_features=sqrt, classifier__max_leaf_nodes=15, classifier__max_samples=None, classifier__n_estimators=50;, score=(train=0.853, test=0.854) total time=   2.0s
[CV 5/5] END classifier__max_depth=25, classifier__max_features=sqrt, classifier__max_leaf_nodes=15, classifier__max_samples=None, classifier__n_estimators=50;, score=(train=0.852, test=0.855) total time=   2.0s
[CV 1/5] END classifier__max_depth=25, classifier__max_features=sqrt, classifier__max_leaf_nodes=15, classifier__max_samples=None, classifier__n_estimators=100;, score=(train=0.854, test=0.853) total time= 3.8s
[CV 2/5] END classifier__max_depth=25, classifier__max_features=sqrt, classifier__max_leaf_nodes=15, classifier__max_samples=None, classifier__n_estimators=100;, score=(train=0.853, test=0.849) total time= 3.9s
[CV 3/5] END classifier__max_depth=25, classifier__max_features=sqrt, classifier__max_leaf_nodes=15, classifier__max_samples=None, classifier__n_estimators=100;, score=(train=0.851, test=0.850) total time= 3.9s
[CV 4/5] END classifier__max_depth=25, classifier__max_features=sqrt, classifier__max_leaf_nodes=15, classifier__max_samples=None, classifier__n_estimators=100;, score=(train=0.854, test=0.853) total time= 3.8s
[CV 1/5] END classifier__max_depth=25, classifier__max_features=sqrt, classifier__max_leaf_nodes=50, classifier__max_samples=0.5, classifier__n_estimators=50;, score=(train=0.860, test=0.859) total time=   2.7s
[CV 5/5] END classifier__max_depth=25, classifier__max_features=sqrt, classifier__max_leaf_nodes=15, classifier__max_samples=None, classifier__n_estimators=100;, score=(train=0.854, test=0.856) total time= 3.8s
[CV 2/5] END classifier__max_depth=25, classifier__max_features=sqrt, classifier__max_leaf_nodes=50, classifier__max_samples=0.5, classifier__n_estimators=50;, score=(train=0.863, test=0.859) total time=   2.5s
[CV 3/5] END classifier__max_depth=25, classifier__max_features=sqrt, classifier__max_leaf_nodes=50, classifier__max_samples=0.5, classifier__n_estimators=50;, score=(train=0.863, test=0.862) total time=   2.7s

[CV 4/5] END classifier__max_depth=25, classifier__max_features=sqrt,
classifier__max_leaf_nodes=50, classifier__max_samples=0.5,
classifier__n_estimators=50;, score=(train=0.865, test=0.864) total time=   2.7s
[CV 5/5] END classifier__max_depth=25, classifier__max_features=sqrt,
classifier__max_leaf_nodes=50, classifier__max_samples=0.5,
classifier__n_estimators=50;, score=(train=0.861, test=0.862) total time=   2.5s
[CV 1/5] END classifier__max_depth=25, classifier__max_features=sqrt,
classifier__max_leaf_nodes=50, classifier__max_samples=0.5,
classifier__n_estimators=100;, score=(train=0.865, test=0.864) total time=
5.3s
[CV 2/5] END classifier__max_depth=25, classifier__max_features=sqrt,
classifier__max_leaf_nodes=50, classifier__max_samples=0.5,
classifier__n_estimators=100;, score=(train=0.865, test=0.861) total time=
5.2s
[CV 3/5] END classifier__max_depth=25, classifier__max_features=sqrt,
classifier__max_leaf_nodes=50, classifier__max_samples=0.5,
classifier__n_estimators=100;, score=(train=0.864, test=0.861) total time=
5.1s
[CV 1/5] END classifier__max_depth=25, classifier__max_features=sqrt,
classifier__max_leaf_nodes=50, classifier__max_samples=None,
classifier__n_estimators=50;, score=(train=0.862, test=0.862) total time=   3.3s
[CV 4/5] END classifier__max_depth=25, classifier__max_features=sqrt,
classifier__max_leaf_nodes=50, classifier__max_samples=0.5,
classifier__n_estimators=100;, score=(train=0.866, test=0.865) total time=
5.1s
[CV 5/5] END classifier__max_depth=25, classifier__max_features=sqrt,
classifier__max_leaf_nodes=50, classifier__max_samples=0.5,
classifier__n_estimators=100;, score=(train=0.862, test=0.863) total time=
5.0s
[CV 2/5] END classifier__max_depth=25, classifier__max_features=sqrt,
classifier__max_leaf_nodes=50, classifier__max_samples=None,
classifier__n_estimators=50;, score=(train=0.862, test=0.858) total time=   3.4s
[CV 3/5] END classifier__max_depth=25, classifier__max_features=sqrt,
classifier__max_leaf_nodes=50, classifier__max_samples=None,
classifier__n_estimators=50;, score=(train=0.858, test=0.855) total time=   3.4s
[CV 4/5] END classifier__max_depth=25, classifier__max_features=sqrt,
classifier__max_leaf_nodes=50, classifier__max_samples=None,
classifier__n_estimators=50;, score=(train=0.864, test=0.863) total time=   3.3s
[CV 5/5] END classifier__max_depth=25, classifier__max_features=sqrt,
classifier__max_leaf_nodes=50, classifier__max_samples=None,
classifier__n_estimators=50;, score=(train=0.862, test=0.863) total time=   3.4s
[CV 1/5] END classifier__max_depth=25, classifier__max_features=sqrt,
classifier__max_leaf_nodes=50, classifier__max_samples=None,
classifier__n_estimators=100;, score=(train=0.865, test=0.863) total time=
6.6s
[CV 2/5] END classifier__max_depth=25, classifier__max_features=sqrt,
classifier__max_leaf_nodes=50, classifier__max_samples=None,
classifier__n_estimators=100;, score=(train=0.864, test=0.860) total time=

6.6s
[CV 3/5] END classifier__max_depth=25, classifier__max_features=sqrt,
classifier__max_leaf_nodes=50, classifier__max_samples=None,
classifier__n_estimators=100;, score=(train=0.863, test=0.860) total time=
6.5s
[CV 1/5] END classifier__max_depth=25, classifier__max_features=log2,
classifier__max_leaf_nodes=15, classifier__max_samples=0.5,
classifier__n_estimators=50;, score=(train=0.847, test=0.847) total time=   1.5s
[CV 4/5] END classifier__max_depth=25, classifier__max_features=sqrt,
classifier__max_leaf_nodes=50, classifier__max_samples=None,
classifier__n_estimators=100;, score=(train=0.866, test=0.864) total time=
6.4s
[CV 2/5] END classifier__max_depth=25, classifier__max_features=log2,
classifier__max_leaf_nodes=15, classifier__max_samples=0.5,
classifier__n_estimators=50;, score=(train=0.851, test=0.849) total time=   1.5s
[CV 5/5] END classifier__max_depth=25, classifier__max_features=sqrt,
classifier__max_leaf_nodes=50, classifier__max_samples=None,
classifier__n_estimators=100;, score=(train=0.863, test=0.865) total time=
6.5s
[CV 3/5] END classifier__max_depth=25, classifier__max_features=log2,
classifier__max_leaf_nodes=15, classifier__max_samples=0.5,
classifier__n_estimators=50;, score=(train=0.850, test=0.849) total time=   1.4s
[CV 4/5] END classifier__max_depth=25, classifier__max_features=log2,
classifier__max_leaf_nodes=15, classifier__max_samples=0.5,
classifier__n_estimators=50;, score=(train=0.847, test=0.846) total time=   1.4s
[CV 5/5] END classifier__max_depth=25, classifier__max_features=log2,
classifier__max_leaf_nodes=15, classifier__max_samples=0.5,
classifier__n_estimators=50;, score=(train=0.841, test=0.842) total time=   1.4s
[CV 1/5] END classifier__max_depth=25, classifier__max_features=log2,
classifier__max_leaf_nodes=15, classifier__max_samples=0.5,
classifier__n_estimators=100;, score=(train=0.855, test=0.854) total time=
2.7s
[CV 2/5] END classifier__max_depth=25, classifier__max_features=log2,
classifier__max_leaf_nodes=15, classifier__max_samples=0.5,
classifier__n_estimators=100;, score=(train=0.847, test=0.844) total time=
2.7s
[CV 3/5] END classifier__max_depth=25, classifier__max_features=log2,
classifier__max_leaf_nodes=15, classifier__max_samples=0.5,
classifier__n_estimators=100;, score=(train=0.850, test=0.849) total time=
2.7s
[CV 1/5] END classifier__max_depth=25, classifier__max_features=log2,
classifier__max_leaf_nodes=15, classifier__max_samples=None,
classifier__n_estimators=50;, score=(train=0.841, test=0.842) total time=   1.6s
[CV 4/5] END classifier__max_depth=25, classifier__max_features=log2,
classifier__max_leaf_nodes=15, classifier__max_samples=0.5,
classifier__n_estimators=100;, score=(train=0.850, test=0.850) total time=
2.5s
[CV 5/5] END classifier__max_depth=25, classifier__max_features=log2,

classifier__max_leaf_nodes=15, classifier__max_samples=0.5,
classifier__n_estimators=100;, score=(train=0.849, test=0.851) total time=
2.5s
[CV 2/5] END classifier__max_depth=25, classifier__max_features=log2,
classifier__max_leaf_nodes=15, classifier__max_samples=None,
classifier__n_estimators=50;, score=(train=0.853, test=0.850) total time=   1.6s
[CV 3/5] END classifier__max_depth=25, classifier__max_features=log2,
classifier__max_leaf_nodes=15, classifier__max_samples=None,
classifier__n_estimators=50;, score=(train=0.851, test=0.850) total time=   1.7s
[CV 4/5] END classifier__max_depth=25, classifier__max_features=log2,
classifier__max_leaf_nodes=15, classifier__max_samples=None,
classifier__n_estimators=50;, score=(train=0.853, test=0.852) total time=   1.7s
[CV 5/5] END classifier__max_depth=25, classifier__max_features=log2,
classifier__max_leaf_nodes=15, classifier__max_samples=None,
classifier__n_estimators=50;, score=(train=0.841, test=0.843) total time=   1.6s
[CV 1/5] END classifier__max_depth=25, classifier__max_features=log2,
classifier__max_leaf_nodes=15, classifier__max_samples=None,
classifier__n_estimators=100;, score=(train=0.848, test=0.848) total time=
3.1s
[CV 2/5] END classifier__max_depth=25, classifier__max_features=log2,
classifier__max_leaf_nodes=15, classifier__max_samples=None,
classifier__n_estimators=100;, score=(train=0.852, test=0.848) total time=
3.1s
[CV 3/5] END classifier__max_depth=25, classifier__max_features=log2,
classifier__max_leaf_nodes=15, classifier__max_samples=None,
classifier__n_estimators=100;, score=(train=0.848, test=0.846) total time=
3.0s
[CV 1/5] END classifier__max_depth=25, classifier__max_features=log2,
classifier__max_leaf_nodes=50, classifier__max_samples=0.5,
classifier__n_estimators=50;, score=(train=0.858, test=0.857) total time=   2.1s
[CV 4/5] END classifier__max_depth=25, classifier__max_features=log2,
classifier__max_leaf_nodes=15, classifier__max_samples=None,
classifier__n_estimators=100;, score=(train=0.855, test=0.854) total time=
3.1s
[CV 5/5] END classifier__max_depth=25, classifier__max_features=log2,
classifier__max_leaf_nodes=15, classifier__max_samples=None,
classifier__n_estimators=100;, score=(train=0.847, test=0.848) total time=
3.1s
[CV 2/5] END classifier__max_depth=25, classifier__max_features=log2,
classifier__max_leaf_nodes=50, classifier__max_samples=0.5,
classifier__n_estimators=50;, score=(train=0.861, test=0.857) total time=   2.0s
[CV 3/5] END classifier__max_depth=25, classifier__max_features=log2,
classifier__max_leaf_nodes=50, classifier__max_samples=0.5,
classifier__n_estimators=50;, score=(train=0.863, test=0.860) total time=   2.1s
[CV 4/5] END classifier__max_depth=25, classifier__max_features=log2,
classifier__max_leaf_nodes=50, classifier__max_samples=0.5,
classifier__n_estimators=50;, score=(train=0.859, test=0.856) total time=   2.0s
[CV 5/5] END classifier__max_depth=25, classifier__max_features=log2,

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classifier__max_leaf_nodes=50, classifier__max_samples=0.5,
classifier__n_estimators=50;, score=(train=0.858, test=0.858) total time=   2.0s
[CV 1/5] END classifier__max_depth=25, classifier__max_features=log2,
classifier__max_leaf_nodes=50, classifier__max_samples=0.5,
classifier__n_estimators=100;, score=(train=0.861, test=0.859) total time=
3.8s
[CV 2/5] END classifier__max_depth=25, classifier__max_features=log2,
classifier__max_leaf_nodes=50, classifier__max_samples=0.5,
classifier__n_estimators=100;, score=(train=0.859, test=0.855) total time=
3.8s
[CV 3/5] END classifier__max_depth=25, classifier__max_features=log2,
classifier__max_leaf_nodes=50, classifier__max_samples=0.5,
classifier__n_estimators=100;, score=(train=0.862, test=0.859) total time=
3.8s
[CV 4/5] END classifier__max_depth=25, classifier__max_features=log2,
classifier__max_leaf_nodes=50, classifier__max_samples=0.5,
classifier__n_estimators=100;, score=(train=0.860, test=0.858) total time=
3.8s
[CV 5/5] END classifier__max_depth=25, classifier__max_features=log2,
classifier__max_leaf_nodes=50, classifier__max_samples=0.5,
classifier__n_estimators=100;, score=(train=0.860, test=0.860) total time=
3.9s
[CV 1/5] END classifier__max_depth=25, classifier__max_features=log2,
classifier__max_leaf_nodes=50, classifier__max_samples=None,
classifier__n_estimators=50;, score=(train=0.859, test=0.858) total time=   2.4s
[CV 2/5] END classifier__max_depth=25, classifier__max_features=log2,
classifier__max_leaf_nodes=50, classifier__max_samples=None,
classifier__n_estimators=50;, score=(train=0.864, test=0.860) total time=   2.5s
[CV 3/5] END classifier__max_depth=25, classifier__max_features=log2,
classifier__max_leaf_nodes=50, classifier__max_samples=None,
classifier__n_estimators=50;, score=(train=0.858, test=0.855) total time=   2.5s
[CV 4/5] END classifier__max_depth=25, classifier__max_features=log2,
classifier__max_leaf_nodes=50, classifier__max_samples=None,
classifier__n_estimators=50;, score=(train=0.860, test=0.858) total time=   2.5s
[CV 5/5] END classifier__max_depth=25, classifier__max_features=log2,
classifier__max_leaf_nodes=50, classifier__max_samples=None,
classifier__n_estimators=50;, score=(train=0.858, test=0.859) total time=   2.4s
[CV 1/5] END classifier__max_depth=25, classifier__max_features=log2,
classifier__max_leaf_nodes=50, classifier__max_samples=None,
classifier__n_estimators=100;, score=(train=0.860, test=0.859) total time=
4.8s
[CV 2/5] END classifier__max_depth=25, classifier__max_features=log2,
classifier__max_leaf_nodes=50, classifier__max_samples=None,
classifier__n_estimators=100;, score=(train=0.863, test=0.858) total time=
4.8s
[CV 3/5] END classifier__max_depth=25, classifier__max_features=log2,
classifier__max_leaf_nodes=50, classifier__max_samples=None,
classifier__n_estimators=100;, score=(train=0.858, test=0.855) total time=
```

4.6s
[CV 4/5] END classifier__max_depth=25, classifier__max_features=log2,
classifier__max_leaf_nodes=50, classifier__max_samples=None,
classifier__n_estimators=100;, score=(train=0.863, test=0.860) total time=
4.6s
[CV 5/5] END classifier__max_depth=25, classifier__max_features=log2,
classifier__max_leaf_nodes=50, classifier__max_samples=None,
classifier__n_estimators=100;, score=(train=0.860, test=0.861) total time=
4.6s
[CV 1/5] END classifier__max_depth=25, classifier__max_features=0.5,
classifier__max_leaf_nodes=15, classifier__max_samples=0.5,
classifier__n_estimators=50;, score=(train=0.850, test=0.847) total time=   5.6s
[CV 2/5] END classifier__max_depth=25, classifier__max_features=0.5,
classifier__max_leaf_nodes=15, classifier__max_samples=0.5,
classifier__n_estimators=50;, score=(train=0.850, test=0.848) total time=   5.6s
[CV 3/5] END classifier__max_depth=25, classifier__max_features=0.5,
classifier__max_leaf_nodes=15, classifier__max_samples=0.5,
classifier__n_estimators=50;, score=(train=0.847, test=0.848) total time=   5.6s
[CV 4/5] END classifier__max_depth=25, classifier__max_features=0.5,
classifier__max_leaf_nodes=15, classifier__max_samples=0.5,
classifier__n_estimators=50;, score=(train=0.848, test=0.845) total time=   5.6s
[CV 5/5] END classifier__max_depth=25, classifier__max_features=0.5,
classifier__max_leaf_nodes=15, classifier__max_samples=0.5,
classifier__n_estimators=50;, score=(train=0.849, test=0.852) total time=   6.0s
[CV 1/5] END classifier__max_depth=25, classifier__max_features=0.5,
classifier__max_leaf_nodes=15, classifier__max_samples=0.5,
classifier__n_estimators=100;, score=(train=0.849, test=0.847) total time=
11.4s
[CV 2/5] END classifier__max_depth=25, classifier__max_features=0.5,
classifier__max_leaf_nodes=15, classifier__max_samples=0.5,
classifier__n_estimators=100;, score=(train=0.849, test=0.847) total time=
11.2s
[CV 3/5] END classifier__max_depth=25, classifier__max_features=0.5,
classifier__max_leaf_nodes=15, classifier__max_samples=0.5,
classifier__n_estimators=100;, score=(train=0.848, test=0.848) total time=
10.9s
[CV 4/5] END classifier__max_depth=25, classifier__max_features=0.5,
classifier__max_leaf_nodes=15, classifier__max_samples=0.5,
classifier__n_estimators=100;, score=(train=0.850, test=0.847) total time=
11.7s
[CV 1/5] END classifier__max_depth=25, classifier__max_features=0.5,
classifier__max_leaf_nodes=15, classifier__max_samples=None,
classifier__n_estimators=50;, score=(train=0.848, test=0.845) total time=   8.2s
[CV 5/5] END classifier__max_depth=25, classifier__max_features=0.5,
classifier__max_leaf_nodes=15, classifier__max_samples=0.5,
classifier__n_estimators=100;, score=(train=0.849, test=0.853) total time=
11.9s
[CV 2/5] END classifier__max_depth=25, classifier__max_features=0.5,

classifier__max_leaf_nodes=15, classifier__max_samples=None,
classifier__n_estimators=50;, score=(train=0.850, test=0.849) total time=   7.9s
[CV 3/5] END classifier__max_depth=25, classifier__max_features=0.5,
classifier__max_leaf_nodes=15, classifier__max_samples=None,
classifier__n_estimators=50;, score=(train=0.848, test=0.849) total time=   7.8s
[CV 4/5] END classifier__max_depth=25, classifier__max_features=0.5,
classifier__max_leaf_nodes=15, classifier__max_samples=None,
classifier__n_estimators=50;, score=(train=0.849, test=0.845) total time=   8.0s
[CV 5/5] END classifier__max_depth=25, classifier__max_features=0.5,
classifier__max_leaf_nodes=15, classifier__max_samples=None,
classifier__n_estimators=50;, score=(train=0.849, test=0.853) total time=   7.4s
[CV 1/5] END classifier__max_depth=25, classifier__max_features=0.5,
classifier__max_leaf_nodes=15, classifier__max_samples=None,
classifier__n_estimators=100;, score=(train=0.849, test=0.845) total time=
14.6s
[CV 2/5] END classifier__max_depth=25, classifier__max_features=0.5,
classifier__max_leaf_nodes=15, classifier__max_samples=None,
classifier__n_estimators=100;, score=(train=0.849, test=0.847) total time=
14.5s
[CV 3/5] END classifier__max_depth=25, classifier__max_features=0.5,
classifier__max_leaf_nodes=15, classifier__max_samples=None,
classifier__n_estimators=100;, score=(train=0.847, test=0.848) total time=
14.5s
[CV 4/5] END classifier__max_depth=25, classifier__max_features=0.5,
classifier__max_leaf_nodes=15, classifier__max_samples=None,
classifier__n_estimators=100;, score=(train=0.850, test=0.846) total time=
18.4s
[CV 5/5] END classifier__max_depth=25, classifier__max_features=0.5,
classifier__max_leaf_nodes=15, classifier__max_samples=None,
classifier__n_estimators=100;, score=(train=0.848, test=0.853) total time=
18.9s
[CV 1/5] END classifier__max_depth=25, classifier__max_features=0.5,
classifier__max_leaf_nodes=50, classifier__max_samples=0.5,
classifier__n_estimators=50;, score=(train=0.867, test=0.865) total time= 18.1s
[CV 2/5] END classifier__max_depth=25, classifier__max_features=0.5,
classifier__max_leaf_nodes=50, classifier__max_samples=0.5,
classifier__n_estimators=50;, score=(train=0.867, test=0.864) total time= 16.3s
[CV 3/5] END classifier__max_depth=25, classifier__max_features=0.5,
classifier__max_leaf_nodes=50, classifier__max_samples=0.5,
classifier__n_estimators=50;, score=(train=0.866, test=0.865) total time= 15.3s
[CV 4/5] END classifier__max_depth=25, classifier__max_features=0.5,
classifier__max_leaf_nodes=50, classifier__max_samples=0.5,
classifier__n_estimators=50;, score=(train=0.867, test=0.861) total time= 15.5s
[CV 5/5] END classifier__max_depth=25, classifier__max_features=0.5,
classifier__max_leaf_nodes=50, classifier__max_samples=0.5,
classifier__n_estimators=50;, score=(train=0.867, test=0.869) total time= 14.9s
[CV 1/5] END classifier__max_depth=25, classifier__max_features=0.5,
classifier__max_leaf_nodes=50, classifier__max_samples=0.5,

classifier__n_estimators=100;, score=(train=0.867, test=0.865) total time=
27.7s
[CV 2/5] END classifier__max_depth=25, classifier__max_features=0.5,
classifier__max_leaf_nodes=50, classifier__max_samples=0.5,
classifier__n_estimators=100;, score=(train=0.867, test=0.864) total time=
26.3s
[CV 3/5] END classifier__max_depth=25, classifier__max_features=0.5,
classifier__max_leaf_nodes=50, classifier__max_samples=0.5,
classifier__n_estimators=100;, score=(train=0.866, test=0.865) total time=
25.9s
[CV 4/5] END classifier__max_depth=25, classifier__max_features=0.5,
classifier__max_leaf_nodes=50, classifier__max_samples=0.5,
classifier__n_estimators=100;, score=(train=0.868, test=0.862) total time=
25.9s
[CV 5/5] END classifier__max_depth=25, classifier__max_features=0.5,
classifier__max_leaf_nodes=50, classifier__max_samples=0.5,
classifier__n_estimators=100;, score=(train=0.867, test=0.869) total time=
25.8s
[CV 1/5] END classifier__max_depth=25, classifier__max_features=0.5,
classifier__max_leaf_nodes=50, classifier__max_samples=None,
classifier__n_estimators=50;, score=(train=0.866, test=0.864) total time=   17.8s
[CV 2/5] END classifier__max_depth=25, classifier__max_features=0.5,
classifier__max_leaf_nodes=50, classifier__max_samples=None,
classifier__n_estimators=50;, score=(train=0.867, test=0.864) total time=   17.0s
[CV 3/5] END classifier__max_depth=25, classifier__max_features=0.5,
classifier__max_leaf_nodes=50, classifier__max_samples=None,
classifier__n_estimators=50;, score=(train=0.866, test=0.865) total time=   16.6s
[CV 4/5] END classifier__max_depth=25, classifier__max_features=0.5,
classifier__max_leaf_nodes=50, classifier__max_samples=None,
classifier__n_estimators=50;, score=(train=0.867, test=0.860) total time=   16.6s
[CV 5/5] END classifier__max_depth=25, classifier__max_features=0.5,
classifier__max_leaf_nodes=50, classifier__max_samples=None,
classifier__n_estimators=50;, score=(train=0.866, test=0.868) total time=   18.2s
[CV 1/5] END classifier__max_depth=25, classifier__max_features=0.5,
classifier__max_leaf_nodes=50, classifier__max_samples=None,
classifier__n_estimators=100;, score=(train=0.866, test=0.864) total time=
35.9s
[CV 2/5] END classifier__max_depth=25, classifier__max_features=0.5,
classifier__max_leaf_nodes=50, classifier__max_samples=None,
classifier__n_estimators=100;, score=(train=0.867, test=0.864) total time=
35.7s
[CV 3/5] END classifier__max_depth=25, classifier__max_features=0.5,
classifier__max_leaf_nodes=50, classifier__max_samples=None,
classifier__n_estimators=100;, score=(train=0.866, test=0.865) total time=
33.9s
[CV 4/5] END classifier__max_depth=25, classifier__max_features=0.5,
classifier__max_leaf_nodes=50, classifier__max_samples=None,
classifier__n_estimators=100;, score=(train=0.868, test=0.861) total time=

30.9s
[CV 5/5] END classifier__max_depth=25, classifier__max_features=0.5,
classifier__max_leaf_nodes=50, classifier__max_samples=None,
classifier__n_estimators=100;, score=(train=0.866, test=0.868) total time=
31.1s
Best parameters for outer fold 2: {'classifier__max_depth': 15,
'classifier__max_features': 0.5, 'classifier__max_leaf_nodes': 50,
'classifier__max_samples': 0.5, 'classifier__n_estimators': 100}
ROC AUC for outer fold 2: 0.8646265177972543

Starting outer fold 3
Fitting 5 folds for each of 72 candidates, totalling 360 fits
[CV 1/5] END classifier__max_depth=5, classifier__max_features=sqrt,
classifier__max_leaf_nodes=15, classifier__max_samples=0.5,
classifier__n_estimators=50;, score=(train=0.849, test=0.845) total time=   1.5s
[CV 2/5] END classifier__max_depth=5, classifier__max_features=sqrt,
classifier__max_leaf_nodes=15, classifier__max_samples=0.5,
classifier__n_estimators=50;, score=(train=0.851, test=0.850) total time=   1.5s
[CV 3/5] END classifier__max_depth=5, classifier__max_features=sqrt,
classifier__max_leaf_nodes=15, classifier__max_samples=0.5,
classifier__n_estimators=50;, score=(train=0.844, test=0.849) total time=   1.6s
[CV 4/5] END classifier__max_depth=5, classifier__max_features=sqrt,
classifier__max_leaf_nodes=15, classifier__max_samples=0.5,
classifier__n_estimators=50;, score=(train=0.847, test=0.841) total time=   1.5s
[CV 5/5] END classifier__max_depth=5, classifier__max_features=sqrt,
classifier__max_leaf_nodes=15, classifier__max_samples=0.5,
classifier__n_estimators=50;, score=(train=0.853, test=0.853) total time=   1.5s
[CV 1/5] END classifier__max_depth=5, classifier__max_features=sqrt,
classifier__max_leaf_nodes=15, classifier__max_samples=0.5,
classifier__n_estimators=100;, score=(train=0.849, test=0.845) total time=
2.8s
[CV 2/5] END classifier__max_depth=5, classifier__max_features=sqrt,
classifier__max_leaf_nodes=15, classifier__max_samples=0.5,
classifier__n_estimators=100;, score=(train=0.853, test=0.853) total time=
2.8s
[CV 3/5] END classifier__max_depth=5, classifier__max_features=sqrt,
classifier__max_leaf_nodes=15, classifier__max_samples=0.5,
classifier__n_estimators=100;, score=(train=0.845, test=0.851) total time=
2.8s
[CV 4/5] END classifier__max_depth=5, classifier__max_features=sqrt,
classifier__max_leaf_nodes=15, classifier__max_samples=0.5,
classifier__n_estimators=100;, score=(train=0.851, test=0.845) total time=
2.7s
[CV 1/5] END classifier__max_depth=5, classifier__max_features=sqrt,
classifier__max_leaf_nodes=15, classifier__max_samples=None,
classifier__n_estimators=50;, score=(train=0.848, test=0.844) total time=   1.7s
[CV 5/5] END classifier__max_depth=5, classifier__max_features=sqrt,
classifier__max_leaf_nodes=15, classifier__max_samples=0.5,

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classifier__n_estimators=100;, score=(train=0.854, test=0.854) total time=
2.7s
[CV 2/5] END classifier__max_depth=5, classifier__max_features=sqrt,
classifier__max_leaf_nodes=15, classifier__max_samples=None,
classifier__n_estimators=50;, score=(train=0.852, test=0.852) total time=   1.7s
[CV 3/5] END classifier__max_depth=5, classifier__max_features=sqrt,
classifier__max_leaf_nodes=15, classifier__max_samples=None,
classifier__n_estimators=50;, score=(train=0.843, test=0.847) total time=   1.8s
[CV 4/5] END classifier__max_depth=5, classifier__max_features=sqrt,
classifier__max_leaf_nodes=15, classifier__max_samples=None,
classifier__n_estimators=50;, score=(train=0.839, test=0.832) total time=   1.7s
[CV 5/5] END classifier__max_depth=5, classifier__max_features=sqrt,
classifier__max_leaf_nodes=15, classifier__max_samples=None,
classifier__n_estimators=50;, score=(train=0.853, test=0.852) total time=   1.7s
[CV 1/5] END classifier__max_depth=5, classifier__max_features=sqrt,
classifier__max_leaf_nodes=15, classifier__max_samples=None,
classifier__n_estimators=100;, score=(train=0.850, test=0.847) total time=
3.4s
[CV 2/5] END classifier__max_depth=5, classifier__max_features=sqrt,
classifier__max_leaf_nodes=15, classifier__max_samples=None,
classifier__n_estimators=100;, score=(train=0.852, test=0.852) total time=
3.3s
[CV 3/5] END classifier__max_depth=5, classifier__max_features=sqrt,
classifier__max_leaf_nodes=15, classifier__max_samples=None,
classifier__n_estimators=100;, score=(train=0.846, test=0.851) total time=
3.2s
[CV 1/5] END classifier__max_depth=5, classifier__max_features=sqrt,
classifier__max_leaf_nodes=50, classifier__max_samples=0.5,
classifier__n_estimators=50;, score=(train=0.850, test=0.846) total time=   1.5s
[CV 4/5] END classifier__max_depth=5, classifier__max_features=sqrt,
classifier__max_leaf_nodes=15, classifier__max_samples=None,
classifier__n_estimators=100;, score=(train=0.845, test=0.838) total time=
3.0s
[CV 5/5] END classifier__max_depth=5, classifier__max_features=sqrt,
classifier__max_leaf_nodes=15, classifier__max_samples=None,
classifier__n_estimators=100;, score=(train=0.854, test=0.854) total time=
3.1s
[CV 2/5] END classifier__max_depth=5, classifier__max_features=sqrt,
classifier__max_leaf_nodes=50, classifier__max_samples=0.5,
classifier__n_estimators=50;, score=(train=0.851, test=0.850) total time=   1.4s
[CV 3/5] END classifier__max_depth=5, classifier__max_features=sqrt,
classifier__max_leaf_nodes=50, classifier__max_samples=0.5,
classifier__n_estimators=50;, score=(train=0.845, test=0.850) total time=   1.5s
[CV 4/5] END classifier__max_depth=5, classifier__max_features=sqrt,
classifier__max_leaf_nodes=50, classifier__max_samples=0.5,
classifier__n_estimators=50;, score=(train=0.849, test=0.843) total time=   1.4s
[CV 5/5] END classifier__max_depth=5, classifier__max_features=sqrt,
classifier__max_leaf_nodes=50, classifier__max_samples=0.5,
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classifier__n_estimators=50;, score=(train=0.854, test=0.853) total time=   1.4s
[CV 1/5] END classifier__max_depth=5, classifier__max_features=sqrt,
classifier__max_leaf_nodes=50, classifier__max_samples=0.5,
classifier__n_estimators=100;, score=(train=0.849, test=0.846) total time=
2.8s
[CV 2/5] END classifier__max_depth=5, classifier__max_features=sqrt,
classifier__max_leaf_nodes=50, classifier__max_samples=0.5,
classifier__n_estimators=100;, score=(train=0.854, test=0.853) total time=
3.0s
[CV 3/5] END classifier__max_depth=5, classifier__max_features=sqrt,
classifier__max_leaf_nodes=50, classifier__max_samples=0.5,
classifier__n_estimators=100;, score=(train=0.846, test=0.851) total time=
3.0s
[CV 4/5] END classifier__max_depth=5, classifier__max_features=sqrt,
classifier__max_leaf_nodes=50, classifier__max_samples=0.5,
classifier__n_estimators=100;, score=(train=0.852, test=0.846) total time=
2.8s
[CV 1/5] END classifier__max_depth=5, classifier__max_features=sqrt,
classifier__max_leaf_nodes=50, classifier__max_samples=None,
classifier__n_estimators=50;, score=(train=0.848, test=0.844) total time=   1.6s
[CV 5/5] END classifier__max_depth=5, classifier__max_features=sqrt,
classifier__max_leaf_nodes=50, classifier__max_samples=0.5,
classifier__n_estimators=100;, score=(train=0.855, test=0.854) total time=
2.6s
[CV 2/5] END classifier__max_depth=5, classifier__max_features=sqrt,
classifier__max_leaf_nodes=50, classifier__max_samples=None,
classifier__n_estimators=50;, score=(train=0.854, test=0.853) total time=   1.7s
[CV 3/5] END classifier__max_depth=5, classifier__max_features=sqrt,
classifier__max_leaf_nodes=50, classifier__max_samples=None,
classifier__n_estimators=50;, score=(train=0.844, test=0.848) total time=   1.8s
[CV 4/5] END classifier__max_depth=5, classifier__max_features=sqrt,
classifier__max_leaf_nodes=50, classifier__max_samples=None,
classifier__n_estimators=50;, score=(train=0.840, test=0.832) total time=   1.7s
[CV 5/5] END classifier__max_depth=5, classifier__max_features=sqrt,
classifier__max_leaf_nodes=50, classifier__max_samples=None,
classifier__n_estimators=50;, score=(train=0.854, test=0.852) total time=   1.8s
[CV 1/5] END classifier__max_depth=5, classifier__max_features=sqrt,
classifier__max_leaf_nodes=50, classifier__max_samples=None,
classifier__n_estimators=100;, score=(train=0.851, test=0.847) total time=
3.4s
[CV 2/5] END classifier__max_depth=5, classifier__max_features=sqrt,
classifier__max_leaf_nodes=50, classifier__max_samples=None,
classifier__n_estimators=100;, score=(train=0.853, test=0.852) total time=
3.4s
[CV 3/5] END classifier__max_depth=5, classifier__max_features=sqrt,
classifier__max_leaf_nodes=50, classifier__max_samples=None,
classifier__n_estimators=100;, score=(train=0.847, test=0.852) total time=
3.5s

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[CV 1/5] END classifier__max_depth=5, classifier__max_features=log2,
classifier__max_leaf_nodes=15, classifier__max_samples=0.5,
classifier__n_estimators=50;, score=(train=0.838, test=0.834) total time=    1.5s
[CV 4/5] END classifier__max_depth=5, classifier__max_features=sqrt,
classifier__max_leaf_nodes=50, classifier__max_samples=None,
classifier__n_estimators=100;, score=(train=0.846, test=0.839) total time=
3.6s
[CV 5/5] END classifier__max_depth=5, classifier__max_features=sqrt,
classifier__max_leaf_nodes=50, classifier__max_samples=None,
classifier__n_estimators=100;, score=(train=0.855, test=0.854) total time=
3.7s
[CV 2/5] END classifier__max_depth=5, classifier__max_features=log2,
classifier__max_leaf_nodes=15, classifier__max_samples=0.5,
classifier__n_estimators=50;, score=(train=0.840, test=0.839) total time=    1.3s
[CV 3/5] END classifier__max_depth=5, classifier__max_features=log2,
classifier__max_leaf_nodes=15, classifier__max_samples=0.5,
classifier__n_estimators=50;, score=(train=0.832, test=0.839) total time=    1.4s
[CV 4/5] END classifier__max_depth=5, classifier__max_features=log2,
classifier__max_leaf_nodes=15, classifier__max_samples=0.5,
classifier__n_estimators=50;, score=(train=0.840, test=0.834) total time=    1.3s
[CV 5/5] END classifier__max_depth=5, classifier__max_features=log2,
classifier__max_leaf_nodes=15, classifier__max_samples=0.5,
classifier__n_estimators=50;, score=(train=0.848, test=0.849) total time=    1.1s
[CV 1/5] END classifier__max_depth=5, classifier__max_features=log2,
classifier__max_leaf_nodes=15, classifier__max_samples=0.5,
classifier__n_estimators=100;, score=(train=0.847, test=0.843) total time=
2.1s
[CV 2/5] END classifier__max_depth=5, classifier__max_features=log2,
classifier__max_leaf_nodes=15, classifier__max_samples=0.5,
classifier__n_estimators=100;, score=(train=0.848, test=0.848) total time=
2.2s
[CV 3/5] END classifier__max_depth=5, classifier__max_features=log2,
classifier__max_leaf_nodes=15, classifier__max_samples=0.5,
classifier__n_estimators=100;, score=(train=0.840, test=0.846) total time=
2.3s
[CV 4/5] END classifier__max_depth=5, classifier__max_features=log2,
classifier__max_leaf_nodes=15, classifier__max_samples=0.5,
classifier__n_estimators=100;, score=(train=0.845, test=0.839) total time=
2.2s
[CV 1/5] END classifier__max_depth=5, classifier__max_features=log2,
classifier__max_leaf_nodes=15, classifier__max_samples=None,
classifier__n_estimators=50;, score=(train=0.833, test=0.830) total time=    1.4s
[CV 5/5] END classifier__max_depth=5, classifier__max_features=log2,
classifier__max_leaf_nodes=15, classifier__max_samples=0.5,
classifier__n_estimators=100;, score=(train=0.844, test=0.845) total time=
2.3s
[CV 2/5] END classifier__max_depth=5, classifier__max_features=log2,
classifier__max_leaf_nodes=15, classifier__max_samples=None,
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classifier__n_estimators=50;, score=(train=0.836, test=0.835) total time=   1.3s
[CV 3/5] END classifier__max_depth=5, classifier__max_features=log2,
classifier__max_leaf_nodes=15, classifier__max_samples=None,
classifier__n_estimators=50;, score=(train=0.835, test=0.841) total time=   1.3s
[CV 4/5] END classifier__max_depth=5, classifier__max_features=log2,
classifier__max_leaf_nodes=15, classifier__max_samples=None,
classifier__n_estimators=50;, score=(train=0.837, test=0.829) total time=   1.3s
[CV 5/5] END classifier__max_depth=5, classifier__max_features=log2,
classifier__max_leaf_nodes=15, classifier__max_samples=None,
classifier__n_estimators=50;, score=(train=0.849, test=0.850) total time=   1.3s
[CV 1/5] END classifier__max_depth=5, classifier__max_features=log2,
classifier__max_leaf_nodes=15, classifier__max_samples=None,
classifier__n_estimators=100;, score=(train=0.841, test=0.838) total time=
2.3s
[CV 2/5] END classifier__max_depth=5, classifier__max_features=log2,
classifier__max_leaf_nodes=15, classifier__max_samples=None,
classifier__n_estimators=100;, score=(train=0.846, test=0.846) total time=
2.4s
[CV 3/5] END classifier__max_depth=5, classifier__max_features=log2,
classifier__max_leaf_nodes=15, classifier__max_samples=None,
classifier__n_estimators=100;, score=(train=0.842, test=0.847) total time=
2.4s
[CV 4/5] END classifier__max_depth=5, classifier__max_features=log2,
classifier__max_leaf_nodes=15, classifier__max_samples=None,
classifier__n_estimators=100;, score=(train=0.846, test=0.839) total time=
2.2s
[CV 1/5] END classifier__max_depth=5, classifier__max_features=log2,
classifier__max_leaf_nodes=50, classifier__max_samples=0.5,
classifier__n_estimators=50;, score=(train=0.838, test=0.834) total time=   1.1s
[CV 5/5] END classifier__max_depth=5, classifier__max_features=log2,
classifier__max_leaf_nodes=15, classifier__max_samples=None,
classifier__n_estimators=100;, score=(train=0.842, test=0.842) total time=
2.3s
[CV 2/5] END classifier__max_depth=5, classifier__max_features=log2,
classifier__max_leaf_nodes=50, classifier__max_samples=0.5,
classifier__n_estimators=50;, score=(train=0.841, test=0.839) total time=   1.2s
[CV 3/5] END classifier__max_depth=5, classifier__max_features=log2,
classifier__max_leaf_nodes=50, classifier__max_samples=0.5,
classifier__n_estimators=50;, score=(train=0.832, test=0.839) total time=   1.2s
[CV 4/5] END classifier__max_depth=5, classifier__max_features=log2,
classifier__max_leaf_nodes=50, classifier__max_samples=0.5,
classifier__n_estimators=50;, score=(train=0.840, test=0.834) total time=   1.1s
[CV 5/5] END classifier__max_depth=5, classifier__max_features=log2,
classifier__max_leaf_nodes=50, classifier__max_samples=0.5,
classifier__n_estimators=50;, score=(train=0.849, test=0.849) total time=   1.1s
[CV 1/5] END classifier__max_depth=5, classifier__max_features=log2,
classifier__max_leaf_nodes=50, classifier__max_samples=0.5,
classifier__n_estimators=100;, score=(train=0.847, test=0.843) total time=
```

2.1s

[CV 2/5] END classifier__max_depth=5, classifier__max_features=log2,
classifier__max_leaf_nodes=50, classifier__max_samples=0.5,
classifier__n_estimators=100;, score=(train=0.848, test=0.848) total time=
2.1s

[CV 3/5] END classifier__max_depth=5, classifier__max_features=log2,
classifier__max_leaf_nodes=50, classifier__max_samples=0.5,
classifier__n_estimators=100;, score=(train=0.841, test=0.846) total time=
2.1s

[CV 4/5] END classifier__max_depth=5, classifier__max_features=log2,
classifier__max_leaf_nodes=50, classifier__max_samples=0.5,
classifier__n_estimators=100;, score=(train=0.845, test=0.839) total time=
2.1s

[CV 1/5] END classifier__max_depth=5, classifier__max_features=log2,
classifier__max_leaf_nodes=50, classifier__max_samples=None,
classifier__n_estimators=50;, score=(train=0.833, test=0.830) total time=   1.3s

[CV 5/5] END classifier__max_depth=5, classifier__max_features=log2,
classifier__max_leaf_nodes=50, classifier__max_samples=0.5,
classifier__n_estimators=100;, score=(train=0.845, test=0.845) total time=
2.0s

[CV 2/5] END classifier__max_depth=5, classifier__max_features=log2,
classifier__max_leaf_nodes=50, classifier__max_samples=None,
classifier__n_estimators=50;, score=(train=0.836, test=0.835) total time=   1.3s

[CV 3/5] END classifier__max_depth=5, classifier__max_features=log2,
classifier__max_leaf_nodes=50, classifier__max_samples=None,
classifier__n_estimators=50;, score=(train=0.835, test=0.841) total time=   1.3s

[CV 4/5] END classifier__max_depth=5, classifier__max_features=log2,
classifier__max_leaf_nodes=50, classifier__max_samples=None,
classifier__n_estimators=50;, score=(train=0.838, test=0.830) total time=   1.3s

[CV 5/5] END classifier__max_depth=5, classifier__max_features=log2,
classifier__max_leaf_nodes=50, classifier__max_samples=None,
classifier__n_estimators=50;, score=(train=0.849, test=0.850) total time=   1.4s

[CV 1/5] END classifier__max_depth=5, classifier__max_features=log2,
classifier__max_leaf_nodes=50, classifier__max_samples=None,
classifier__n_estimators=100;, score=(train=0.841, test=0.838) total time=
2.6s

[CV 2/5] END classifier__max_depth=5, classifier__max_features=log2,
classifier__max_leaf_nodes=50, classifier__max_samples=None,
classifier__n_estimators=100;, score=(train=0.847, test=0.846) total time=
2.7s

[CV 3/5] END classifier__max_depth=5, classifier__max_features=log2,
classifier__max_leaf_nodes=50, classifier__max_samples=None,
classifier__n_estimators=100;, score=(train=0.842, test=0.847) total time=
2.7s

[CV 4/5] END classifier__max_depth=5, classifier__max_features=log2,
classifier__max_leaf_nodes=50, classifier__max_samples=None,
classifier__n_estimators=100;, score=(train=0.846, test=0.839) total time=
2.7s

[CV 5/5] END classifier__max_depth=5, classifier__max_features=log2,
classifier__max_leaf_nodes=50, classifier__max_samples=None,
classifier__n_estimators=100;, score=(train=0.843, test=0.843) total time=
2.7s
[CV 1/5] END classifier__max_depth=5, classifier__max_features=0.5,
classifier__max_leaf_nodes=15, classifier__max_samples=0.5,
classifier__n_estimators=50;, score=(train=0.845, test=0.842) total time=   4.8s
[CV 2/5] END classifier__max_depth=5, classifier__max_features=0.5,
classifier__max_leaf_nodes=15, classifier__max_samples=0.5,
classifier__n_estimators=50;, score=(train=0.845, test=0.844) total time=   4.6s
[CV 3/5] END classifier__max_depth=5, classifier__max_features=0.5,
classifier__max_leaf_nodes=15, classifier__max_samples=0.5,
classifier__n_estimators=50;, score=(train=0.843, test=0.849) total time=   4.7s
[CV 4/5] END classifier__max_depth=5, classifier__max_features=0.5,
classifier__max_leaf_nodes=15, classifier__max_samples=0.5,
classifier__n_estimators=50;, score=(train=0.846, test=0.841) total time=   4.9s
[CV 5/5] END classifier__max_depth=5, classifier__max_features=0.5,
classifier__max_leaf_nodes=15, classifier__max_samples=0.5,
classifier__n_estimators=50;, score=(train=0.846, test=0.847) total time=   4.7s
[CV 1/5] END classifier__max_depth=5, classifier__max_features=0.5,
classifier__max_leaf_nodes=15, classifier__max_samples=0.5,
classifier__n_estimators=100;, score=(train=0.846, test=0.842) total time=
9.1s
[CV 2/5] END classifier__max_depth=5, classifier__max_features=0.5,
classifier__max_leaf_nodes=15, classifier__max_samples=0.5,
classifier__n_estimators=100;, score=(train=0.845, test=0.844) total time=
9.2s
[CV 3/5] END classifier__max_depth=5, classifier__max_features=0.5,
classifier__max_leaf_nodes=15, classifier__max_samples=0.5,
classifier__n_estimators=100;, score=(train=0.844, test=0.850) total time=
9.0s
[CV 4/5] END classifier__max_depth=5, classifier__max_features=0.5,
classifier__max_leaf_nodes=15, classifier__max_samples=0.5,
classifier__n_estimators=100;, score=(train=0.845, test=0.840) total time=
11.9s
[CV 1/5] END classifier__max_depth=5, classifier__max_features=0.5,
classifier__max_leaf_nodes=15, classifier__max_samples=None,
classifier__n_estimators=50;, score=(train=0.846, test=0.842) total time=   6.4s
[CV 5/5] END classifier__max_depth=5, classifier__max_features=0.5,
classifier__max_leaf_nodes=15, classifier__max_samples=0.5,
classifier__n_estimators=100;, score=(train=0.845, test=0.845) total time=
11.9s
[CV 2/5] END classifier__max_depth=5, classifier__max_features=0.5,
classifier__max_leaf_nodes=15, classifier__max_samples=None,
classifier__n_estimators=50;, score=(train=0.843, test=0.842) total time=   6.2s
[CV 3/5] END classifier__max_depth=5, classifier__max_features=0.5,
classifier__max_leaf_nodes=15, classifier__max_samples=None,
classifier__n_estimators=50;, score=(train=0.843, test=0.849) total time=   6.2s

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[CV 4/5] END classifier__max_depth=5, classifier__max_features=0.5,
classifier__max_leaf_nodes=15, classifier__max_samples=None,
classifier__n_estimators=50;, score=(train=0.845, test=0.840) total time=   6.1s
[CV 5/5] END classifier__max_depth=5, classifier__max_features=0.5,
classifier__max_leaf_nodes=15, classifier__max_samples=None,
classifier__n_estimators=50;, score=(train=0.845, test=0.845) total time=   6.2s
[CV 1/5] END classifier__max_depth=5, classifier__max_features=0.5,
classifier__max_leaf_nodes=15, classifier__max_samples=None,
classifier__n_estimators=100;, score=(train=0.846, test=0.842) total time=
12.2s
[CV 2/5] END classifier__max_depth=5, classifier__max_features=0.5,
classifier__max_leaf_nodes=15, classifier__max_samples=None,
classifier__n_estimators=100;, score=(train=0.844, test=0.843) total time=
12.1s
[CV 3/5] END classifier__max_depth=5, classifier__max_features=0.5,
classifier__max_leaf_nodes=15, classifier__max_samples=None,
classifier__n_estimators=100;, score=(train=0.844, test=0.850) total time=
12.0s
[CV 1/5] END classifier__max_depth=5, classifier__max_features=0.5,
classifier__max_leaf_nodes=50, classifier__max_samples=0.5,
classifier__n_estimators=50;, score=(train=0.850, test=0.845) total time=   5.7s
[CV 4/5] END classifier__max_depth=5, classifier__max_features=0.5,
classifier__max_leaf_nodes=15, classifier__max_samples=None,
classifier__n_estimators=100;, score=(train=0.846, test=0.842) total time=
11.7s
[CV 5/5] END classifier__max_depth=5, classifier__max_features=0.5,
classifier__max_leaf_nodes=15, classifier__max_samples=None,
classifier__n_estimators=100;, score=(train=0.844, test=0.845) total time=
12.0s
[CV 2/5] END classifier__max_depth=5, classifier__max_features=0.5,
classifier__max_leaf_nodes=50, classifier__max_samples=0.5,
classifier__n_estimators=50;, score=(train=0.849, test=0.848) total time=   6.4s
[CV 3/5] END classifier__max_depth=5, classifier__max_features=0.5,
classifier__max_leaf_nodes=50, classifier__max_samples=0.5,
classifier__n_estimators=50;, score=(train=0.848, test=0.853) total time=   7.3s
[CV 4/5] END classifier__max_depth=5, classifier__max_features=0.5,
classifier__max_leaf_nodes=50, classifier__max_samples=0.5,
classifier__n_estimators=50;, score=(train=0.850, test=0.845) total time=   8.3s
[CV 5/5] END classifier__max_depth=5, classifier__max_features=0.5,
classifier__max_leaf_nodes=50, classifier__max_samples=0.5,
classifier__n_estimators=50;, score=(train=0.851, test=0.851) total time=   8.9s
[CV 1/5] END classifier__max_depth=5, classifier__max_features=0.5,
classifier__max_leaf_nodes=50, classifier__max_samples=0.5,
classifier__n_estimators=100;, score=(train=0.850, test=0.845) total time=
13.3s
[CV 2/5] END classifier__max_depth=5, classifier__max_features=0.5,
classifier__max_leaf_nodes=50, classifier__max_samples=0.5,
classifier__n_estimators=100;, score=(train=0.849, test=0.848) total time=
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12.2s
[CV 3/5] END classifier__max_depth=5, classifier__max_features=0.5,
classifier__max_leaf_nodes=50, classifier__max_samples=0.5,
classifier__n_estimators=100;, score=(train=0.849, test=0.854) total time=
11.5s
[CV 4/5] END classifier__max_depth=5, classifier__max_features=0.5,
classifier__max_leaf_nodes=50, classifier__max_samples=0.5,
classifier__n_estimators=100;, score=(train=0.850, test=0.844) total time=
11.7s
[CV 1/5] END classifier__max_depth=5, classifier__max_features=0.5,
classifier__max_leaf_nodes=50, classifier__max_samples=None,
classifier__n_estimators=50;, score=(train=0.850, test=0.845) total time=   8.1s
[CV 5/5] END classifier__max_depth=5, classifier__max_features=0.5,
classifier__max_leaf_nodes=50, classifier__max_samples=0.5,
classifier__n_estimators=100;, score=(train=0.849, test=0.849) total time=
11.7s
[CV 2/5] END classifier__max_depth=5, classifier__max_features=0.5,
classifier__max_leaf_nodes=50, classifier__max_samples=None,
classifier__n_estimators=50;, score=(train=0.848, test=0.846) total time=   8.8s
[CV 3/5] END classifier__max_depth=5, classifier__max_features=0.5,
classifier__max_leaf_nodes=50, classifier__max_samples=None,
classifier__n_estimators=50;, score=(train=0.848, test=0.853) total time=   8.7s
[CV 4/5] END classifier__max_depth=5, classifier__max_features=0.5,
classifier__max_leaf_nodes=50, classifier__max_samples=None,
classifier__n_estimators=50;, score=(train=0.849, test=0.844) total time=   8.9s
[CV 5/5] END classifier__max_depth=5, classifier__max_features=0.5,
classifier__max_leaf_nodes=50, classifier__max_samples=None,
classifier__n_estimators=50;, score=(train=0.849, test=0.849) total time=   9.5s
[CV 1/5] END classifier__max_depth=5, classifier__max_features=0.5,
classifier__max_leaf_nodes=50, classifier__max_samples=None,
classifier__n_estimators=100;, score=(train=0.850, test=0.845) total time=
19.7s
[CV 2/5] END classifier__max_depth=5, classifier__max_features=0.5,
classifier__max_leaf_nodes=50, classifier__max_samples=None,
classifier__n_estimators=100;, score=(train=0.848, test=0.847) total time=
20.4s
[CV 3/5] END classifier__max_depth=5, classifier__max_features=0.5,
classifier__max_leaf_nodes=50, classifier__max_samples=None,
classifier__n_estimators=100;, score=(train=0.849, test=0.854) total time=
19.8s
[CV 1/5] END classifier__max_depth=15, classifier__max_features=sqrt,
classifier__max_leaf_nodes=15, classifier__max_samples=0.5,
classifier__n_estimators=50;, score=(train=0.854, test=0.851) total time=   1.8s
[CV 2/5] END classifier__max_depth=15, classifier__max_features=sqrt,
classifier__max_leaf_nodes=15, classifier__max_samples=0.5,
classifier__n_estimators=50;, score=(train=0.855, test=0.855) total time=   1.8s
[CV 3/5] END classifier__max_depth=15, classifier__max_features=sqrt,
classifier__max_leaf_nodes=15, classifier__max_samples=0.5,

classifier__n_estimators=50;, score=(train=0.851, test=0.856) total time=   2.5s
[CV 4/5] END classifier__max_depth=5, classifier__max_features=0.5,
classifier__max_leaf_nodes=50, classifier__max_samples=None,
classifier__n_estimators=100;, score=(train=0.851, test=0.845) total time=
17.0s
[CV 5/5] END classifier__max_depth=5, classifier__max_features=0.5,
classifier__max_leaf_nodes=50, classifier__max_samples=None,
classifier__n_estimators=100;, score=(train=0.848, test=0.848) total time=
16.8s
[CV 4/5] END classifier__max_depth=15, classifier__max_features=sqrt,
classifier__max_leaf_nodes=15, classifier__max_samples=0.5,
classifier__n_estimators=50;, score=(train=0.854, test=0.848) total time=   2.6s
[CV 5/5] END classifier__max_depth=15, classifier__max_features=sqrt,
classifier__max_leaf_nodes=15, classifier__max_samples=0.5,
classifier__n_estimators=50;, score=(train=0.857, test=0.858) total time=   2.3s
[CV 1/5] END classifier__max_depth=15, classifier__max_features=sqrt,
classifier__max_leaf_nodes=15, classifier__max_samples=0.5,
classifier__n_estimators=100;, score=(train=0.855, test=0.852) total time=
3.6s
[CV 2/5] END classifier__max_depth=15, classifier__max_features=sqrt,
classifier__max_leaf_nodes=15, classifier__max_samples=0.5,
classifier__n_estimators=100;, score=(train=0.855, test=0.856) total time=
3.7s
[CV 3/5] END classifier__max_depth=15, classifier__max_features=sqrt,
classifier__max_leaf_nodes=15, classifier__max_samples=0.5,
classifier__n_estimators=100;, score=(train=0.852, test=0.857) total time=
3.4s
[CV 1/5] END classifier__max_depth=15, classifier__max_features=sqrt,
classifier__max_leaf_nodes=15, classifier__max_samples=None,
classifier__n_estimators=50;, score=(train=0.854, test=0.850) total time=   3.3s
[CV 4/5] END classifier__max_depth=15, classifier__max_features=sqrt,
classifier__max_leaf_nodes=15, classifier__max_samples=0.5,
classifier__n_estimators=100;, score=(train=0.854, test=0.849) total time=
4.8s
[CV 5/5] END classifier__max_depth=15, classifier__max_features=sqrt,
classifier__max_leaf_nodes=15, classifier__max_samples=0.5,
classifier__n_estimators=100;, score=(train=0.856, test=0.857) total time=
5.1s
[CV 2/5] END classifier__max_depth=15, classifier__max_features=sqrt,
classifier__max_leaf_nodes=15, classifier__max_samples=None,
classifier__n_estimators=50;, score=(train=0.854, test=0.854) total time=   3.0s
[CV 3/5] END classifier__max_depth=15, classifier__max_features=sqrt,
classifier__max_leaf_nodes=15, classifier__max_samples=None,
classifier__n_estimators=50;, score=(train=0.850, test=0.855) total time=   2.7s
[CV 4/5] END classifier__max_depth=15, classifier__max_features=sqrt,
classifier__max_leaf_nodes=15, classifier__max_samples=None,
classifier__n_estimators=50;, score=(train=0.849, test=0.843) total time=   2.8s
[CV 5/5] END classifier__max_depth=15, classifier__max_features=sqrt,

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classifier__max_leaf_nodes=15, classifier__max_samples=None,
classifier__n_estimators=50;, score=(train=0.854, test=0.854) total time=   3.1s
[CV 1/5] END classifier__max_depth=15, classifier__max_features=sqrt,
classifier__max_leaf_nodes=15, classifier__max_samples=None,
classifier__n_estimators=100;, score=(train=0.855, test=0.851) total time=
5.3s
[CV 2/5] END classifier__max_depth=15, classifier__max_features=sqrt,
classifier__max_leaf_nodes=15, classifier__max_samples=None,
classifier__n_estimators=100;, score=(train=0.854, test=0.855) total time=
5.4s
[CV 3/5] END classifier__max_depth=15, classifier__max_features=sqrt,
classifier__max_leaf_nodes=15, classifier__max_samples=None,
classifier__n_estimators=100;, score=(train=0.851, test=0.856) total time=
4.7s
[CV 4/5] END classifier__max_depth=15, classifier__max_features=sqrt,
classifier__max_leaf_nodes=15, classifier__max_samples=None,
classifier__n_estimators=100;, score=(train=0.851, test=0.846) total time=
4.1s
[CV 5/5] END classifier__max_depth=15, classifier__max_features=sqrt,
classifier__max_leaf_nodes=15, classifier__max_samples=None,
classifier__n_estimators=100;, score=(train=0.856, test=0.856) total time=
4.2s
[CV 1/5] END classifier__max_depth=15, classifier__max_features=sqrt,
classifier__max_leaf_nodes=50, classifier__max_samples=0.5,
classifier__n_estimators=50;, score=(train=0.865, test=0.861) total time=   2.6s
[CV 2/5] END classifier__max_depth=15, classifier__max_features=sqrt,
classifier__max_leaf_nodes=50, classifier__max_samples=0.5,
classifier__n_estimators=50;, score=(train=0.864, test=0.863) total time=   2.5s
[CV 3/5] END classifier__max_depth=15, classifier__max_features=sqrt,
classifier__max_leaf_nodes=50, classifier__max_samples=0.5,
classifier__n_estimators=50;, score=(train=0.862, test=0.865) total time=   2.6s
[CV 4/5] END classifier__max_depth=15, classifier__max_features=sqrt,
classifier__max_leaf_nodes=50, classifier__max_samples=0.5,
classifier__n_estimators=50;, score=(train=0.864, test=0.858) total time=   2.6s
[CV 5/5] END classifier__max_depth=15, classifier__max_features=sqrt,
classifier__max_leaf_nodes=50, classifier__max_samples=0.5,
classifier__n_estimators=50;, score=(train=0.865, test=0.865) total time=   2.9s
[CV 1/5] END classifier__max_depth=15, classifier__max_features=sqrt,
classifier__max_leaf_nodes=50, classifier__max_samples=0.5,
classifier__n_estimators=100;, score=(train=0.865, test=0.862) total time=
6.2s
[CV 2/5] END classifier__max_depth=15, classifier__max_features=sqrt,
classifier__max_leaf_nodes=50, classifier__max_samples=0.5,
classifier__n_estimators=100;, score=(train=0.865, test=0.864) total time=
6.3s
[CV 3/5] END classifier__max_depth=15, classifier__max_features=sqrt,
classifier__max_leaf_nodes=50, classifier__max_samples=0.5,
classifier__n_estimators=100;, score=(train=0.864, test=0.867) total time=
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6.2s
[CV 4/5] END classifier__max_depth=15, classifier__max_features=sqrt,
classifier__max_leaf_nodes=50, classifier__max_samples=0.5,
classifier__n_estimators=100;, score=(train=0.865, test=0.859) total time=
6.6s
[CV 5/5] END classifier__max_depth=15, classifier__max_features=sqrt,
classifier__max_leaf_nodes=50, classifier__max_samples=0.5,
classifier__n_estimators=100;, score=(train=0.865, test=0.865) total time=
6.5s
[CV 1/5] END classifier__max_depth=15, classifier__max_features=sqrt,
classifier__max_leaf_nodes=50, classifier__max_samples=None,
classifier__n_estimators=50;, score=(train=0.864, test=0.860) total time=   4.4s
[CV 2/5] END classifier__max_depth=15, classifier__max_features=sqrt,
classifier__max_leaf_nodes=50, classifier__max_samples=None,
classifier__n_estimators=50;, score=(train=0.864, test=0.864) total time=   4.6s
[CV 3/5] END classifier__max_depth=15, classifier__max_features=sqrt,
classifier__max_leaf_nodes=50, classifier__max_samples=None,
classifier__n_estimators=50;, score=(train=0.862, test=0.864) total time=   4.6s
[CV 4/5] END classifier__max_depth=15, classifier__max_features=sqrt,
classifier__max_leaf_nodes=50, classifier__max_samples=None,
classifier__n_estimators=50;, score=(train=0.862, test=0.856) total time=   4.6s
[CV 5/5] END classifier__max_depth=15, classifier__max_features=sqrt,
classifier__max_leaf_nodes=50, classifier__max_samples=None,
classifier__n_estimators=50;, score=(train=0.864, test=0.863) total time=   4.8s
[CV 1/5] END classifier__max_depth=15, classifier__max_features=sqrt,
classifier__max_leaf_nodes=50, classifier__max_samples=None,
classifier__n_estimators=100;, score=(train=0.865, test=0.861) total time=
8.0s
[CV 2/5] END classifier__max_depth=15, classifier__max_features=sqrt,
classifier__max_leaf_nodes=50, classifier__max_samples=None,
classifier__n_estimators=100;, score=(train=0.866, test=0.865) total time=
7.9s
[CV 3/5] END classifier__max_depth=15, classifier__max_features=sqrt,
classifier__max_leaf_nodes=50, classifier__max_samples=None,
classifier__n_estimators=100;, score=(train=0.864, test=0.867) total time=
6.9s
[CV 1/5] END classifier__max_depth=15, classifier__max_features=log2,
classifier__max_leaf_nodes=15, classifier__max_samples=0.5,
classifier__n_estimators=50;, score=(train=0.842, test=0.838) total time=   1.6s
[CV 4/5] END classifier__max_depth=15, classifier__max_features=sqrt,
classifier__max_leaf_nodes=50, classifier__max_samples=None,
classifier__n_estimators=100;, score=(train=0.864, test=0.858) total time=
7.0s
[CV 2/5] END classifier__max_depth=15, classifier__max_features=log2,
classifier__max_leaf_nodes=15, classifier__max_samples=0.5,
classifier__n_estimators=50;, score=(train=0.848, test=0.849) total time=   1.7s
[CV 5/5] END classifier__max_depth=15, classifier__max_features=sqrt,
classifier__max_leaf_nodes=50, classifier__max_samples=None,
```

classifier__n_estimators=100;, score=(train=0.865, test=0.864) total time=
7.1s
[CV 3/5] END classifier__max_depth=15, classifier__max_features=log2,
classifier__max_leaf_nodes=15, classifier__max_samples=0.5,
classifier__n_estimators=50;, score=(train=0.842, test=0.847) total time=   2.0s
[CV 4/5] END classifier__max_depth=15, classifier__max_features=log2,
classifier__max_leaf_nodes=15, classifier__max_samples=0.5,
classifier__n_estimators=50;, score=(train=0.852, test=0.847) total time=   2.4s
[CV 5/5] END classifier__max_depth=15, classifier__max_features=log2,
classifier__max_leaf_nodes=15, classifier__max_samples=0.5,
classifier__n_estimators=50;, score=(train=0.853, test=0.853) total time=   2.5s
[CV 1/5] END classifier__max_depth=15, classifier__max_features=log2,
classifier__max_leaf_nodes=15, classifier__max_samples=0.5,
classifier__n_estimators=100;, score=(train=0.847, test=0.844) total time=
4.1s
[CV 2/5] END classifier__max_depth=15, classifier__max_features=log2,
classifier__max_leaf_nodes=15, classifier__max_samples=0.5,
classifier__n_estimators=100;, score=(train=0.853, test=0.853) total time=
4.2s
[CV 3/5] END classifier__max_depth=15, classifier__max_features=log2,
classifier__max_leaf_nodes=15, classifier__max_samples=0.5,
classifier__n_estimators=100;, score=(train=0.845, test=0.850) total time=
4.2s
[CV 1/5] END classifier__max_depth=15, classifier__max_features=log2,
classifier__max_leaf_nodes=15, classifier__max_samples=None,
classifier__n_estimators=50;, score=(train=0.841, test=0.838) total time=   1.8s
[CV 4/5] END classifier__max_depth=15, classifier__max_features=log2,
classifier__max_leaf_nodes=15, classifier__max_samples=0.5,
classifier__n_estimators=100;, score=(train=0.852, test=0.848) total time=
3.1s
[CV 5/5] END classifier__max_depth=15, classifier__max_features=log2,
classifier__max_leaf_nodes=15, classifier__max_samples=0.5,
classifier__n_estimators=100;, score=(train=0.849, test=0.850) total time=
2.8s
[CV 2/5] END classifier__max_depth=15, classifier__max_features=log2,
classifier__max_leaf_nodes=15, classifier__max_samples=None,
classifier__n_estimators=50;, score=(train=0.842, test=0.841) total time=   1.6s
[CV 3/5] END classifier__max_depth=15, classifier__max_features=log2,
classifier__max_leaf_nodes=15, classifier__max_samples=None,
classifier__n_estimators=50;, score=(train=0.848, test=0.853) total time=   1.5s
[CV 4/5] END classifier__max_depth=15, classifier__max_features=log2,
classifier__max_leaf_nodes=15, classifier__max_samples=None,
classifier__n_estimators=50;, score=(train=0.849, test=0.842) total time=   1.6s
[CV 5/5] END classifier__max_depth=15, classifier__max_features=log2,
classifier__max_leaf_nodes=15, classifier__max_samples=None,
classifier__n_estimators=50;, score=(train=0.852, test=0.853) total time=   1.8s
[CV 1/5] END classifier__max_depth=15, classifier__max_features=log2,
classifier__max_leaf_nodes=15, classifier__max_samples=None,

classifier__n_estimators=100;, score=(train=0.847, test=0.844) total time=
3.2s
[CV 2/5] END classifier__max_depth=15, classifier__max_features=log2,
classifier__max_leaf_nodes=15, classifier__max_samples=None,
classifier__n_estimators=100;, score=(train=0.847, test=0.847) total time=
3.2s
[CV 3/5] END classifier__max_depth=15, classifier__max_features=log2,
classifier__max_leaf_nodes=15, classifier__max_samples=None,
classifier__n_estimators=100;, score=(train=0.852, test=0.856) total time=
3.2s
[CV 4/5] END classifier__max_depth=15, classifier__max_features=log2,
classifier__max_leaf_nodes=15, classifier__max_samples=None,
classifier__n_estimators=100;, score=(train=0.848, test=0.842) total time=
3.2s
[CV 1/5] END classifier__max_depth=15, classifier__max_features=log2,
classifier__max_leaf_nodes=50, classifier__max_samples=0.5,
classifier__n_estimators=50;, score=(train=0.856, test=0.852) total time=   2.3s
[CV 5/5] END classifier__max_depth=15, classifier__max_features=log2,
classifier__max_leaf_nodes=15, classifier__max_samples=None,
classifier__n_estimators=100;, score=(train=0.850, test=0.850) total time=
3.8s
[CV 2/5] END classifier__max_depth=15, classifier__max_features=log2,
classifier__max_leaf_nodes=50, classifier__max_samples=0.5,
classifier__n_estimators=50;, score=(train=0.857, test=0.856) total time=   3.3s
[CV 3/5] END classifier__max_depth=15, classifier__max_features=log2,
classifier__max_leaf_nodes=50, classifier__max_samples=0.5,
classifier__n_estimators=50;, score=(train=0.856, test=0.860) total time=   3.2s
[CV 4/5] END classifier__max_depth=15, classifier__max_features=log2,
classifier__max_leaf_nodes=50, classifier__max_samples=0.5,
classifier__n_estimators=50;, score=(train=0.860, test=0.854) total time=   3.2s
[CV 5/5] END classifier__max_depth=15, classifier__max_features=log2,
classifier__max_leaf_nodes=50, classifier__max_samples=0.5,
classifier__n_estimators=50;, score=(train=0.858, test=0.858) total time=   1.9s
[CV 1/5] END classifier__max_depth=15, classifier__max_features=log2,
classifier__max_leaf_nodes=50, classifier__max_samples=0.5,
classifier__n_estimators=100;, score=(train=0.857, test=0.854) total time=
3.9s
[CV 2/5] END classifier__max_depth=15, classifier__max_features=log2,
classifier__max_leaf_nodes=50, classifier__max_samples=0.5,
classifier__n_estimators=100;, score=(train=0.859, test=0.858) total time=
3.9s
[CV 3/5] END classifier__max_depth=15, classifier__max_features=log2,
classifier__max_leaf_nodes=50, classifier__max_samples=0.5,
classifier__n_estimators=100;, score=(train=0.856, test=0.860) total time=
3.8s
[CV 4/5] END classifier__max_depth=15, classifier__max_features=log2,
classifier__max_leaf_nodes=50, classifier__max_samples=0.5,
classifier__n_estimators=100;, score=(train=0.861, test=0.855) total time=

3.6s
[CV 1/5] END classifier__max_depth=15, classifier__max_features=log2,
classifier__max_leaf_nodes=50, classifier__max_samples=None,
classifier__n_estimators=50;, score=(train=0.856, test=0.852) total time=   2.3s
[CV 5/5] END classifier__max_depth=15, classifier__max_features=log2,
classifier__max_leaf_nodes=50, classifier__max_samples=0.5,
classifier__n_estimators=100;, score=(train=0.859, test=0.858) total time=
3.6s
[CV 2/5] END classifier__max_depth=15, classifier__max_features=log2,
classifier__max_leaf_nodes=50, classifier__max_samples=None,
classifier__n_estimators=50;, score=(train=0.853, test=0.852) total time=   3.1s
[CV 3/5] END classifier__max_depth=15, classifier__max_features=log2,
classifier__max_leaf_nodes=50, classifier__max_samples=None,
classifier__n_estimators=50;, score=(train=0.858, test=0.861) total time=   2.8s
[CV 4/5] END classifier__max_depth=15, classifier__max_features=log2,
classifier__max_leaf_nodes=50, classifier__max_samples=None,
classifier__n_estimators=50;, score=(train=0.859, test=0.851) total time=   2.8s
[CV 5/5] END classifier__max_depth=15, classifier__max_features=log2,
classifier__max_leaf_nodes=50, classifier__max_samples=None,
classifier__n_estimators=50;, score=(train=0.859, test=0.859) total time=   2.3s
[CV 1/5] END classifier__max_depth=15, classifier__max_features=log2,
classifier__max_leaf_nodes=50, classifier__max_samples=None,
classifier__n_estimators=100;, score=(train=0.858, test=0.855) total time=
4.7s
[CV 2/5] END classifier__max_depth=15, classifier__max_features=log2,
classifier__max_leaf_nodes=50, classifier__max_samples=None,
classifier__n_estimators=100;, score=(train=0.857, test=0.856) total time=
4.9s
[CV 3/5] END classifier__max_depth=15, classifier__max_features=log2,
classifier__max_leaf_nodes=50, classifier__max_samples=None,
classifier__n_estimators=100;, score=(train=0.859, test=0.861) total time=
5.4s
[CV 4/5] END classifier__max_depth=15, classifier__max_features=log2,
classifier__max_leaf_nodes=50, classifier__max_samples=None,
classifier__n_estimators=100;, score=(train=0.858, test=0.851) total time=
4.3s
[CV 5/5] END classifier__max_depth=15, classifier__max_features=log2,
classifier__max_leaf_nodes=50, classifier__max_samples=None,
classifier__n_estimators=100;, score=(train=0.859, test=0.858) total time=
4.3s
[CV 1/5] END classifier__max_depth=15, classifier__max_features=0.5,
classifier__max_leaf_nodes=15, classifier__max_samples=0.5,
classifier__n_estimators=50;, score=(train=0.849, test=0.845) total time=   6.7s
[CV 2/5] END classifier__max_depth=15, classifier__max_features=0.5,
classifier__max_leaf_nodes=15, classifier__max_samples=0.5,
classifier__n_estimators=50;, score=(train=0.850, test=0.849) total time=   7.6s
[CV 3/5] END classifier__max_depth=15, classifier__max_features=0.5,
classifier__max_leaf_nodes=15, classifier__max_samples=0.5,

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classifier__n_estimators=50;, score=(train=0.847, test=0.852) total time=   7.9s
[CV 4/5] END classifier__max_depth=15, classifier__max_features=0.5,
classifier__max_leaf_nodes=15, classifier__max_samples=0.5,
classifier__n_estimators=50;, score=(train=0.850, test=0.845) total time=   7.2s
[CV 5/5] END classifier__max_depth=15, classifier__max_features=0.5,
classifier__max_leaf_nodes=15, classifier__max_samples=0.5,
classifier__n_estimators=50;, score=(train=0.848, test=0.849) total time=   6.3s
[CV 1/5] END classifier__max_depth=15, classifier__max_features=0.5,
classifier__max_leaf_nodes=15, classifier__max_samples=0.5,
classifier__n_estimators=100;, score=(train=0.849, test=0.846) total time=
12.6s
[CV 2/5] END classifier__max_depth=15, classifier__max_features=0.5,
classifier__max_leaf_nodes=15, classifier__max_samples=0.5,
classifier__n_estimators=100;, score=(train=0.849, test=0.848) total time=
12.8s
[CV 3/5] END classifier__max_depth=15, classifier__max_features=0.5,
classifier__max_leaf_nodes=15, classifier__max_samples=0.5,
classifier__n_estimators=100;, score=(train=0.848, test=0.854) total time=
13.4s
[CV 4/5] END classifier__max_depth=15, classifier__max_features=0.5,
classifier__max_leaf_nodes=15, classifier__max_samples=0.5,
classifier__n_estimators=100;, score=(train=0.849, test=0.845) total time=
16.2s
[CV 1/5] END classifier__max_depth=15, classifier__max_features=0.5,
classifier__max_leaf_nodes=15, classifier__max_samples=None,
classifier__n_estimators=50;, score=(train=0.850, test=0.846) total time=  11.7s
[CV 5/5] END classifier__max_depth=15, classifier__max_features=0.5,
classifier__max_leaf_nodes=15, classifier__max_samples=0.5,
classifier__n_estimators=100;, score=(train=0.848, test=0.848) total time=
16.6s
[CV 2/5] END classifier__max_depth=15, classifier__max_features=0.5,
classifier__max_leaf_nodes=15, classifier__max_samples=None,
classifier__n_estimators=50;, score=(train=0.848, test=0.846) total time=   8.8s
[CV 3/5] END classifier__max_depth=15, classifier__max_features=0.5,
classifier__max_leaf_nodes=15, classifier__max_samples=None,
classifier__n_estimators=50;, score=(train=0.846, test=0.851) total time=   7.9s
[CV 4/5] END classifier__max_depth=15, classifier__max_features=0.5,
classifier__max_leaf_nodes=15, classifier__max_samples=None,
classifier__n_estimators=50;, score=(train=0.850, test=0.846) total time=   7.6s
[CV 5/5] END classifier__max_depth=15, classifier__max_features=0.5,
classifier__max_leaf_nodes=15, classifier__max_samples=None,
classifier__n_estimators=50;, score=(train=0.849, test=0.849) total time=   7.5s
[CV 1/5] END classifier__max_depth=15, classifier__max_features=0.5,
classifier__max_leaf_nodes=15, classifier__max_samples=None,
classifier__n_estimators=100;, score=(train=0.850, test=0.846) total time=
15.3s
[CV 2/5] END classifier__max_depth=15, classifier__max_features=0.5,
classifier__max_leaf_nodes=15, classifier__max_samples=None,
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classifier__n_estimators=100;, score=(train=0.848, test=0.847) total time=
15.6s
[CV 3/5] END classifier__max_depth=15, classifier__max_features=0.5,
classifier__max_leaf_nodes=15, classifier__max_samples=None,
classifier__n_estimators=100;, score=(train=0.847, test=0.853) total time=
16.0s
[CV 4/5] END classifier__max_depth=15, classifier__max_features=0.5,
classifier__max_leaf_nodes=15, classifier__max_samples=None,
classifier__n_estimators=100;, score=(train=0.850, test=0.846) total time=
16.6s
[CV 5/5] END classifier__max_depth=15, classifier__max_features=0.5,
classifier__max_leaf_nodes=15, classifier__max_samples=None,
classifier__n_estimators=100;, score=(train=0.849, test=0.849) total time=
16.5s
[CV 1/5] END classifier__max_depth=15, classifier__max_features=0.5,
classifier__max_leaf_nodes=50, classifier__max_samples=0.5,
classifier__n_estimators=50;, score=(train=0.867, test=0.862) total time=   14.3s
[CV 2/5] END classifier__max_depth=15, classifier__max_features=0.5,
classifier__max_leaf_nodes=50, classifier__max_samples=0.5,
classifier__n_estimators=50;, score=(train=0.867, test=0.866) total time=   14.0s
[CV 3/5] END classifier__max_depth=15, classifier__max_features=0.5,
classifier__max_leaf_nodes=50, classifier__max_samples=0.5,
classifier__n_estimators=50;, score=(train=0.866, test=0.869) total time=   14.4s
[CV 4/5] END classifier__max_depth=15, classifier__max_features=0.5,
classifier__max_leaf_nodes=50, classifier__max_samples=0.5,
classifier__n_estimators=50;, score=(train=0.867, test=0.860) total time=   14.4s
[CV 5/5] END classifier__max_depth=15, classifier__max_features=0.5,
classifier__max_leaf_nodes=50, classifier__max_samples=0.5,
classifier__n_estimators=50;, score=(train=0.866, test=0.866) total time=   14.4s
[CV 1/5] END classifier__max_depth=15, classifier__max_features=0.5,
classifier__max_leaf_nodes=50, classifier__max_samples=0.5,
classifier__n_estimators=100;, score=(train=0.867, test=0.862) total time=
28.7s
[CV 2/5] END classifier__max_depth=15, classifier__max_features=0.5,
classifier__max_leaf_nodes=50, classifier__max_samples=0.5,
classifier__n_estimators=100;, score=(train=0.866, test=0.865) total time=
28.9s
[CV 3/5] END classifier__max_depth=15, classifier__max_features=0.5,
classifier__max_leaf_nodes=50, classifier__max_samples=0.5,
classifier__n_estimators=100;, score=(train=0.866, test=0.869) total time=
29.6s
[CV 4/5] END classifier__max_depth=15, classifier__max_features=0.5,
classifier__max_leaf_nodes=50, classifier__max_samples=0.5,
classifier__n_estimators=100;, score=(train=0.867, test=0.861) total time=
31.8s
[CV 5/5] END classifier__max_depth=15, classifier__max_features=0.5,
classifier__max_leaf_nodes=50, classifier__max_samples=0.5,
classifier__n_estimators=100;, score=(train=0.866, test=0.866) total time=

31.0s
[CV 1/5] END classifier__max_depth=15, classifier__max_features=0.5,
classifier__max_leaf_nodes=50, classifier__max_samples=None,
classifier__n_estimators=50;, score=(train=0.867, test=0.862) total time= 21.9s
[CV 2/5] END classifier__max_depth=15, classifier__max_features=0.5,
classifier__max_leaf_nodes=50, classifier__max_samples=None,
classifier__n_estimators=50;, score=(train=0.866, test=0.864) total time= 19.2s
[CV 3/5] END classifier__max_depth=15, classifier__max_features=0.5,
classifier__max_leaf_nodes=50, classifier__max_samples=None,
classifier__n_estimators=50;, score=(train=0.865, test=0.868) total time= 19.2s
[CV 4/5] END classifier__max_depth=15, classifier__max_features=0.5,
classifier__max_leaf_nodes=50, classifier__max_samples=None,
classifier__n_estimators=50;, score=(train=0.867, test=0.861) total time= 19.9s
[CV 5/5] END classifier__max_depth=15, classifier__max_features=0.5,
classifier__max_leaf_nodes=50, classifier__max_samples=None,
classifier__n_estimators=50;, score=(train=0.866, test=0.865) total time= 21.0s
[CV 1/5] END classifier__max_depth=15, classifier__max_features=0.5,
classifier__max_leaf_nodes=50, classifier__max_samples=None,
classifier__n_estimators=100;, score=(train=0.867, test=0.862) total time=
40.4s
[CV 2/5] END classifier__max_depth=15, classifier__max_features=0.5,
classifier__max_leaf_nodes=50, classifier__max_samples=None,
classifier__n_estimators=100;, score=(train=0.866, test=0.865) total time=
40.1s
[CV 3/5] END classifier__max_depth=15, classifier__max_features=0.5,
classifier__max_leaf_nodes=50, classifier__max_samples=None,
classifier__n_estimators=100;, score=(train=0.866, test=0.869) total time=
39.5s
[CV 1/5] END classifier__max_depth=25, classifier__max_features=sqrt,
classifier__max_leaf_nodes=15, classifier__max_samples=0.5,
classifier__n_estimators=50;, score=(train=0.854, test=0.851) total time=   2.2s
[CV 2/5] END classifier__max_depth=25, classifier__max_features=sqrt,
classifier__max_leaf_nodes=15, classifier__max_samples=0.5,
classifier__n_estimators=50;, score=(train=0.855, test=0.855) total time=   2.3s
[CV 3/5] END classifier__max_depth=25, classifier__max_features=sqrt,
classifier__max_leaf_nodes=15, classifier__max_samples=0.5,
classifier__n_estimators=50;, score=(train=0.851, test=0.856) total time=   2.2s
[CV 4/5] END classifier__max_depth=25, classifier__max_features=sqrt,
classifier__max_leaf_nodes=15, classifier__max_samples=0.5,
classifier__n_estimators=50;, score=(train=0.854, test=0.848) total time=   2.3s
[CV 5/5] END classifier__max_depth=25, classifier__max_features=sqrt,
classifier__max_leaf_nodes=15, classifier__max_samples=0.5,
classifier__n_estimators=50;, score=(train=0.857, test=0.858) total time=   2.2s
[CV 1/5] END classifier__max_depth=25, classifier__max_features=sqrt,
classifier__max_leaf_nodes=15, classifier__max_samples=0.5,
classifier__n_estimators=100;, score=(train=0.855, test=0.852) total time=
4.2s
[CV 4/5] END classifier__max_depth=15, classifier__max_features=0.5,

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classifier__max_leaf_nodes=50, classifier__max_samples=None,
classifier__n_estimators=100;, score=(train=0.867, test=0.861) total time=
40.4s
[CV 5/5] END classifier__max_depth=15, classifier__max_features=0.5,
classifier__max_leaf_nodes=50, classifier__max_samples=None,
classifier__n_estimators=100;, score=(train=0.866, test=0.865) total time=
40.4s
[CV 2/5] END classifier__max_depth=25, classifier__max_features=sqrt,
classifier__max_leaf_nodes=15, classifier__max_samples=0.5,
classifier__n_estimators=100;, score=(train=0.855, test=0.856) total time=
4.2s
[CV 3/5] END classifier__max_depth=25, classifier__max_features=sqrt,
classifier__max_leaf_nodes=15, classifier__max_samples=0.5,
classifier__n_estimators=100;, score=(train=0.852, test=0.857) total time=
4.2s
[CV 4/5] END classifier__max_depth=25, classifier__max_features=sqrt,
classifier__max_leaf_nodes=15, classifier__max_samples=0.5,
classifier__n_estimators=100;, score=(train=0.854, test=0.849) total time=
4.2s
[CV 5/5] END classifier__max_depth=25, classifier__max_features=sqrt,
classifier__max_leaf_nodes=15, classifier__max_samples=0.5,
classifier__n_estimators=100;, score=(train=0.856, test=0.857) total time=
4.3s
[CV 1/5] END classifier__max_depth=25, classifier__max_features=sqrt,
classifier__max_leaf_nodes=15, classifier__max_samples=None,
classifier__n_estimators=50;, score=(train=0.854, test=0.850) total time=   3.0s
[CV 2/5] END classifier__max_depth=25, classifier__max_features=sqrt,
classifier__max_leaf_nodes=15, classifier__max_samples=None,
classifier__n_estimators=50;, score=(train=0.854, test=0.854) total time=   3.0s
[CV 3/5] END classifier__max_depth=25, classifier__max_features=sqrt,
classifier__max_leaf_nodes=15, classifier__max_samples=None,
classifier__n_estimators=50;, score=(train=0.850, test=0.855) total time=   2.9s
[CV 4/5] END classifier__max_depth=25, classifier__max_features=sqrt,
classifier__max_leaf_nodes=15, classifier__max_samples=None,
classifier__n_estimators=50;, score=(train=0.849, test=0.843) total time=   2.6s
[CV 5/5] END classifier__max_depth=25, classifier__max_features=sqrt,
classifier__max_leaf_nodes=15, classifier__max_samples=None,
classifier__n_estimators=50;, score=(train=0.854, test=0.854) total time=   3.0s
[CV 1/5] END classifier__max_depth=25, classifier__max_features=sqrt,
classifier__max_leaf_nodes=15, classifier__max_samples=None,
classifier__n_estimators=100;, score=(train=0.855, test=0.851) total time=
5.0s
[CV 2/5] END classifier__max_depth=25, classifier__max_features=sqrt,
classifier__max_leaf_nodes=15, classifier__max_samples=None,
classifier__n_estimators=100;, score=(train=0.854, test=0.855) total time=
4.6s
[CV 3/5] END classifier__max_depth=25, classifier__max_features=sqrt,
classifier__max_leaf_nodes=15, classifier__max_samples=None,
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classifier__n_estimators=100;, score=(train=0.851, test=0.856) total time=
5.4s
[CV 4/5] END classifier__max_depth=25, classifier__max_features=sqrt,
classifier__max_leaf_nodes=15, classifier__max_samples=None,
classifier__n_estimators=100;, score=(train=0.851, test=0.846) total time=
5.0s
[CV 1/5] END classifier__max_depth=25, classifier__max_features=sqrt,
classifier__max_leaf_nodes=50, classifier__max_samples=0.5,
classifier__n_estimators=50;, score=(train=0.864, test=0.860) total time=   2.7s
[CV 5/5] END classifier__max_depth=25, classifier__max_features=sqrt,
classifier__max_leaf_nodes=15, classifier__max_samples=None,
classifier__n_estimators=100;, score=(train=0.856, test=0.856) total time=
4.4s
[CV 2/5] END classifier__max_depth=25, classifier__max_features=sqrt,
classifier__max_leaf_nodes=50, classifier__max_samples=0.5,
classifier__n_estimators=50;, score=(train=0.864, test=0.863) total time=   3.3s
[CV 3/5] END classifier__max_depth=25, classifier__max_features=sqrt,
classifier__max_leaf_nodes=50, classifier__max_samples=0.5,
classifier__n_estimators=50;, score=(train=0.862, test=0.865) total time=   3.6s
[CV 4/5] END classifier__max_depth=25, classifier__max_features=sqrt,
classifier__max_leaf_nodes=50, classifier__max_samples=0.5,
classifier__n_estimators=50;, score=(train=0.864, test=0.858) total time=   3.6s
[CV 5/5] END classifier__max_depth=25, classifier__max_features=sqrt,
classifier__max_leaf_nodes=50, classifier__max_samples=0.5,
classifier__n_estimators=50;, score=(train=0.865, test=0.865) total time=   3.1s
[CV 1/5] END classifier__max_depth=25, classifier__max_features=sqrt,
classifier__max_leaf_nodes=50, classifier__max_samples=0.5,
classifier__n_estimators=100;, score=(train=0.865, test=0.861) total time=
5.9s
[CV 2/5] END classifier__max_depth=25, classifier__max_features=sqrt,
classifier__max_leaf_nodes=50, classifier__max_samples=0.5,
classifier__n_estimators=100;, score=(train=0.865, test=0.864) total time=
5.9s
[CV 3/5] END classifier__max_depth=25, classifier__max_features=sqrt,
classifier__max_leaf_nodes=50, classifier__max_samples=0.5,
classifier__n_estimators=100;, score=(train=0.864, test=0.867) total time=
6.3s
[CV 1/5] END classifier__max_depth=25, classifier__max_features=sqrt,
classifier__max_leaf_nodes=50, classifier__max_samples=None,
classifier__n_estimators=50;, score=(train=0.865, test=0.860) total time=   4.0s
[CV 4/5] END classifier__max_depth=25, classifier__max_features=sqrt,
classifier__max_leaf_nodes=50, classifier__max_samples=0.5,
classifier__n_estimators=100;, score=(train=0.865, test=0.860) total time=
6.9s
[CV 5/5] END classifier__max_depth=25, classifier__max_features=sqrt,
classifier__max_leaf_nodes=50, classifier__max_samples=0.5,
classifier__n_estimators=100;, score=(train=0.865, test=0.866) total time=
6.9s

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[CV 2/5] END classifier__max_depth=25, classifier__max_features=sqrt,
classifier__max_leaf_nodes=50, classifier__max_samples=None,
classifier__n_estimators=50;, score=(train=0.864, test=0.864) total time=   4.0s
[CV 3/5] END classifier__max_depth=25, classifier__max_features=sqrt,
classifier__max_leaf_nodes=50, classifier__max_samples=None,
classifier__n_estimators=50;, score=(train=0.862, test=0.865) total time=   4.0s
[CV 4/5] END classifier__max_depth=25, classifier__max_features=sqrt,
classifier__max_leaf_nodes=50, classifier__max_samples=None,
classifier__n_estimators=50;, score=(train=0.862, test=0.856) total time=   4.9s
[CV 5/5] END classifier__max_depth=25, classifier__max_features=sqrt,
classifier__max_leaf_nodes=50, classifier__max_samples=None,
classifier__n_estimators=50;, score=(train=0.864, test=0.863) total time=   4.5s
[CV 1/5] END classifier__max_depth=25, classifier__max_features=sqrt,
classifier__max_leaf_nodes=50, classifier__max_samples=None,
classifier__n_estimators=100;, score=(train=0.865, test=0.861) total time=
8.2s
[CV 2/5] END classifier__max_depth=25, classifier__max_features=sqrt,
classifier__max_leaf_nodes=50, classifier__max_samples=None,
classifier__n_estimators=100;, score=(train=0.865, test=0.865) total time=
8.3s
[CV 3/5] END classifier__max_depth=25, classifier__max_features=sqrt,
classifier__max_leaf_nodes=50, classifier__max_samples=None,
classifier__n_estimators=100;, score=(train=0.864, test=0.867) total time=
7.7s
[CV 1/5] END classifier__max_depth=25, classifier__max_features=log2,
classifier__max_leaf_nodes=15, classifier__max_samples=0.5,
classifier__n_estimators=50;, score=(train=0.842, test=0.838) total time=   1.8s
[CV 4/5] END classifier__max_depth=25, classifier__max_features=sqrt,
classifier__max_leaf_nodes=50, classifier__max_samples=None,
classifier__n_estimators=100;, score=(train=0.863, test=0.857) total time=
7.3s
[CV 2/5] END classifier__max_depth=25, classifier__max_features=log2,
classifier__max_leaf_nodes=15, classifier__max_samples=0.5,
classifier__n_estimators=50;, score=(train=0.848, test=0.849) total time=   1.6s
[CV 5/5] END classifier__max_depth=25, classifier__max_features=sqrt,
classifier__max_leaf_nodes=50, classifier__max_samples=None,
classifier__n_estimators=100;, score=(train=0.865, test=0.865) total time=
7.3s
[CV 3/5] END classifier__max_depth=25, classifier__max_features=log2,
classifier__max_leaf_nodes=15, classifier__max_samples=0.5,
classifier__n_estimators=50;, score=(train=0.842, test=0.847) total time=   1.6s
[CV 4/5] END classifier__max_depth=25, classifier__max_features=log2,
classifier__max_leaf_nodes=15, classifier__max_samples=0.5,
classifier__n_estimators=50;, score=(train=0.852, test=0.847) total time=   1.6s
[CV 5/5] END classifier__max_depth=25, classifier__max_features=log2,
classifier__max_leaf_nodes=15, classifier__max_samples=0.5,
classifier__n_estimators=50;, score=(train=0.853, test=0.853) total time=   1.5s
[CV 1/5] END classifier__max_depth=25, classifier__max_features=log2,
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classifier__max_leaf_nodes=15, classifier__max_samples=0.5,
classifier__n_estimators=100;, score=(train=0.847, test=0.844) total time=
3.3s
[CV 2/5] END classifier__max_depth=25, classifier__max_features=log2,
classifier__max_leaf_nodes=15, classifier__max_samples=0.5,
classifier__n_estimators=100;, score=(train=0.853, test=0.853) total time=
3.2s
[CV 3/5] END classifier__max_depth=25, classifier__max_features=log2,
classifier__max_leaf_nodes=15, classifier__max_samples=0.5,
classifier__n_estimators=100;, score=(train=0.845, test=0.850) total time=
3.2s
[CV 1/5] END classifier__max_depth=25, classifier__max_features=log2,
classifier__max_leaf_nodes=15, classifier__max_samples=None,
classifier__n_estimators=50;, score=(train=0.841, test=0.838) total time=   1.9s
[CV 4/5] END classifier__max_depth=25, classifier__max_features=log2,
classifier__max_leaf_nodes=15, classifier__max_samples=0.5,
classifier__n_estimators=100;, score=(train=0.852, test=0.848) total time=
3.0s
[CV 5/5] END classifier__max_depth=25, classifier__max_features=log2,
classifier__max_leaf_nodes=15, classifier__max_samples=0.5,
classifier__n_estimators=100;, score=(train=0.849, test=0.850) total time=
3.0s
[CV 2/5] END classifier__max_depth=25, classifier__max_features=log2,
classifier__max_leaf_nodes=15, classifier__max_samples=None,
classifier__n_estimators=50;, score=(train=0.842, test=0.841) total time=   1.9s
[CV 3/5] END classifier__max_depth=25, classifier__max_features=log2,
classifier__max_leaf_nodes=15, classifier__max_samples=None,
classifier__n_estimators=50;, score=(train=0.848, test=0.853) total time=   1.9s
[CV 4/5] END classifier__max_depth=25, classifier__max_features=log2,
classifier__max_leaf_nodes=15, classifier__max_samples=None,
classifier__n_estimators=50;, score=(train=0.849, test=0.842) total time=   2.6s
[CV 5/5] END classifier__max_depth=25, classifier__max_features=log2,
classifier__max_leaf_nodes=15, classifier__max_samples=None,
classifier__n_estimators=50;, score=(train=0.852, test=0.853) total time=   1.9s
[CV 1/5] END classifier__max_depth=25, classifier__max_features=log2,
classifier__max_leaf_nodes=15, classifier__max_samples=None,
classifier__n_estimators=100;, score=(train=0.847, test=0.844) total time=
3.2s
[CV 2/5] END classifier__max_depth=25, classifier__max_features=log2,
classifier__max_leaf_nodes=15, classifier__max_samples=None,
classifier__n_estimators=100;, score=(train=0.847, test=0.847) total time=
3.1s
[CV 3/5] END classifier__max_depth=25, classifier__max_features=log2,
classifier__max_leaf_nodes=15, classifier__max_samples=None,
classifier__n_estimators=100;, score=(train=0.852, test=0.856) total time=
3.1s
[CV 4/5] END classifier__max_depth=25, classifier__max_features=log2,
classifier__max_leaf_nodes=15, classifier__max_samples=None,
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classifier__n_estimators=100;, score=(train=0.848, test=0.842) total time=
3.0s
[CV 1/5] END classifier__max_depth=25, classifier__max_features=log2,
classifier__max_leaf_nodes=50, classifier__max_samples=0.5,
classifier__n_estimators=50;, score=(train=0.857, test=0.852) total time=   2.1s
[CV 5/5] END classifier__max_depth=25, classifier__max_features=log2,
classifier__max_leaf_nodes=15, classifier__max_samples=None,
classifier__n_estimators=100;, score=(train=0.850, test=0.850) total time=
3.2s
[CV 2/5] END classifier__max_depth=25, classifier__max_features=log2,
classifier__max_leaf_nodes=50, classifier__max_samples=0.5,
classifier__n_estimators=50;, score=(train=0.857, test=0.856) total time=   2.4s
[CV 3/5] END classifier__max_depth=25, classifier__max_features=log2,
classifier__max_leaf_nodes=50, classifier__max_samples=0.5,
classifier__n_estimators=50;, score=(train=0.855, test=0.858) total time=   2.3s
[CV 4/5] END classifier__max_depth=25, classifier__max_features=log2,
classifier__max_leaf_nodes=50, classifier__max_samples=0.5,
classifier__n_estimators=50;, score=(train=0.861, test=0.855) total time=   2.2s
[CV 5/5] END classifier__max_depth=25, classifier__max_features=log2,
classifier__max_leaf_nodes=50, classifier__max_samples=0.5,
classifier__n_estimators=50;, score=(train=0.860, test=0.860) total time=   1.9s
[CV 1/5] END classifier__max_depth=25, classifier__max_features=log2,
classifier__max_leaf_nodes=50, classifier__max_samples=0.5,
classifier__n_estimators=100;, score=(train=0.858, test=0.854) total time=
4.1s
[CV 2/5] END classifier__max_depth=25, classifier__max_features=log2,
classifier__max_leaf_nodes=50, classifier__max_samples=0.5,
classifier__n_estimators=100;, score=(train=0.861, test=0.860) total time=
4.1s
[CV 3/5] END classifier__max_depth=25, classifier__max_features=log2,
classifier__max_leaf_nodes=50, classifier__max_samples=0.5,
classifier__n_estimators=100;, score=(train=0.858, test=0.861) total time=
4.2s
[CV 4/5] END classifier__max_depth=25, classifier__max_features=log2,
classifier__max_leaf_nodes=50, classifier__max_samples=0.5,
classifier__n_estimators=100;, score=(train=0.862, test=0.856) total time=
6.3s
[CV 5/5] END classifier__max_depth=25, classifier__max_features=log2,
classifier__max_leaf_nodes=50, classifier__max_samples=0.5,
classifier__n_estimators=100;, score=(train=0.859, test=0.859) total time=
6.5s
[CV 1/5] END classifier__max_depth=25, classifier__max_features=log2,
classifier__max_leaf_nodes=50, classifier__max_samples=None,
classifier__n_estimators=50;, score=(train=0.855, test=0.852) total time=   5.3s
[CV 2/5] END classifier__max_depth=25, classifier__max_features=log2,
classifier__max_leaf_nodes=50, classifier__max_samples=None,
classifier__n_estimators=50;, score=(train=0.856, test=0.855) total time=   4.0s
[CV 4/5] END classifier__max_depth=25, classifier__max_features=log2,
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classifier__max_leaf_nodes=50, classifier__max_samples=None,
classifier__n_estimators=50;, score=(train=0.860, test=0.852) total time=   3.5s
[CV 3/5] END classifier__max_depth=25, classifier__max_features=log2,
classifier__max_leaf_nodes=50, classifier__max_samples=None,
classifier__n_estimators=50;, score=(train=0.860, test=0.863) total time=   3.5s
[CV 5/5] END classifier__max_depth=25, classifier__max_features=log2,
classifier__max_leaf_nodes=50, classifier__max_samples=None,
classifier__n_estimators=50;, score=(train=0.860, test=0.859) total time=   2.6s
[CV 2/5] END classifier__max_depth=25, classifier__max_features=log2,
classifier__max_leaf_nodes=50, classifier__max_samples=None,
classifier__n_estimators=100;, score=(train=0.860, test=0.859) total time=
5.0s
[CV 1/5] END classifier__max_depth=25, classifier__max_features=log2,
classifier__max_leaf_nodes=50, classifier__max_samples=None,
classifier__n_estimators=100;, score=(train=0.858, test=0.855) total time=
5.1s
[CV 3/5] END classifier__max_depth=25, classifier__max_features=log2,
classifier__max_leaf_nodes=50, classifier__max_samples=None,
classifier__n_estimators=100;, score=(train=0.861, test=0.863) total time=
5.3s
[CV 4/5] END classifier__max_depth=25, classifier__max_features=log2,
classifier__max_leaf_nodes=50, classifier__max_samples=None,
classifier__n_estimators=100;, score=(train=0.861, test=0.854) total time=
4.6s
[CV 5/5] END classifier__max_depth=25, classifier__max_features=log2,
classifier__max_leaf_nodes=50, classifier__max_samples=None,
classifier__n_estimators=100;, score=(train=0.860, test=0.860) total time=
4.7s
[CV 1/5] END classifier__max_depth=25, classifier__max_features=0.5,
classifier__max_leaf_nodes=15, classifier__max_samples=0.5,
classifier__n_estimators=50;, score=(train=0.849, test=0.845) total time=   5.8s
[CV 2/5] END classifier__max_depth=25, classifier__max_features=0.5,
classifier__max_leaf_nodes=15, classifier__max_samples=0.5,
classifier__n_estimators=50;, score=(train=0.850, test=0.849) total time=   6.7s
[CV 3/5] END classifier__max_depth=25, classifier__max_features=0.5,
classifier__max_leaf_nodes=15, classifier__max_samples=0.5,
classifier__n_estimators=50;, score=(train=0.847, test=0.852) total time=   6.9s
[CV 4/5] END classifier__max_depth=25, classifier__max_features=0.5,
classifier__max_leaf_nodes=15, classifier__max_samples=0.5,
classifier__n_estimators=50;, score=(train=0.850, test=0.845) total time=   7.5s
[CV 5/5] END classifier__max_depth=25, classifier__max_features=0.5,
classifier__max_leaf_nodes=15, classifier__max_samples=0.5,
classifier__n_estimators=50;, score=(train=0.848, test=0.849) total time=   7.1s
[CV 1/5] END classifier__max_depth=25, classifier__max_features=0.5,
classifier__max_leaf_nodes=15, classifier__max_samples=0.5,
classifier__n_estimators=100;, score=(train=0.849, test=0.846) total time=
12.9s
[CV 2/5] END classifier__max_depth=25, classifier__max_features=0.5,

classifier__max_leaf_nodes=15, classifier__max_samples=0.5,
classifier__n_estimators=100;, score=(train=0.849, test=0.848) total time=
12.3s
[CV 3/5] END classifier__max_depth=25, classifier__max_features=0.5,
classifier__max_leaf_nodes=15, classifier__max_samples=0.5,
classifier__n_estimators=100;, score=(train=0.848, test=0.854) total time=
12.5s
[CV 4/5] END classifier__max_depth=25, classifier__max_features=0.5,
classifier__max_leaf_nodes=15, classifier__max_samples=0.5,
classifier__n_estimators=100;, score=(train=0.849, test=0.845) total time=
12.6s
[CV 1/5] END classifier__max_depth=25, classifier__max_features=0.5,
classifier__max_leaf_nodes=15, classifier__max_samples=None,
classifier__n_estimators=50;, score=(train=0.850, test=0.846) total time=   8.2s
[CV 5/5] END classifier__max_depth=25, classifier__max_features=0.5,
classifier__max_leaf_nodes=15, classifier__max_samples=0.5,
classifier__n_estimators=100;, score=(train=0.848, test=0.848) total time=
12.3s
[CV 2/5] END classifier__max_depth=25, classifier__max_features=0.5,
classifier__max_leaf_nodes=15, classifier__max_samples=None,
classifier__n_estimators=50;, score=(train=0.848, test=0.846) total time=   9.9s
[CV 3/5] END classifier__max_depth=25, classifier__max_features=0.5,
classifier__max_leaf_nodes=15, classifier__max_samples=None,
classifier__n_estimators=50;, score=(train=0.846, test=0.851) total time= 10.4s
[CV 4/5] END classifier__max_depth=25, classifier__max_features=0.5,
classifier__max_leaf_nodes=15, classifier__max_samples=None,
classifier__n_estimators=50;, score=(train=0.850, test=0.846) total time= 11.0s
[CV 5/5] END classifier__max_depth=25, classifier__max_features=0.5,
classifier__max_leaf_nodes=15, classifier__max_samples=None,
classifier__n_estimators=50;, score=(train=0.849, test=0.849) total time=   9.9s
[CV 1/5] END classifier__max_depth=25, classifier__max_features=0.5,
classifier__max_leaf_nodes=15, classifier__max_samples=None,
classifier__n_estimators=100;, score=(train=0.850, test=0.846) total time=
18.2s
[CV 2/5] END classifier__max_depth=25, classifier__max_features=0.5,
classifier__max_leaf_nodes=15, classifier__max_samples=None,
classifier__n_estimators=100;, score=(train=0.848, test=0.847) total time=
17.7s
[CV 3/5] END classifier__max_depth=25, classifier__max_features=0.5,
classifier__max_leaf_nodes=15, classifier__max_samples=None,
classifier__n_estimators=100;, score=(train=0.847, test=0.853) total time=
17.6s
[CV 4/5] END classifier__max_depth=25, classifier__max_features=0.5,
classifier__max_leaf_nodes=15, classifier__max_samples=None,
classifier__n_estimators=100;, score=(train=0.850, test=0.846) total time=
16.2s
[CV 5/5] END classifier__max_depth=25, classifier__max_features=0.5,
classifier__max_leaf_nodes=15, classifier__max_samples=None,

classifier__n_estimators=100;, score=(train=0.849, test=0.849) total time=
16.1s
[CV 1/5] END classifier__max_depth=25, classifier__max_features=0.5,
classifier__max_leaf_nodes=50, classifier__max_samples=0.5,
classifier__n_estimators=50;, score=(train=0.867, test=0.862) total time= 13.5s
[CV 2/5] END classifier__max_depth=25, classifier__max_features=0.5,
classifier__max_leaf_nodes=50, classifier__max_samples=0.5,
classifier__n_estimators=50;, score=(train=0.867, test=0.866) total time= 16.2s
[CV 3/5] END classifier__max_depth=25, classifier__max_features=0.5,
classifier__max_leaf_nodes=50, classifier__max_samples=0.5,
classifier__n_estimators=50;, score=(train=0.866, test=0.869) total time= 16.2s
[CV 4/5] END classifier__max_depth=25, classifier__max_features=0.5,
classifier__max_leaf_nodes=50, classifier__max_samples=0.5,
classifier__n_estimators=50;, score=(train=0.867, test=0.860) total time= 15.9s
[CV 5/5] END classifier__max_depth=25, classifier__max_features=0.5,
classifier__max_leaf_nodes=50, classifier__max_samples=0.5,
classifier__n_estimators=50;, score=(train=0.866, test=0.866) total time= 16.8s
[CV 1/5] END classifier__max_depth=25, classifier__max_features=0.5,
classifier__max_leaf_nodes=50, classifier__max_samples=0.5,
classifier__n_estimators=100;, score=(train=0.867, test=0.862) total time=
28.6s
[CV 2/5] END classifier__max_depth=25, classifier__max_features=0.5,
classifier__max_leaf_nodes=50, classifier__max_samples=0.5,
classifier__n_estimators=100;, score=(train=0.866, test=0.865) total time=
27.7s
[CV 3/5] END classifier__max_depth=25, classifier__max_features=0.5,
classifier__max_leaf_nodes=50, classifier__max_samples=0.5,
classifier__n_estimators=100;, score=(train=0.866, test=0.869) total time=
23.6s
[CV 4/5] END classifier__max_depth=25, classifier__max_features=0.5,
classifier__max_leaf_nodes=50, classifier__max_samples=0.5,
classifier__n_estimators=100;, score=(train=0.867, test=0.861) total time=
23.3s
[CV 5/5] END classifier__max_depth=25, classifier__max_features=0.5,
classifier__max_leaf_nodes=50, classifier__max_samples=0.5,
classifier__n_estimators=100;, score=(train=0.866, test=0.866) total time=
23.1s
[CV 1/5] END classifier__max_depth=25, classifier__max_features=0.5,
classifier__max_leaf_nodes=50, classifier__max_samples=None,
classifier__n_estimators=50;, score=(train=0.867, test=0.862) total time= 16.7s
[CV 2/5] END classifier__max_depth=25, classifier__max_features=0.5,
classifier__max_leaf_nodes=50, classifier__max_samples=None,
classifier__n_estimators=50;, score=(train=0.866, test=0.864) total time= 16.9s
[CV 3/5] END classifier__max_depth=25, classifier__max_features=0.5,
classifier__max_leaf_nodes=50, classifier__max_samples=None,
classifier__n_estimators=50;, score=(train=0.865, test=0.868) total time= 17.1s
[CV 4/5] END classifier__max_depth=25, classifier__max_features=0.5,
classifier__max_leaf_nodes=50, classifier__max_samples=None,

```
classifier__n_estimators=50;, score=(train=0.867, test=0.861) total time=  16.5s
[CV 5/5] END classifier__max_depth=25, classifier__max_features=0.5,
classifier__max_leaf_nodes=50, classifier__max_samples=None,
classifier__n_estimators=50;, score=(train=0.866, test=0.865) total time=  16.9s
[CV 1/5] END classifier__max_depth=25, classifier__max_features=0.5,
classifier__max_leaf_nodes=50, classifier__max_samples=None,
classifier__n_estimators=100;, score=(train=0.867, test=0.862) total time=
32.2s
[CV 2/5] END classifier__max_depth=25, classifier__max_features=0.5,
classifier__max_leaf_nodes=50, classifier__max_samples=None,
classifier__n_estimators=100;, score=(train=0.866, test=0.865) total time=
32.0s
[CV 3/5] END classifier__max_depth=25, classifier__max_features=0.5,
classifier__max_leaf_nodes=50, classifier__max_samples=None,
classifier__n_estimators=100;, score=(train=0.865, test=0.869) total time=
31.5s
[CV 4/5] END classifier__max_depth=25, classifier__max_features=0.5,
classifier__max_leaf_nodes=50, classifier__max_samples=None,
classifier__n_estimators=100;, score=(train=0.867, test=0.861) total time=
34.9s
[CV 5/5] END classifier__max_depth=25, classifier__max_features=0.5,
classifier__max_leaf_nodes=50, classifier__max_samples=None,
classifier__n_estimators=100;, score=(train=0.866, test=0.865) total time=
35.6s
Best parameters for outer fold 3: {'classifier__max_depth': 25,
'classifier__max_features': 0.5, 'classifier__max_leaf_nodes': 50,
'classifier__max_samples': 0.5, 'classifier__n_estimators': 100}
ROC AUC for outer fold 3: 0.8644364721886271
```

```python
# Print the average outer fold score and best parameters
print(f"\nAverage ROC AUC across outer folds: {np.mean(outer_fold_scores)}")
for i, params in enumerate(best_params_per_fold):
    print(f"Best parameters for outer fold {i+1}: {params}")
```

```
Average ROC AUC across outer folds: 0.864679065548915
Best parameters for outer fold 1: {'classifier__max_depth': 25,
'classifier__max_features': 0.5, 'classifier__max_leaf_nodes': 50,
'classifier__max_samples': 0.5, 'classifier__n_estimators': 100}
Best parameters for outer fold 2: {'classifier__max_depth': 15,
'classifier__max_features': 0.5, 'classifier__max_leaf_nodes': 50,
'classifier__max_samples': 0.5, 'classifier__n_estimators': 100}
Best parameters for outer fold 3: {'classifier__max_depth': 25,
'classifier__max_features': 0.5, 'classifier__max_leaf_nodes': 50,
'classifier__max_samples': 0.5, 'classifier__n_estimators': 100}
```

your answer here

- Report the inner and outer fold scores for all combinations of hyperparams and interpret the

results.

- – Unlike for the decision tree, complexity makes a much larger difference in terms of run time here. Furthermore, the optimal hyperparameters are different. In this case, max features seems to impact run time a lot more. Overall the process is much more computationally expensive, and we still see risks of overfitting.
- Report the best hyperparams used in each outer fold.
  - – Best parameters for outer fold 1: {'classifier__max_depth': 25, 'classifier__max_features': 0.5, 'classifier__max_leaf_nodes': 50, 'classifier__max_samples': 0.5, 'classifier__n_estimators': 100}
  - – Best parameters for outer fold 2: {'classifier__max_depth': 15, 'classifier__max_features': 0.5, 'classifier__max_leaf_nodes': 50, 'classifier__max_samples': 0.5, 'classifier__n_estimators': 100}
  - – Best parameters for outer fold 3: {'classifier__max_depth': 25, 'classifier__max_features': 0.5, 'classifier__max_leaf_nodes': 50, 'classifier__max_samples': 0.5, 'classifier__n_estimators': 100}
- What do you notice about these results?
  - – Interestingly the best hyperparameters are similar but not identical to the decision tree results where applicable. However, the nested-cv score is better for the random forest relative to the decision as well.
  - – This seems to imply that random forests are also at risk of overfitting like the decision tree. At the same time, the nature of the random forest leads to higher performace, even though it is closely related to the decision tree model.
- How are these results related to those from the decision tree pipeline?
  - – Even though the hyperparameters chosen are pretty similar accross both the Decision Tree and Random Forest, we still see the random forest has a higher AUC score. Thus, even though the results are closely related, the models still differ, leading to higher performance for the random forest.
  - – This is likely because the random forest considers multiple trees, accounting for stochasticity that the single decision tree does not account for. Thus, at the tree level, the models might be relatively similar, but the aggregation aspect of the random forest leads to higher performance.
- Is hyperparameter optimization worth the trouble?
  - – Yes, even though the results are similar in this, case, this may not always be true. Furthermore, the random forest has other hyperparameters that the decision tree does not have. Thus, while computationally expensive, hyperparameter optimization is still worth it to avoid overfitting risks. In the end, the random forest chose different hyperparameters and had better results, so it's not pointless to do fine tuning.

1.3.4 3.4 Take stock of parts II and III

What do you conclude from parts II and III? If you were to choose between a decision tree and a random forest for this classification task, what would be your choice and why?

your answer here

It seems as though the results from the decision are much more interpretable, but the random forest is much better for classification in general. If I were to choose one or the other, I would choose the random forest. Looking at the feature importances, we can see how the random forest classifier results in different important features. This is

likely because it considers multiple trees and aggregates their predictions, taking into account more stochasticity. This can lead to higher performance. We observed this when we saw how the nested-cv random forest outperformes the nested-cv decision tree. Overall the main reason for choosing a decision tree would be interpreatibility and cost effectiveness. However, when prioritizing accuracy and quality of out-of-sample fit, the random forest is the best option in my opinion. So for the task of purely classification, random forests are the better choice

1.4 Part IV: Test data, ROC curves and fairness thresholds

Note that until now, we have not used the test data for any purpose. Let's now incorporate it into our analysis and use it to find a "fair" threshold value.

1.4.1 4.1 Find the optimal hyperparameters and fit a decision tree pipeline

Use all of your training data to find the optimal hyperparameters and fit a decision tree pipeline. Report the optimal hyperparameters.

Note: Recall that nested cross-validation is only providing you with an estimate of the out-of-sample performance of the model finding procedure that involves hyperparameter optimization. At training time you should carry out the entire model finding procedure, including hyperparameter optimization.

```python
# your code here

# Define the decision tree classifier
decision_tree = DecisionTreeClassifier(random_state=0)

# Define the pipeline with preprocessing and decision tree classifier
pipeline = Pipeline(steps=[('preprocessor', preprocessor),
                           ('classifier', decision_tree)])

# Set up the hyperparameter grid
# Define the parameter grid
param_grid = {
    'classifier__max_depth': [5, 15, 25, 50],
    'classifier__max_features': ['sqrt', 'log2', 0.5],
    'classifier__max_leaf_nodes': [10, 15, 25, 50],
}

# Perform grid search to find optimal hyperparameters
grid_search = GridSearchCV(estimator=pipeline, param_grid=param_grid, cv=5,
  ↪scoring='roc_auc', verbose=3, n_jobs=3)
grid_search.fit(X_train, y_train)

# Report the optimal hyperparameters
print("Optimal hyperparameters:", grid_search.best_params_)
```

```
# Fit the decision tree pipeline on the entire training dataset with the␣
 ↪optimal hyperparameters
best_pipeline = grid_search.best_estimator_
best_pipeline.fit(X_train, y_train)
```

```
Fitting 5 folds for each of 48 candidates, totalling 240 fits
[CV 2/5] END classifier__max_depth=5, classifier__max_features=sqrt,
classifier__max_leaf_nodes=10;, score=0.687 total time=    0.4s
[CV 3/5] END classifier__max_depth=5, classifier__max_features=sqrt,
classifier__max_leaf_nodes=10;, score=0.648 total time=    0.4s
[CV 1/5] END classifier__max_depth=5, classifier__max_features=sqrt,
classifier__max_leaf_nodes=10;, score=0.664 total time=    0.4s
[CV 4/5] END classifier__max_depth=5, classifier__max_features=sqrt,
classifier__max_leaf_nodes=10;, score=0.729 total time=    0.4s
[CV 5/5] END classifier__max_depth=5, classifier__max_features=sqrt,
classifier__max_leaf_nodes=10;, score=0.667 total time=    0.4s
[CV 1/5] END classifier__max_depth=5, classifier__max_features=sqrt,
classifier__max_leaf_nodes=15;, score=0.664 total time=    0.4s
[CV 2/5] END classifier__max_depth=5, classifier__max_features=sqrt,
classifier__max_leaf_nodes=15;, score=0.688 total time=    0.4s
[CV 3/5] END classifier__max_depth=5, classifier__max_features=sqrt,
classifier__max_leaf_nodes=15;, score=0.649 total time=    0.4s
[CV 4/5] END classifier__max_depth=5, classifier__max_features=sqrt,
classifier__max_leaf_nodes=15;, score=0.730 total time=    0.4s
[CV 5/5] END classifier__max_depth=5, classifier__max_features=sqrt,
classifier__max_leaf_nodes=15;, score=0.667 total time=    0.4s
[CV 1/5] END classifier__max_depth=5, classifier__max_features=sqrt,
classifier__max_leaf_nodes=25;, score=0.664 total time=    0.4s
[CV 2/5] END classifier__max_depth=5, classifier__max_features=sqrt,
classifier__max_leaf_nodes=25;, score=0.689 total time=    0.4s
[CV 3/5] END classifier__max_depth=5, classifier__max_features=sqrt,
classifier__max_leaf_nodes=25;, score=0.649 total time=    0.4s
[CV 4/5] END classifier__max_depth=5, classifier__max_features=sqrt,
classifier__max_leaf_nodes=25;, score=0.733 total time=    0.4s
[CV 5/5] END classifier__max_depth=5, classifier__max_features=sqrt,
classifier__max_leaf_nodes=25;, score=0.667 total time=    0.4s
[CV 1/5] END classifier__max_depth=5, classifier__max_features=sqrt,
classifier__max_leaf_nodes=50;, score=0.664 total time=    0.4s
[CV 2/5] END classifier__max_depth=5, classifier__max_features=sqrt,
classifier__max_leaf_nodes=50;, score=0.689 total time=    0.4s
[CV 3/5] END classifier__max_depth=5, classifier__max_features=sqrt,
classifier__max_leaf_nodes=50;, score=0.649 total time=    0.4s
[CV 4/5] END classifier__max_depth=5, classifier__max_features=sqrt,
classifier__max_leaf_nodes=50;, score=0.733 total time=    0.4s
[CV 5/5] END classifier__max_depth=5, classifier__max_features=sqrt,
classifier__max_leaf_nodes=50;, score=0.667 total time=    0.4s
[CV 1/5] END classifier__max_depth=5, classifier__max_features=log2,
```

```
classifier__max_leaf_nodes=10;, score=0.665 total time=    0.5s
[CV 2/5] END classifier__max_depth=5, classifier__max_features=log2,
classifier__max_leaf_nodes=10;, score=0.659 total time=    0.4s
[CV 3/5] END classifier__max_depth=5, classifier__max_features=log2,
classifier__max_leaf_nodes=10;, score=0.660 total time=    0.4s
[CV 4/5] END classifier__max_depth=5, classifier__max_features=log2,
classifier__max_leaf_nodes=10;, score=0.641 total time=    0.4s
[CV 5/5] END classifier__max_depth=5, classifier__max_features=log2,
classifier__max_leaf_nodes=10;, score=0.663 total time=    0.4s
[CV 1/5] END classifier__max_depth=5, classifier__max_features=log2,
classifier__max_leaf_nodes=15;, score=0.665 total time=    0.4s
[CV 2/5] END classifier__max_depth=5, classifier__max_features=log2,
classifier__max_leaf_nodes=15;, score=0.659 total time=    0.4s
[CV 3/5] END classifier__max_depth=5, classifier__max_features=log2,
classifier__max_leaf_nodes=15;, score=0.660 total time=    0.4s
[CV 4/5] END classifier__max_depth=5, classifier__max_features=log2,
classifier__max_leaf_nodes=15;, score=0.641 total time=    0.4s
[CV 5/5] END classifier__max_depth=5, classifier__max_features=log2,
classifier__max_leaf_nodes=15;, score=0.663 total time=    0.4s
[CV 1/5] END classifier__max_depth=5, classifier__max_features=log2,
classifier__max_leaf_nodes=25;, score=0.665 total time=    0.4s
[CV 2/5] END classifier__max_depth=5, classifier__max_features=log2,
classifier__max_leaf_nodes=25;, score=0.659 total time=    0.4s
[CV 3/5] END classifier__max_depth=5, classifier__max_features=log2,
classifier__max_leaf_nodes=25;, score=0.660 total time=    0.4s
[CV 4/5] END classifier__max_depth=5, classifier__max_features=log2,
classifier__max_leaf_nodes=25;, score=0.641 total time=    0.4s
[CV 5/5] END classifier__max_depth=5, classifier__max_features=log2,
classifier__max_leaf_nodes=25;, score=0.663 total time=    0.4s
[CV 1/5] END classifier__max_depth=5, classifier__max_features=log2,
classifier__max_leaf_nodes=50;, score=0.665 total time=    0.4s
[CV 2/5] END classifier__max_depth=5, classifier__max_features=log2,
classifier__max_leaf_nodes=50;, score=0.659 total time=    0.4s
[CV 3/5] END classifier__max_depth=5, classifier__max_features=log2,
classifier__max_leaf_nodes=50;, score=0.660 total time=    0.4s
[CV 4/5] END classifier__max_depth=5, classifier__max_features=log2,
classifier__max_leaf_nodes=50;, score=0.641 total time=    0.4s
[CV 5/5] END classifier__max_depth=5, classifier__max_features=log2,
classifier__max_leaf_nodes=50;, score=0.663 total time=    0.4s
[CV 1/5] END classifier__max_depth=5, classifier__max_features=0.5,
classifier__max_leaf_nodes=10;, score=0.787 total time=    0.8s
[CV 2/5] END classifier__max_depth=5, classifier__max_features=0.5,
classifier__max_leaf_nodes=10;, score=0.806 total time=    0.8s
[CV 3/5] END classifier__max_depth=5, classifier__max_features=0.5,
classifier__max_leaf_nodes=10;, score=0.800 total time=    0.7s
[CV 4/5] END classifier__max_depth=5, classifier__max_features=0.5,
classifier__max_leaf_nodes=10;, score=0.788 total time=    0.6s
[CV 5/5] END classifier__max_depth=5, classifier__max_features=0.5,
```

```
classifier__max_leaf_nodes=10;, score=0.788 total time=   0.7s
[CV 1/5] END classifier__max_depth=5, classifier__max_features=0.5,
classifier__max_leaf_nodes=15;, score=0.792 total time=   0.7s
[CV 2/5] END classifier__max_depth=5, classifier__max_features=0.5,
classifier__max_leaf_nodes=15;, score=0.814 total time=   0.7s
[CV 3/5] END classifier__max_depth=5, classifier__max_features=0.5,
classifier__max_leaf_nodes=15;, score=0.806 total time=   0.7s
[CV 4/5] END classifier__max_depth=5, classifier__max_features=0.5,
classifier__max_leaf_nodes=15;, score=0.792 total time=   0.6s
[CV 5/5] END classifier__max_depth=5, classifier__max_features=0.5,
classifier__max_leaf_nodes=15;, score=0.799 total time=   0.6s
[CV 1/5] END classifier__max_depth=5, classifier__max_features=0.5,
classifier__max_leaf_nodes=25;, score=0.796 total time=   0.6s
[CV 2/5] END classifier__max_depth=5, classifier__max_features=0.5,
classifier__max_leaf_nodes=25;, score=0.816 total time=   0.6s
[CV 3/5] END classifier__max_depth=5, classifier__max_features=0.5,
classifier__max_leaf_nodes=25;, score=0.810 total time=   0.6s
[CV 4/5] END classifier__max_depth=5, classifier__max_features=0.5,
classifier__max_leaf_nodes=25;, score=0.795 total time=   0.6s
[CV 5/5] END classifier__max_depth=5, classifier__max_features=0.5,
classifier__max_leaf_nodes=25;, score=0.803 total time=   0.6s
[CV 1/5] END classifier__max_depth=5, classifier__max_features=0.5,
classifier__max_leaf_nodes=50;, score=0.796 total time=   0.7s
[CV 2/5] END classifier__max_depth=5, classifier__max_features=0.5,
classifier__max_leaf_nodes=50;, score=0.816 total time=   0.6s
[CV 3/5] END classifier__max_depth=5, classifier__max_features=0.5,
classifier__max_leaf_nodes=50;, score=0.810 total time=   0.7s
[CV 4/5] END classifier__max_depth=5, classifier__max_features=0.5,
classifier__max_leaf_nodes=50;, score=0.795 total time=   1.1s
[CV 1/5] END classifier__max_depth=15, classifier__max_features=sqrt,
classifier__max_leaf_nodes=10;, score=0.682 total time=   0.9s
[CV 5/5] END classifier__max_depth=5, classifier__max_features=0.5,
classifier__max_leaf_nodes=50;, score=0.803 total time=   1.2s
[CV 2/5] END classifier__max_depth=15, classifier__max_features=sqrt,
classifier__max_leaf_nodes=10;, score=0.677 total time=   0.6s
[CV 3/5] END classifier__max_depth=15, classifier__max_features=sqrt,
classifier__max_leaf_nodes=10;, score=0.635 total time=   0.5s
[CV 4/5] END classifier__max_depth=15, classifier__max_features=sqrt,
classifier__max_leaf_nodes=10;, score=0.766 total time=   0.4s
[CV 5/5] END classifier__max_depth=15, classifier__max_features=sqrt,
classifier__max_leaf_nodes=10;, score=0.718 total time=   0.4s
[CV 1/5] END classifier__max_depth=15, classifier__max_features=sqrt,
classifier__max_leaf_nodes=15;, score=0.700 total time=   0.4s
[CV 2/5] END classifier__max_depth=15, classifier__max_features=sqrt,
classifier__max_leaf_nodes=15;, score=0.700 total time=   0.4s
[CV 3/5] END classifier__max_depth=15, classifier__max_features=sqrt,
classifier__max_leaf_nodes=15;, score=0.646 total time=   0.4s
[CV 4/5] END classifier__max_depth=15, classifier__max_features=sqrt,
```

```
classifier__max_leaf_nodes=15;, score=0.774 total time=    0.4s
[CV 5/5] END classifier__max_depth=15, classifier__max_features=sqrt,
classifier__max_leaf_nodes=15;, score=0.735 total time=    0.4s
[CV 1/5] END classifier__max_depth=15, classifier__max_features=sqrt,
classifier__max_leaf_nodes=25;, score=0.729 total time=    0.4s
[CV 2/5] END classifier__max_depth=15, classifier__max_features=sqrt,
classifier__max_leaf_nodes=25;, score=0.739 total time=    0.5s
[CV 3/5] END classifier__max_depth=15, classifier__max_features=sqrt,
classifier__max_leaf_nodes=25;, score=0.725 total time=    0.6s
[CV 4/5] END classifier__max_depth=15, classifier__max_features=sqrt,
classifier__max_leaf_nodes=25;, score=0.778 total time=    0.5s
[CV 5/5] END classifier__max_depth=15, classifier__max_features=sqrt,
classifier__max_leaf_nodes=25;, score=0.750 total time=    0.5s
[CV 1/5] END classifier__max_depth=15, classifier__max_features=sqrt,
classifier__max_leaf_nodes=50;, score=0.744 total time=    0.5s
[CV 2/5] END classifier__max_depth=15, classifier__max_features=sqrt,
classifier__max_leaf_nodes=50;, score=0.776 total time=    0.4s
[CV 3/5] END classifier__max_depth=15, classifier__max_features=sqrt,
classifier__max_leaf_nodes=50;, score=0.756 total time=    0.4s
[CV 4/5] END classifier__max_depth=15, classifier__max_features=sqrt,
classifier__max_leaf_nodes=50;, score=0.791 total time=    0.4s
[CV 1/5] END classifier__max_depth=15, classifier__max_features=log2,
classifier__max_leaf_nodes=10;, score=0.679 total time=    0.4s
[CV 5/5] END classifier__max_depth=15, classifier__max_features=sqrt,
classifier__max_leaf_nodes=50;, score=0.772 total time=    0.5s
[CV 2/5] END classifier__max_depth=15, classifier__max_features=log2,
classifier__max_leaf_nodes=10;, score=0.687 total time=    0.4s
[CV 3/5] END classifier__max_depth=15, classifier__max_features=log2,
classifier__max_leaf_nodes=10;, score=0.676 total time=    0.4s
[CV 4/5] END classifier__max_depth=15, classifier__max_features=log2,
classifier__max_leaf_nodes=10;, score=0.694 total time=    0.4s
[CV 5/5] END classifier__max_depth=15, classifier__max_features=log2,
classifier__max_leaf_nodes=10;, score=0.677 total time=    0.4s
[CV 1/5] END classifier__max_depth=15, classifier__max_features=log2,
classifier__max_leaf_nodes=15;, score=0.721 total time=    0.3s
[CV 2/5] END classifier__max_depth=15, classifier__max_features=log2,
classifier__max_leaf_nodes=15;, score=0.698 total time=    0.3s
[CV 3/5] END classifier__max_depth=15, classifier__max_features=log2,
classifier__max_leaf_nodes=15;, score=0.692 total time=    0.3s
[CV 4/5] END classifier__max_depth=15, classifier__max_features=log2,
classifier__max_leaf_nodes=15;, score=0.702 total time=    0.4s
[CV 5/5] END classifier__max_depth=15, classifier__max_features=log2,
classifier__max_leaf_nodes=15;, score=0.683 total time=    0.5s
[CV 1/5] END classifier__max_depth=15, classifier__max_features=log2,
classifier__max_leaf_nodes=25;, score=0.729 total time=    0.5s
[CV 2/5] END classifier__max_depth=15, classifier__max_features=log2,
classifier__max_leaf_nodes=25;, score=0.722 total time=    0.4s
[CV 3/5] END classifier__max_depth=15, classifier__max_features=log2,
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classifier__max_leaf_nodes=25;, score=0.713 total time=   0.4s
[CV 4/5] END classifier__max_depth=15, classifier__max_features=log2,
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[CV 5/5] END classifier__max_depth=15, classifier__max_features=log2,
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classifier__max_leaf_nodes=50;, score=0.754 total time=   0.4s
[CV 2/5] END classifier__max_depth=15, classifier__max_features=log2,
classifier__max_leaf_nodes=50;, score=0.733 total time=   0.4s
[CV 3/5] END classifier__max_depth=15, classifier__max_features=log2,
classifier__max_leaf_nodes=50;, score=0.723 total time=   0.4s
[CV 4/5] END classifier__max_depth=15, classifier__max_features=log2,
classifier__max_leaf_nodes=50;, score=0.727 total time=   0.4s
[CV 5/5] END classifier__max_depth=15, classifier__max_features=log2,
classifier__max_leaf_nodes=50;, score=0.721 total time=   0.4s
[CV 1/5] END classifier__max_depth=15, classifier__max_features=0.5,
classifier__max_leaf_nodes=10;, score=0.798 total time=   0.5s
[CV 2/5] END classifier__max_depth=15, classifier__max_features=0.5,
classifier__max_leaf_nodes=10;, score=0.810 total time=   0.5s
[CV 3/5] END classifier__max_depth=15, classifier__max_features=0.5,
classifier__max_leaf_nodes=10;, score=0.802 total time=   0.5s
[CV 4/5] END classifier__max_depth=15, classifier__max_features=0.5,
classifier__max_leaf_nodes=10;, score=0.808 total time=   0.5s
[CV 5/5] END classifier__max_depth=15, classifier__max_features=0.5,
classifier__max_leaf_nodes=10;, score=0.795 total time=   0.5s
[CV 1/5] END classifier__max_depth=15, classifier__max_features=0.5,
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[CV 2/5] END classifier__max_depth=15, classifier__max_features=0.5,
classifier__max_leaf_nodes=15;, score=0.825 total time=   0.6s
[CV 3/5] END classifier__max_depth=15, classifier__max_features=0.5,
classifier__max_leaf_nodes=15;, score=0.823 total time=   0.6s
[CV 4/5] END classifier__max_depth=15, classifier__max_features=0.5,
classifier__max_leaf_nodes=15;, score=0.822 total time=   0.6s
[CV 5/5] END classifier__max_depth=15, classifier__max_features=0.5,
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[CV 5/5] END classifier__max_depth=15, classifier__max_features=0.5,
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[CV 4/5] END classifier__max_depth=25, classifier__max_features=sqrt,
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[CV 5/5] END classifier__max_depth=25, classifier__max_features=sqrt,
classifier__max_leaf_nodes=15;, score=0.735 total time=   0.4s
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[CV 2/5] END classifier__max_depth=25, classifier__max_features=sqrt,
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[CV 3/5] END classifier__max_depth=25, classifier__max_features=sqrt,
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[CV 4/5] END classifier__max_depth=25, classifier__max_features=sqrt,
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[CV 5/5] END classifier__max_depth=25, classifier__max_features=sqrt,
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[CV 1/5] END classifier__max_depth=25, classifier__max_features=sqrt,
classifier__max_leaf_nodes=50;, score=0.788 total time=   0.4s
[CV 2/5] END classifier__max_depth=25, classifier__max_features=sqrt,
classifier__max_leaf_nodes=50;, score=0.770 total time=   0.4s
[CV 3/5] END classifier__max_depth=25, classifier__max_features=sqrt,
classifier__max_leaf_nodes=50;, score=0.795 total time=   0.5s
[CV 4/5] END classifier__max_depth=25, classifier__max_features=sqrt,
classifier__max_leaf_nodes=50;, score=0.794 total time=   0.5s
[CV 1/5] END classifier__max_depth=25, classifier__max_features=log2,
classifier__max_leaf_nodes=10;, score=0.679 total time=   0.4s
[CV 5/5] END classifier__max_depth=25, classifier__max_features=sqrt,

```
classifier__max_leaf_nodes=50;, score=0.770 total time=    0.5s
[CV 2/5] END classifier__max_depth=25, classifier__max_features=log2,
classifier__max_leaf_nodes=10;, score=0.687 total time=    0.4s
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[CV 4/5] END classifier__max_depth=25, classifier__max_features=log2,
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[CV 5/5] END classifier__max_depth=25, classifier__max_features=log2,
classifier__max_leaf_nodes=50;, score=0.734 total time=    0.4s
[CV 1/5] END classifier__max_depth=25, classifier__max_features=0.5,
classifier__max_leaf_nodes=10;, score=0.798 total time=    0.6s
[CV 2/5] END classifier__max_depth=25, classifier__max_features=0.5,
classifier__max_leaf_nodes=10;, score=0.810 total time=    0.6s
[CV 3/5] END classifier__max_depth=25, classifier__max_features=0.5,
classifier__max_leaf_nodes=10;, score=0.802 total time=    0.6s
[CV 4/5] END classifier__max_depth=25, classifier__max_features=0.5,
classifier__max_leaf_nodes=10;, score=0.808 total time=    0.6s
[CV 5/5] END classifier__max_depth=25, classifier__max_features=0.5,
```

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classifier__max_leaf_nodes=15;, score=0.813 total time=   0.6s
[CV 2/5] END classifier__max_depth=25, classifier__max_features=0.5,
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[CV 3/5] END classifier__max_depth=25, classifier__max_features=0.5,
classifier__max_leaf_nodes=15;, score=0.823 total time=   0.6s
[CV 4/5] END classifier__max_depth=25, classifier__max_features=0.5,
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[CV 5/5] END classifier__max_depth=25, classifier__max_features=0.5,
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[CV 4/5] END classifier__max_depth=25, classifier__max_features=0.5,
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classifier__max_leaf_nodes=10;, score=0.677 total time=   0.4s
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classifier__max_leaf_nodes=10;, score=0.635 total time=   0.4s
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classifier__max_leaf_nodes=15;, score=0.774 total time=   0.3s
[CV 5/5] END classifier__max_depth=50, classifier__max_features=sqrt,
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[CV 1/5] END classifier__max_depth=50, classifier__max_features=sqrt,
classifier__max_leaf_nodes=25;, score=0.779 total time=   0.4s
[CV 2/5] END classifier__max_depth=50, classifier__max_features=sqrt,
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classifier__max_leaf_nodes=25;, score=0.725 total time=   0.3s
[CV 4/5] END classifier__max_depth=50, classifier__max_features=sqrt,
classifier__max_leaf_nodes=25;, score=0.778 total time=   0.4s
[CV 5/5] END classifier__max_depth=50, classifier__max_features=sqrt,
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classifier__max_leaf_nodes=10;, score=0.677 total time=   0.3s
[CV 1/5] END classifier__max_depth=50, classifier__max_features=log2,
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classifier__max_leaf_nodes=15;, score=0.698 total time=   0.4s
[CV 3/5] END classifier__max_depth=50, classifier__max_features=log2,
classifier__max_leaf_nodes=15;, score=0.692 total time=   0.3s
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classifier__max_leaf_nodes=15;, score=0.702 total time=   0.5s
[CV 5/5] END classifier__max_depth=50, classifier__max_features=log2,
classifier__max_leaf_nodes=15;, score=0.683 total time=   0.5s
[CV 1/5] END classifier__max_depth=50, classifier__max_features=log2,
classifier__max_leaf_nodes=25;, score=0.742 total time=   0.6s
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classifier__max_leaf_nodes=25;, score=0.729 total time=   0.4s
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classifier__max_leaf_nodes=25;, score=0.703 total time=   0.4s
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[CV 5/5] END classifier__max_depth=50, classifier__max_features=log2,
classifier__max_leaf_nodes=25;, score=0.691 total time=   0.3s
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[CV 2/5] END classifier__max_depth=50, classifier__max_features=0.5,
classifier__max_leaf_nodes=10;, score=0.810 total time=   0.5s
[CV 3/5] END classifier__max_depth=50, classifier__max_features=0.5,
classifier__max_leaf_nodes=10;, score=0.802 total time=   0.5s
[CV 4/5] END classifier__max_depth=50, classifier__max_features=0.5,
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[CV 5/5] END classifier__max_depth=50, classifier__max_features=0.5,
classifier__max_leaf_nodes=10;, score=0.795 total time=   0.5s
[CV 1/5] END classifier__max_depth=50, classifier__max_features=0.5,
classifier__max_leaf_nodes=15;, score=0.813 total time=   0.5s
[CV 2/5] END classifier__max_depth=50, classifier__max_features=0.5,
classifier__max_leaf_nodes=15;, score=0.825 total time=   0.5s
[CV 3/5] END classifier__max_depth=50, classifier__max_features=0.5,
classifier__max_leaf_nodes=15;, score=0.823 total time=   0.5s
[CV 4/5] END classifier__max_depth=50, classifier__max_features=0.5,
classifier__max_leaf_nodes=15;, score=0.822 total time=   0.5s
[CV 5/5] END classifier__max_depth=50, classifier__max_features=0.5,
classifier__max_leaf_nodes=15;, score=0.812 total time=   0.5s
[CV 1/5] END classifier__max_depth=50, classifier__max_features=0.5,
classifier__max_leaf_nodes=25;, score=0.824 total time=   0.6s
[CV 2/5] END classifier__max_depth=50, classifier__max_features=0.5,
classifier__max_leaf_nodes=25;, score=0.836 total time=   0.6s
[CV 3/5] END classifier__max_depth=50, classifier__max_features=0.5,
classifier__max_leaf_nodes=25;, score=0.836 total time=   0.7s
[CV 4/5] END classifier__max_depth=50, classifier__max_features=0.5,
classifier__max_leaf_nodes=25;, score=0.834 total time=   0.8s
[CV 5/5] END classifier__max_depth=50, classifier__max_features=0.5,
classifier__max_leaf_nodes=25;, score=0.826 total time=   0.8s
[CV 1/5] END classifier__max_depth=50, classifier__max_features=0.5,
classifier__max_leaf_nodes=50;, score=0.839 total time=   0.9s
[CV 2/5] END classifier__max_depth=50, classifier__max_features=0.5,

```
classifier__max_leaf_nodes=50;, score=0.850 total time=    0.9s
[CV 3/5] END classifier__max_depth=50, classifier__max_features=0.5,
classifier__max_leaf_nodes=50;, score=0.849 total time=    0.9s
[CV 4/5] END classifier__max_depth=50, classifier__max_features=0.5,
classifier__max_leaf_nodes=50;, score=0.849 total time=    0.9s
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classifier__max_leaf_nodes=50;, score=0.844 total time=    0.9s
Optimal hyperparameters: {'classifier__max_depth': 15,
'classifier__max_features': 0.5, 'classifier__max_leaf_nodes': 50}
```

```
[ ]: Pipeline(steps=[('preprocessor',
                      ColumnTransformer(transformers=[('num', StandardScaler(),
                                                       ['AGEP', 'WKHP']),
                                                      ('cat',
      OneHotEncoder(handle_unknown='ignore'),
                                                       ['COW', 'SCHL', 'MAR', 'POBP',
                                                        'RELP', 'SEX', 'RAC1P'])])),
                     ('classifier',
                      DecisionTreeClassifier(max_depth=15, max_features=0.5,
                                             max_leaf_nodes=50, random_state=0))])
```

1.4.2 4.2 Scores and the ROC curve

Use the fitted pipeline to compute score values for all instances in the test set. Show the distribution of the scores in a histogram. Additionally, compute the (FPR,TPR) combinations for all relevant threshold values and use them to plot the ROC curve in a different figure. Following the convention, include a dashed line along the diagonal. Remember to label the axes and to make the figures as polished as possible.

Note 1: You should NOT be using sklearn.metrics.auc or sklearn.metrics.RocCurveDisplay to calculate or display the ROC curve. Please code this part yourself.

```
[ ]: # Define thresholds using unique score values or a fixed number of evenly␣
     ↪spaced values
     thresholds = np.linspace(0, 1, 1001)

     # Initialize lists to store TPR and FPR values
     tpr_list = []
     fpr_list = []

     y_proba = best_pipeline.predict_proba(X_test)[:, 1]

     # Calculate TPR and FPR for each threshold
     for threshold in thresholds:
         # Predictions based on the threshold
         y_pred = (y_proba >= threshold).astype(int)

         # True positives, false positives, true negatives, and false negatives
```

```python
        TP = np.sum((y_pred == 1) & (y_test == 1))
        FP = np.sum((y_pred == 1) & (y_test == 0))
        TN = np.sum((y_pred == 0) & (y_test == 0))
        FN = np.sum((y_pred == 0) & (y_test == 1))

        # Calculate TPR and FPR
        TPR = TP / (TP + FN) if (TP + FN) else 0
        FPR = FP / (FP + TN) if (FP + TN) else 0

        # Append to lists
        tpr_list.append(TPR)
        fpr_list.append(FPR)


# Plotting the distribution of the scores in a histogram
plt.figure(figsize=(10, 6))
plt.hist(y_proba, bins=30, alpha=0.7, color='blue', edgecolor='black')
plt.title('Distribution of Score Values')
plt.xlabel('Score')
plt.ylabel('Frequency')
plt.grid(True)
plt.show()

# Plotting the ROC curve manually
plt.figure(figsize=(10, 6))
plt.plot(fpr_list, tpr_list, color='darkorange', lw=2, label='Manual ROC curve')
plt.plot([0, 1], [0, 1], color='navy', lw=2, linestyle='--')
plt.xlim([0.0, 1.0])
plt.ylim([0.0, 1.05])
plt.xlabel('False Positive Rate')
plt.ylabel('True Positive Rate')
plt.title('Receiver Operating Characteristic (ROC) Curve (Manual Calculation)')
plt.legend(loc="lower right")
plt.grid(True)
plt.show()
```
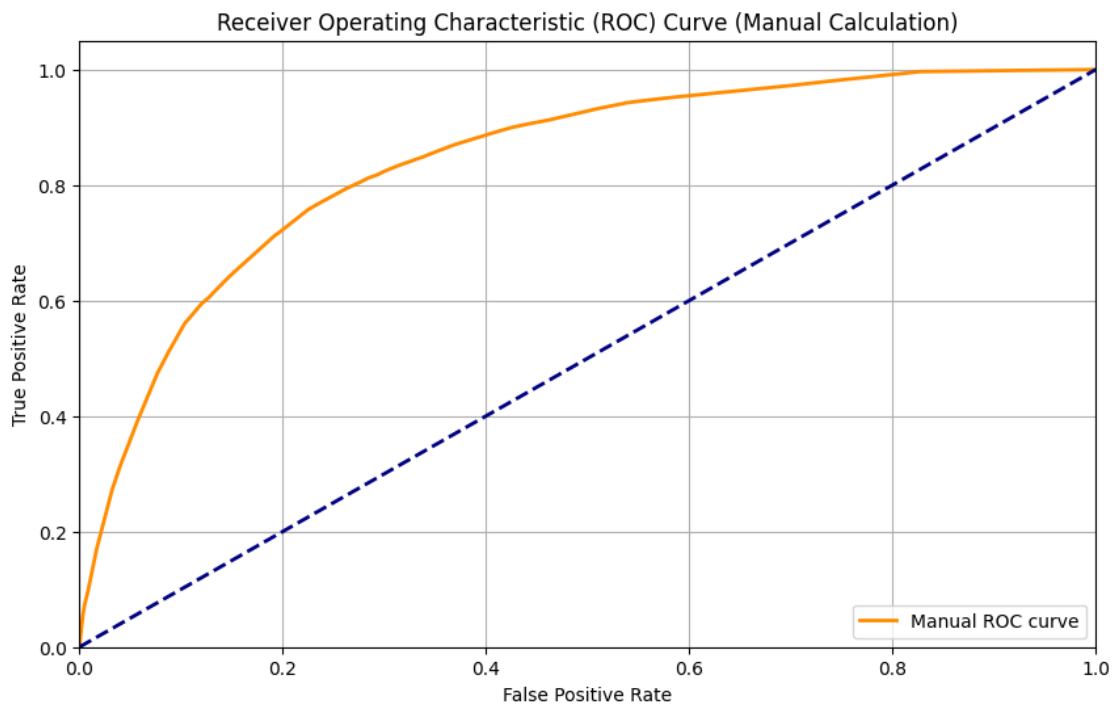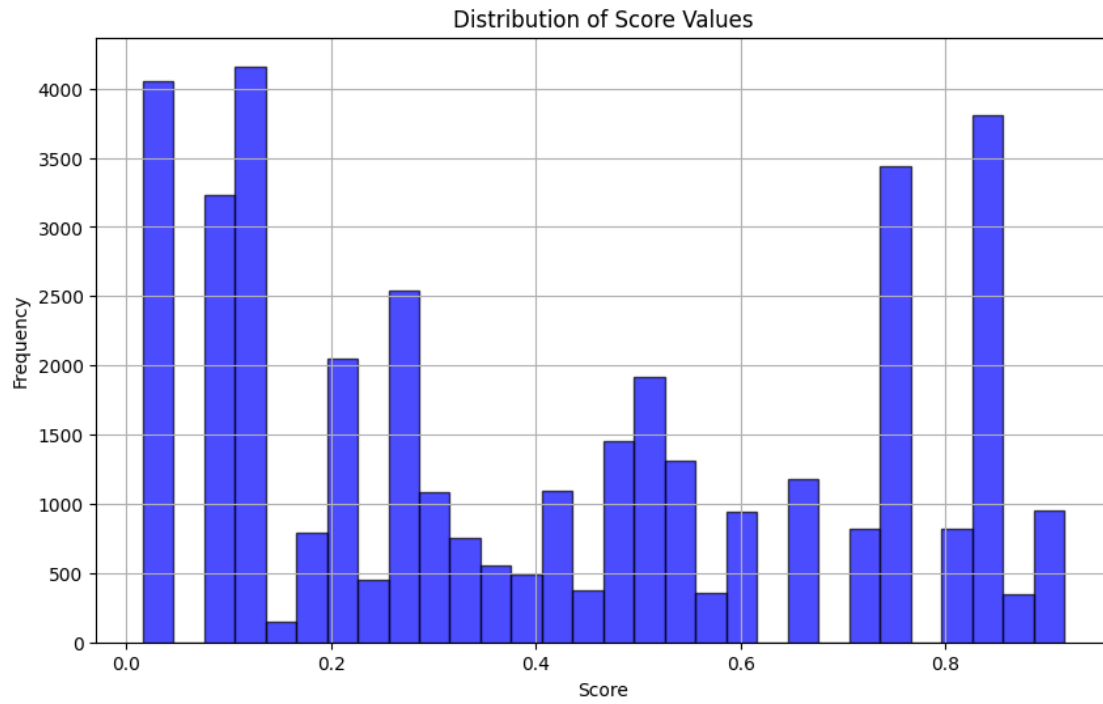
Distribution of Score Values

Receiver Operating Characteristic (ROC) Curve (Manual Calculation)

1.4.3 4.3 ROC curves by racial groups

Compute and plot in the same figure the ROC curves for the following racial groups identified by the ACS:

- White (RAC1P==1) (plot in blue)
- African American (RAC1P==2) (plot in orange)
- Asian American (RAC1P==6) (plot in green)

Interpret the results.

```python
# Segmenting the data by racial group
racial_groups = {
    'White': 1,
    'African American': 2,
    'Asian American': 6
}

# Plotting setup
plt.figure(figsize=(10, 6))
colors = ['blue', 'orange', 'green']
i = 0

for group_name, rac1p_value in racial_groups.items():
    # Extract the subset of data and predictions for the racial group
    group_indices = X_test['RAC1P'] == rac1p_value
    y_test_group = y_test[group_indices]
    y_proba_group = y_proba[group_indices]

    # Compute TPR and FPR for each threshold (assuming a similar approach as
    ↪before)
    tpr_list = []
    fpr_list = []
    thresholds = np.linspace(0, 1, 100)
    for threshold in thresholds:
        y_pred_group = (y_proba_group >= threshold).astype(int)
        TP = np.sum((y_pred_group == 1) & (y_test_group == 1))
        FP = np.sum((y_pred_group == 1) & (y_test_group == 0))
        TN = np.sum((y_pred_group == 0) & (y_test_group == 0))
        FN = np.sum((y_pred_group == 0) & (y_test_group == 1))
        TPR = TP / (TP + FN) if (TP + FN) else 0
        FPR = FP / (FP + TN) if (FP + TN) else 0
        tpr_list.append(TPR)
        fpr_list.append(FPR)

    # Plot the ROC curve for the group
    plt.plot(fpr_list, tpr_list, color=colors[i], lw=2, label=f'ROC curve
    ↪{group_name}')
    i += 1
```

```python
# Adding the no-skill line and labels
plt.plot([0, 1], [0, 1], color='navy', lw=2, linestyle='--')
plt.xlim([0.0, 1.0])
plt.ylim([0.0, 1.05])
plt.xlabel('False Positive Rate')
plt.ylabel('True Positive Rate')
plt.title('ROC Curve by Racial Group')
plt.legend(loc="lower right")
plt.grid(True)
plt.show()
```
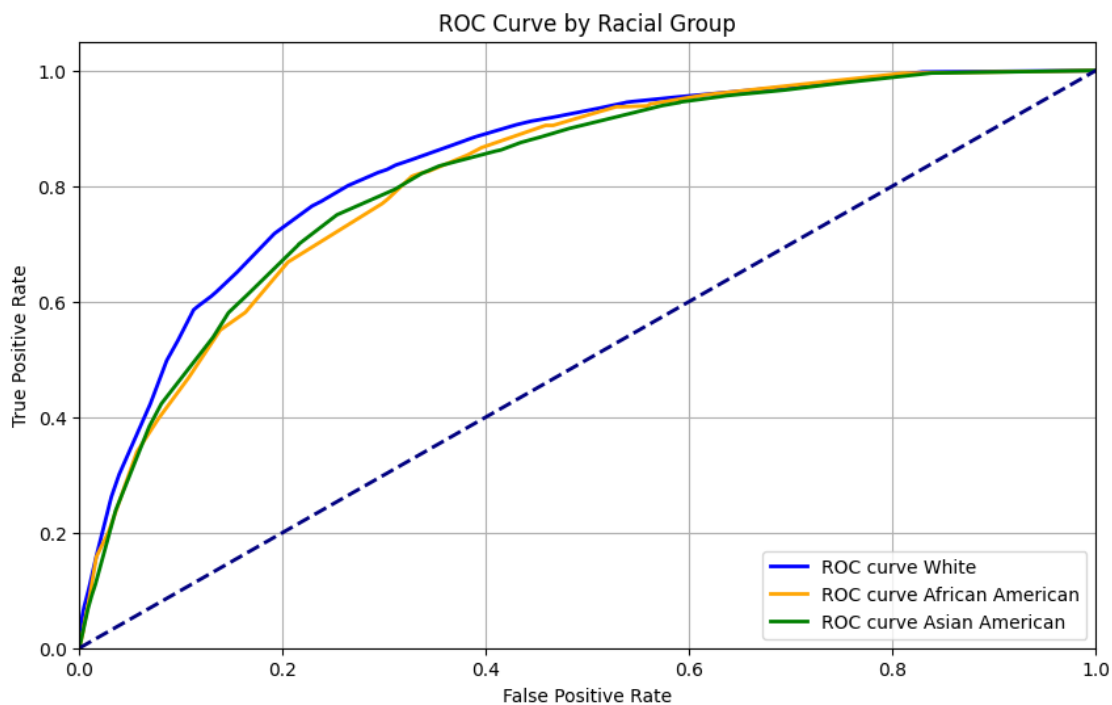

your answer here

The results are pretty similar without any of the lines being drastically different or further away from the others. However, one can note that the line for "White" is consistenly higher than the other two lines. The lines for Asian American and African American indicated a more complex pattern, as they overlap and cross at various points. This seems to imply that the classification is most effective for white individuals but less effective for non-white individuals. This implies that the relationships between the "important" feature and income outcomes are not necessarily equivalent between races and might be more representative of the relationship between the features and white individuals. However, this might simply be influenced by the fact that white individuals make up the majority of the sample size and thus hold a much larger weight in the classification process.

1.4.4 4.4 Achieving error parity

Implement a thresholding strategy that satisfies error parity for all racial groups with FPR $= 0.3$, TPR $= 0.6$ and $\epsilon = 0.025$. In plain english, find a way of setting thresholds for the members of each group in the test data that, when evaluated on the test data, delivers FPR and TPR values that differ at most from the objective values by ϵ. Plot the estimated TPRs and FPRs of the racial groups in the ROC plot. Use star markers, colored accordingly.

Hint: Consider using group-specific stochastic thresholds.

```
[ ]:  # Define target FPR, TPR, and epsilon
      target_fpr, target_tpr, epsilon = 0.3, 0.6, 0.025

      # Racial group identifiers and colors for plotting
      racial_groups = {1: 'blue', 2: 'orange', 6: 'green'}
      group_names = {1: 'White', 2: 'African American', 6: 'Asian American'}

      # Calculate FPR and TPR
      def calculate_metrics(y_true, y_pred):
          TP = np.sum((y_pred == 1) & (y_true == 1))
          FP = np.sum((y_pred == 1) & (y_true == 0))
          TN = np.sum((y_pred == 0) & (y_true == 0))
          FN = np.sum((y_pred == 0) & (y_true == 1))
          TPR = TP / (TP + FN) if TP + FN else 0
          FPR = FP / (FP + TN) if FP + TN else 0
          return FPR, TPR
```

```
[ ]:  def adjust_threshold_distribution(y_proba, y_true, target_fpr, target_tpr,␣
      ↪epsilon, group_name, iterations, adjustment_factor=0.01, verbose=False,␣
      ↪adjustment_interval=10):
          prob_draw_lower = 0.5  # Start with equal probability of drawing from␣
      ↪either distribution
          best_distance = float('inf')
          best_y_pred = None
          best_prob_draw_lower = prob_draw_lower

          for i in range(iterations):
              # Decide which distribution to draw from for each prediction
              draw_from_lower = np.random.rand(len(y_proba)) < prob_draw_lower
              thresholds = np.where(draw_from_lower,
                                    np.random.uniform(0, 0.5, size=len(y_proba)),
                                    np.random.uniform(0.5, 1, size=len(y_proba)))

              y_pred = y_proba >= thresholds
              fpr, tpr = calculate_metrics(y_true, y_pred)

              # Calculate Euclidean distance to the target point
              distance = np.sqrt((fpr - target_fpr)**2 + (tpr - target_tpr)**2)
```

```
        # Update best predictions if this is the closest we've been to the␣
↪target
        if distance < best_distance:
            best_distance = distance
            best_y_pred = y_pred
            best_prob_draw_lower = prob_draw_lower

        if verbose:
            # Debugging output
            print(f"[{group_name}] Iteration {i}: FPR={fpr:.3f}, TPR={tpr:.3f},␣
↪Probability to draw lower threshold={prob_draw_lower:.3f}")

        # Adjust the drawing probability based on the target metrics
        if i % adjustment_interval == 0:
            if fpr > target_fpr:
                prob_draw_lower = max(prob_draw_lower - adjustment_factor, 0) ␣
↪# Decrease probability to draw lower thresholds to reduce FPR
            if tpr < target_tpr:
                prob_draw_lower = min(prob_draw_lower + adjustment_factor, 1) ␣
↪# Increase probability to draw lower thresholds to increase TPR

        check = (abs(fpr - target_fpr) <= epsilon) and (abs(tpr - target_tpr)␣
↪<= epsilon)
        # Terminate if within epsilon tolerance
        if check:
            print(f"Target achieved for {group_name} with probability to draw␣
↪lower threshold: {best_prob_draw_lower:.3f}")
            break
        elif i == iterations-1 and not check:
            print(f"Target not achieved for {group_name} after {iterations}␣
↪iterations.")
            print(f"Using best predictions found with Euclidean distance:␣
↪{best_distance}")
    if best_y_pred is not None:
        print(f"Best Euclidean distance: {best_distance}")
        y_pred = best_y_pred
    return best_y_pred
```

```
[ ]: plt.figure(figsize=(10, 6))

     np.random.seed(25)

     for group_id, color in racial_groups.items():
         # Filter observations by racial group
         group_mask = X_test['RAC1P'] == group_id
```

```python
    y_true_group = y_test[group_mask]
    y_proba_group = y_proba[group_mask]


    if color == "blue":
        a_f = 0.01
        a_i = 5
        iterations = 100000
    elif color == "orange":
        a_f = 0.01
        a_i = 5
        iterations = 10000
    else:
        a_f = 0.01
        a_i = 10
        iterations = 100000


    # Apply stochastic thresholding
    y_pred_group = adjust_threshold_distribution(y_proba_group, y_true_group,␣
 ↪target_fpr, target_tpr,

                                        epsilon,group_name=color,iterations␣
 ↪= iterations, adjustment_factor=a_f, adjustment_interval = a_i)

    # Calculate FPR and TPR for the stochastic predictions
    fpr, tpr = calculate_metrics(y_true_group, y_pred_group)

    # Plot the group's FPR and TPR on the ROC plot
    plt.scatter(fpr, tpr, color=color, marker='*', s=100,␣
 ↪label=f'{group_names[group_id]} (FPR: {fpr:.3f}, TPR: {tpr:.3f})')

# Drawing the target FPR and TPR, and adding plot details
plt.plot([0, 1], [0, 1], 'k--', label='Random chance')
plt.axhline(y=target_tpr, color='grey', linestyle='-.', label='Target TPR')
plt.axvline(x=target_fpr, color='grey', linestyle='-.', label='Target FPR')
plt.xlim([0.0, 1.0])
plt.ylim([0.0, 1.05])
plt.xlabel('False Positive Rate')
plt.ylabel('True Positive Rate')
plt.title('Stochastic Thresholding Results by Racial Group')
plt.legend(loc="lower right")
plt.grid(True)
plt.show()
```

Target achieved for blue with probability to draw lower threshold: 0.500
Best Euclidean distance: 0.02966253689120794
Target achieved for orange with probability to draw lower threshold: 0.500

```
Best Euclidean distance: 0.009916110178674999
Target achieved for green with probability to draw lower threshold: 0.450
Best Euclidean distance: 0.017164450439702078
```

Stochastic Thresholding Results by Racial Group
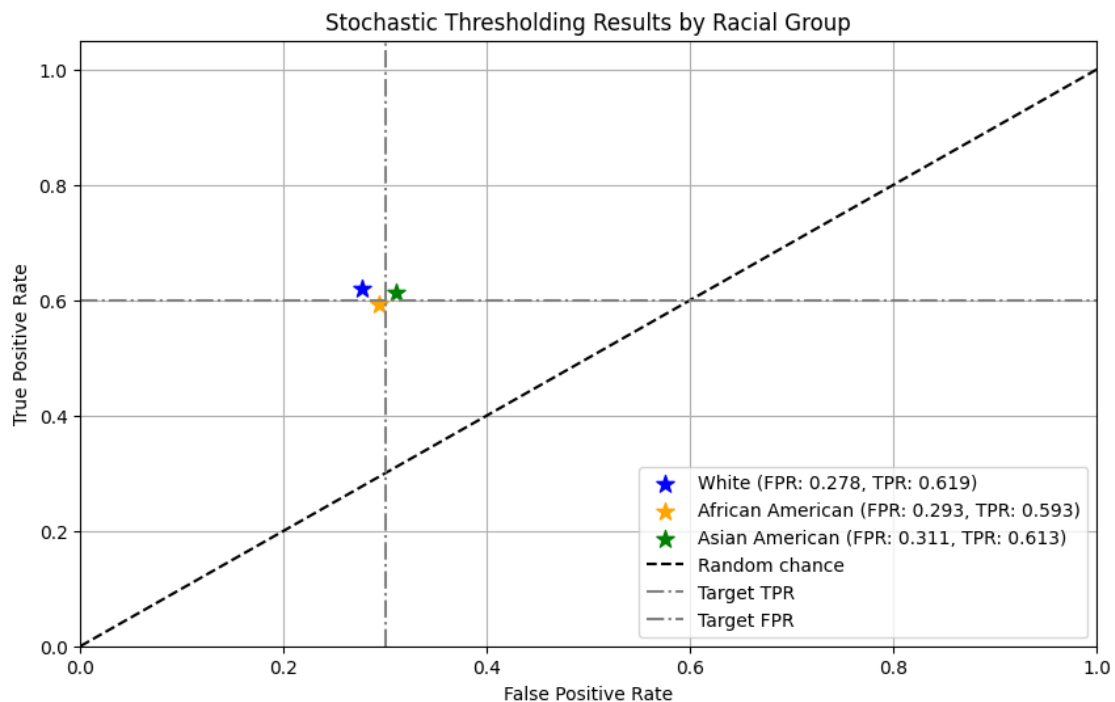
1.4.5   4.5 Improving the results [extra-credit]

Can you improve the results from 4.4? That is, can you tweak your algorithm to deliver a higher TPR and lower FPR while still satisfying error parity with epsilon = 0.025? What is the best result that you are able to achieve? Is there a hard limit on how much you can improve?

```python
# your code here

def adjust_threshold_distribution2(y_proba, y_true, target_fpr, target_tpr,
 epsilon,
                                   group_name, iterations, adjustment_factor=0.
 01,
                                   verbose=False, adjustment_interval=10,
 euclid_dist = False):
    prob_draw_lower = 0.5  # Start with equal probability of drawing from
 either distribution
    best_distance = float('inf')
    best_y_pred = None
    best_prob_draw_lower = prob_draw_lower
```

```python
    satisfying_solutions = []  # Store satisfying solutions

    for i in range(iterations):
        # Decide which distribution to draw from for each prediction
        draw_from_lower = np.random.rand(len(y_proba)) < prob_draw_lower
        thresholds = np.where(draw_from_lower,
                              np.random.uniform(0, 0.5, size=len(y_proba)),
                              np.random.uniform(0.5, 1, size=len(y_proba)))

        y_pred = y_proba >= thresholds
        fpr, tpr = calculate_metrics(y_true, y_pred)

        # Calculate Euclidean distance to the target point
        distance = np.sqrt((fpr - target_fpr)**2 + (tpr - target_tpr)**2)

        # Update best predictions if this is the closest we've been to the
        ↪target
        if distance < best_distance:
            best_distance = distance
            best_y_pred = y_pred
            best_prob_draw_lower = prob_draw_lower

        if verbose:
            # Debugging output
            print(f"[{group_name}] Iteration {i}: FPR={fpr:.3f}, TPR={tpr:.3f},
            ↪Probability to draw lower threshold={prob_draw_lower:.3f}")

        # Check if the solution satisfies the criteria and save it
        if abs(fpr - target_fpr) <= epsilon and abs(tpr - target_tpr) <=
        ↪epsilon:
            satisfying_solutions.append((y_pred, fpr, tpr, distance))

        # Adjust the drawing probability based on the target metrics
        if i % adjustment_interval == 0:
            if fpr > target_fpr:
                prob_draw_lower = max(prob_draw_lower - adjustment_factor, 0)
                ↪# Decrease probability to draw lower thresholds to reduce FPR
            if tpr < target_tpr:
                prob_draw_lower = min(prob_draw_lower + adjustment_factor, 1)
                ↪# Increase probability to draw lower thresholds to increase TPR

    # After all iterations, select the best solution from those that satisfy
    ↪the criteria
    if satisfying_solutions:
        # Choose the solution with the minimum distance or you could prioritize
        ↪FPR/TPR here
```

```
        if euclid_dist:
            best_solution = min(satisfying_solutions, key=lambda x: x[3])
        else:
            best_solution = max(satisfying_solutions, key=lambda x: abs(x[2] -↵
↪x[1]))
        best_y_pred, best_fpr, best_tpr, _ = best_solution
        if verbose:
            print(f"Best satisfying solution chosen for {group_name} with FPR:↵
↪{best_fpr:.3f}, TPR: {best_tpr:.3f}")
    else:
        print(f"No satisfying solution found for {group_name} after↵
↪{iterations} iterations.")
        if best_y_pred is not None:
            print(f"Using best predictions found with Euclidean distance:↵
↪{best_distance}")

    return best_y_pred, satisfying_solutions
```

```python
def plot_results(euclid_dist, ax):
    np.random.seed(25)
    solutions_list = []

    for group_id, color in racial_groups.items():
        # Filter observations by racial group
        group_mask = X_test['RAC1P'] == group_id
        y_true_group = y_test[group_mask]
        y_proba_group = y_proba[group_mask]

        if color == "blue":
            a_f = 0.01
            a_i = 5
            iterations = 100
        elif color == "orange":
            a_f = 0.01
            a_i = 5
            iterations = 100
        else:
            a_f = 0.01
            a_i = 10
            iterations = 100

        # Apply stochastic thresholding with or without Euclidean distance
        y_pred_group, solutions = adjust_threshold_distribution2(y_proba_group,↵
↪y_true_group, target_fpr, target_tpr,
                                                                epsilon,↵
↪group_name=color, iterations=100,
```

```
                                                       ␣
 ↪adjustment_factor=0.01, adjustment_interval=10, euclid_dist=euclid_dist)
        solutions_list.append(solutions)

        # Calculate FPR and TPR for the stochastic predictions
        fpr, tpr = calculate_metrics(y_true_group, y_pred_group)

        # Plot the group's FPR and TPR on the provided axes
        ax.scatter(fpr, tpr, color=color, marker='*', s=100,␣
 ↪label=f'{group_names[group_id]} (FPR: {fpr:.3f}, TPR: {tpr:.3f})')

    # Adding plot details to the provided axes
    ax.plot([0, 1], [0, 1], 'k--', label='Random chance')
    ax.axhline(y=target_tpr, color='grey', linestyle='-.', label='Target TPR')
    ax.axvline(x=target_fpr, color='grey', linestyle='-.', label='Target FPR')
    ax.set_xlim([0.0, 1.0])
    ax.set_ylim([0.0, 1.05])
    ax.set_xlabel('False Positive Rate')
    ax.set_ylabel('True Positive Rate')
    title_suffix = " minimizing Euclidean Distance" if euclid_dist else "␣
 ↪maximizing TPR and minimizing FPR (within epsilon)"
    ax.set_title('Stochastic Thresholding Results by Racial Group' +␣
 ↪title_suffix)
    ax.legend(loc="lower right")
    ax.grid(True)
```

```
[ ]: # Create a figure and subplots outside the function
     fig, axs = plt.subplots(1, 2, figsize=(20, 6))  # Creating two side-by-side␣
      ↪plots

     # Call 'plot_results' for each subplot with the corresponding subplot (axes)␣
      ↪passed as an argument
     plot_results(False, axs[0])  # Plot without Euclidean distance on the first␣
      ↪subplot
     plot_results(True, axs[1])   # Plot with Euclidean distance on the second␣
      ↪subplot

     plt.tight_layout()
     plt.show()
```
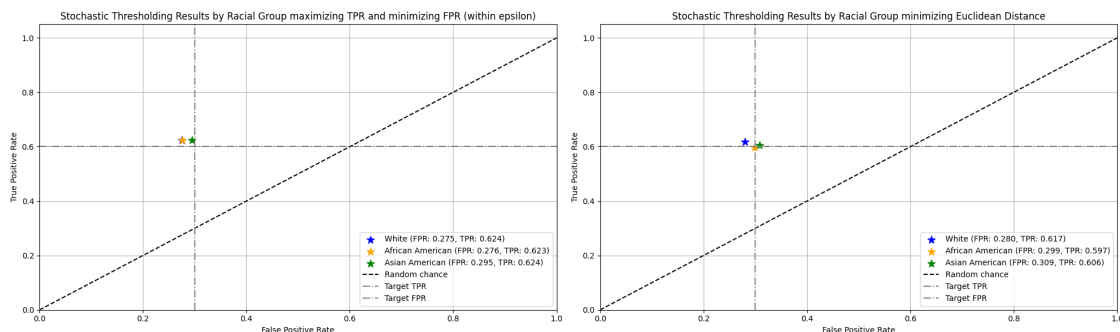
your observations here

Can you improve the results from 4.4? That is, can you tweak your algorithm to deliver a higher TPR and lower FPR while still satisfying error parity with epsilon = 0.025? What is the best result that you are able to achieve? Is there a hard limit on how much you can improve?

I have created a new thresholding function that allows the users to select the predictions that result in (FPR,TPR) pairs that minimize euclidean distance to target or maximize the absolute distance between TPR and FPR while still remaining in the epsilon boundary. The quality of results can change depending on the number of iterations set. The best results are graphed above. I'm not sure if there's a hard limit to how much one can improve, as my algorithm is based on stochasticity. One might note, however, that the model was able to improve quite a lot, as the upper bound of 0.625 was almost reached across the board. The lowed bound of 0.275 was not so easy to reach, likely because of limitations in the empirical group distributions of scores

1.4.6 4.6 Conclusion

What can you say about welfare and error parity? Some things to consider:

- In this income prediction task, is enforcing error parity costly?
- Would you expect this results to generalize to other predictions problems?
- Is the group definition relevant?
- Who benefits from enforcing error parity? Who doesn't?

- In this income prediction task, is enforcing error parity costly?
  - Enforcing error parity could be costly. It depends on the distribution of the scores and how long that takes for convergence. In the above case, the algorithm I used was relatively cheap, but this could change for more difficult data and distributions.
- Would you expect this results to generalize to other predictions problems?
  - Likely not exactly. The balance between different types of errors and the focus on error parity will differ based on the domain, the nature of the predictions, and the impact of errors. However, the stochastic threshodling algoithm itself could be applied in other scenarios.
- Is the group definition relevant?
  - Yes, the group defintion directly influences the measurement of error parity. Groups need to be defined in a way that is meaningful aligns with the societal and ethical concerns

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the error parity is trying to account for. If not, the enforced parity might overlook important nuances, such as within-group disparities.

- Who benefits from enforcing error parity? Who doesn't?
  - Enforcing error parity aims to ensure fairness across different groups, which can benefit historically disadvantaged or marginalized groups. In the context of income prediction, this might mean equalizing the rates of false positives and negatives across racial lines, potentially leading to more equitable outcomes in decisions related to lending, marketing, and social services. As we saw above, the white majority in the same led to the relationships between white individuals and the covariates carrying a larger weight in the classification model. Thus, accounting for group differences using error parity is important if we want to make sure that we ensure fairness across different groups.
  - However, this could also have unintended consequences. Such as overcorrecting and neglecting individual-level fairness or ignoring other important group distinctions.