

XYZ Bank Customer Churn Analysis and Prediction

```
# Importing essential libraries
import pandas as pd
import numpy as np

# Matplotlib for visualizing data
from matplotlib import pyplot as plt

# Displaying plots within the Jupyter notebook
%matplotlib inline

# Seaborn for improved data visualization
import seaborn as sns
sns.set_style('darkgrid')

# Counter for tallying occurrences of elements in a collection
from collections import Counter
```

Exploratory Data Analysis

Reading the CSV and Performing Data Cleaning

```
# Loading the dataset
df = pd.read_csv("dataset.csv")

# Displaying the dimensions of the dataframe
print(f"Dataframe dimensions: {df.shape}")

# Displaying the first few rows of the dataframe
df.head()
```

Dataframe dimensions: (10000, 14)

	RowNumber	CustomerId	Surname	CreditScore	Geography	Gender	Age
0	1	15634602	Hargrave	619	Sweden	Female	42
1	2	15647311	Hill	608	Denmark	Female	41
2	3	15619304	Onio	502	Sweden	Female	42
3	4	15701354	Boni	699	Sweden	Female	39
4	5	15737888	Mitchell	850	Denmark	Female	43

	Tenure	Balance	NumOfProducts	HasCrCard	IsActiveMember	\
0	2	0.00	1	1	1	
1	1	83807.86	1	0	1	
2	8	159660.80	3	1	0	
3	1	0.00	2	0	0	
4	2	125510.82	1	1	1	

	EstimatedSalary	Exited
0	101348.88	1
1	112542.58	0
2	113931.57	1
3	93826.63	0
4	79084.10	0

```
# Displaying information about the dataframe
df.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 10000 entries, 0 to 9999
Data columns (total 14 columns):
#   Column                Non-Null Count  Dtype
---  -
0   RowNumber              10000 non-null  int64
1   CustomerId             10000 non-null  int64
2   Surname                10000 non-null  object
3   CreditScore             10000 non-null  int64
4   Geography              10000 non-null  object
5   Gender                 10000 non-null  object
6   Age                    10000 non-null  int64
7   Tenure                 10000 non-null  int64
8   Balance                 10000 non-null  float64
9   NumOfProducts          10000 non-null  int64
10  HasCrCard              10000 non-null  int64
11  IsActiveMember         10000 non-null  int64
12  EstimatedSalary         10000 non-null  float64
13  Exited                  10000 non-null  int64
dtypes: float64(2), int64(9), object(3)
memory usage: 1.1+ MB
```

There are no "nulls" in our dataframe.

```
# Listing number of unique customer IDs
df.CustomerId.nunique()
```

```
10000
```

All Customer IDs are unique which means there are no duplicates.

```
df.duplicated().sum()
```

```
0
```

Removing Unnecessary features

To make dataset easily readable we will drop features not needed for prediction:

- RowNumber
- CustomerId
- Surname

```
# Drop unused features
df.drop(['RowNumber', 'CustomerId', 'Surname'], axis=1, inplace=True)
print(f"Dataframe dimensions: {df.shape}")
df.head()
```

Dataframe dimensions: (10000, 11)

	CreditScore	Geography	Gender	Age	Tenure	Balance
NumOfProducts \						
0	619	Sweden	Female	42	2	0.00
1						
1	608	Denmark	Female	41	1	83807.86
1						
2	502	Sweden	Female	42	8	159660.80
3						
3	699	Sweden	Female	39	1	0.00
2						
4	850	Denmark	Female	43	2	125510.82
1						

	HasCrCard	IsActiveMember	EstimatedSalary	Exited
0	1	1	101348.88	1
1	0	1	112542.58	0
2	1	0	113931.57	1
3	0	0	93826.63	0
4	1	1	79084.10	0

Univariate Analysis

Distributions of Features (Numerical and Categorical)

Customers by Churn Percentage

```
"""
Parameters:
    data (DataFrame): The input data.
```

```

    chart (str): The title of the countplot.
"""

def plot_countplot_by_target(data, chart):
    """
    Plot a countplot based on the target variable.

    Args:
        data (DataFrame): The input data.
        chart (str): The title of the countplot.
    """
    sns.set_theme(style="whitegrid")

    plt.figure(figsize=(4, 4))
    plt.suptitle(f'{chart}', y=1)

    # Plotting countplot based on the target variable
    g = sns.countplot(x='Exited', data=data, palette='muted')
    g.set(ylabel='Number', xlabel='Target')

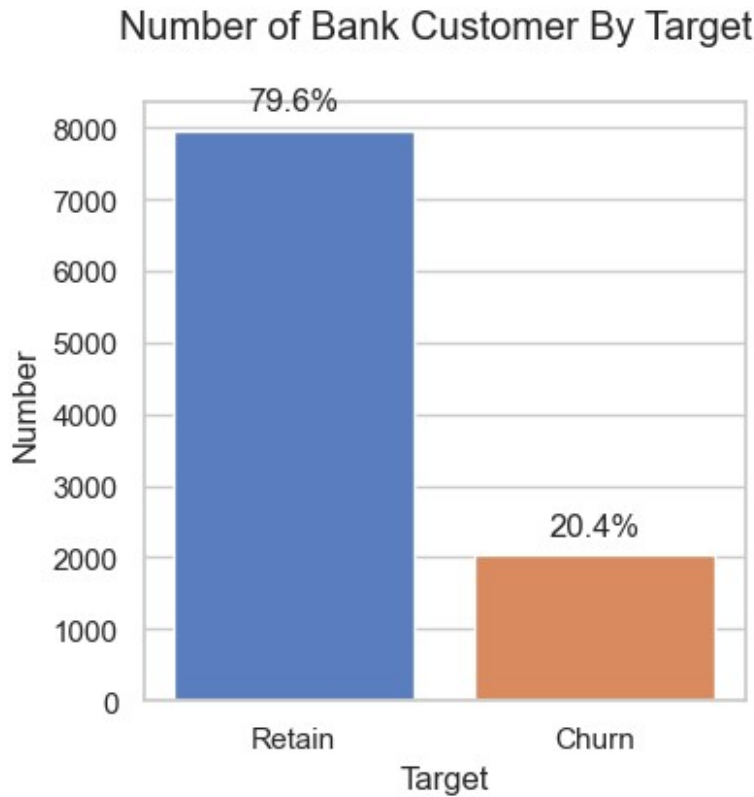
    # Customize xticks
    plt.xticks([0, 1], ['Retain', 'Churn'], fontsize=11)

    # Annotate the percentage on the chart
    total = len(data['Exited'])
    for p in g.patches:
        height = p.get_height()
        percentage = (height / total) * 100
        g.annotate(f'{percentage:.1f}%', (p.get_x() + p.get_width() /
2, height + 200), \
                ha='center', va='bottom', fontsize=12)

    plt.show()

plot_countplot_by_target(df, 'Number of Bank Customer By Target')

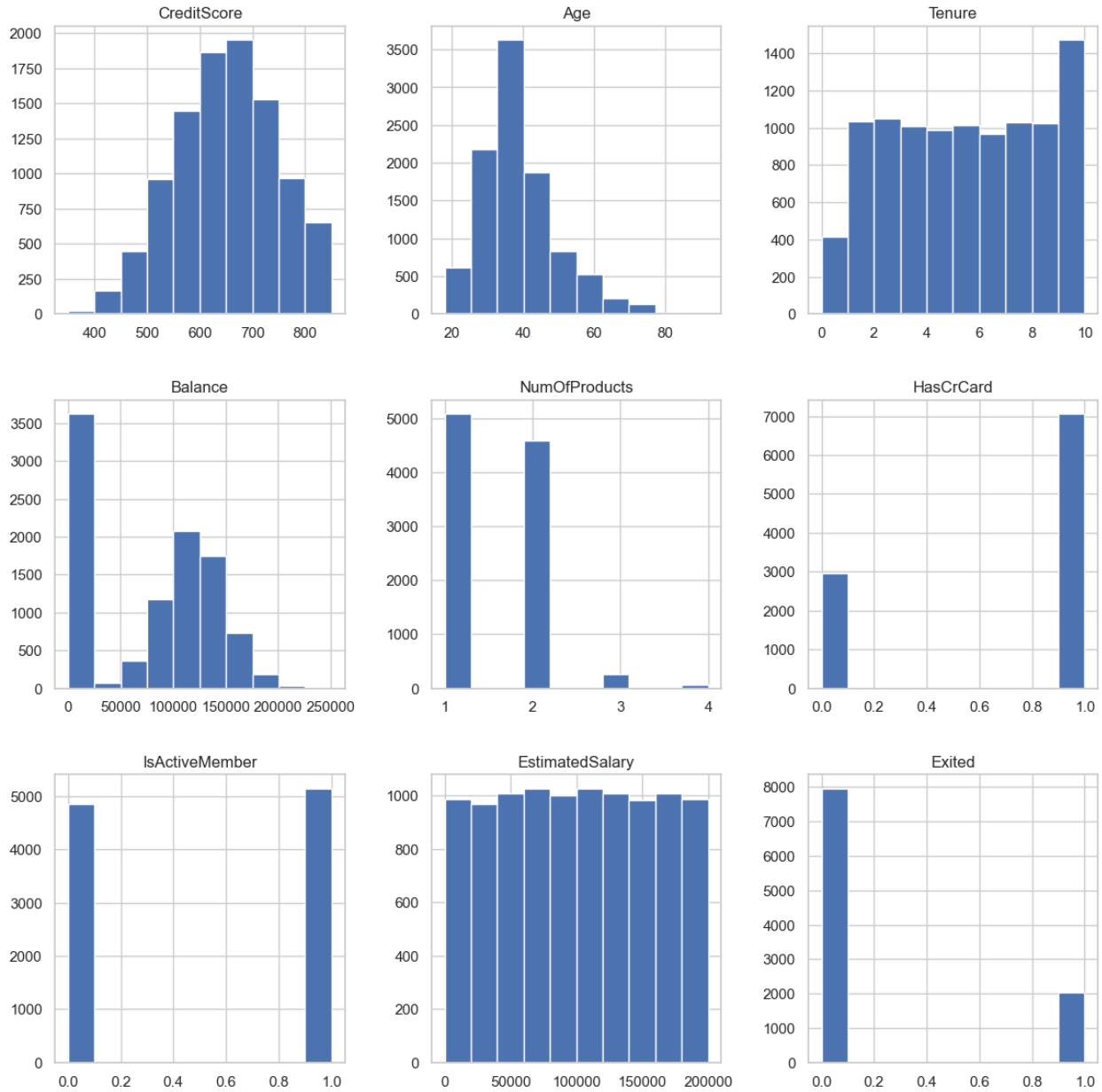
```



The chart depicted above illustrates the distribution of the target variable, indicating that the percentage of Churn among bank customers is 20.4%. This suggests an imbalance in the data related to the target variable.

Plotting Histogram grid

```
# Plotting histogram grid  
df.hist(figsize=(14,14))  
plt.show()
```



Summary statistics for the numeric features

```
# Summarizing the numerical features
df.describe()
```

	CreditScore	Age	Tenure	Balance
count	10000.000000	10000.000000	10000.000000	10000.000000
mean	650.528800	38.921800	5.012800	76485.889288
std	96.653299	10.487806	2.892174	62397.405202
0.581654				

min	350.000000	18.000000	0.000000	0.000000
1.000000				
25%	584.000000	32.000000	3.000000	0.000000
1.000000				
50%	652.000000	37.000000	5.000000	97198.540000
1.000000				
75%	718.000000	44.000000	7.000000	127644.240000
2.000000				
max	850.000000	92.000000	10.000000	250898.090000
4.000000				

	HasCrCard	IsActiveMember	EstimatedSalary	Exited
count	10000.000000	10000.000000	10000.000000	10000.000000
mean	0.70550	0.515100	100090.239881	0.203700
std	0.45584	0.499797	57510.492818	0.402769
min	0.000000	0.000000	11.580000	0.000000
25%	0.000000	0.000000	51002.110000	0.000000
50%	1.000000	1.000000	100193.915000	0.000000
75%	1.000000	1.000000	149388.247500	0.000000
max	1.000000	1.000000	199992.480000	1.000000

Based on the summary statistics and histograms, it can be inferred that all features appear to be within acceptable ranges. No extreme values are observed for any feature.

Distribution of Categorical Features

```
# Summarizing categorical features
df.describe(include=['object'])
```

	Geography	Gender
count	10000	10000
unique	3	2
top	Sweden	Male
freq	5014	5457

This provides the count of unique classes for each feature. For instance, the count of males (5457) exceeds that of females. Additionally, Sweden is the most frequently occurring geography among the three (Sweden, Denmark, Finland) in our dataframe.

Gender Distribution

```
"""
Parameters:
    data (DataFrame): The input data.
    feature (str): The variable for which the bar plot is created.
"""

def plot_bar_count(data, feature):
    """
    Create a bar plot for a specified feature.
```

Args:

data (DataFrame): The input data.

feature (str): The variable for which the bar plot is created.

"""

```
plt.figure(figsize=(4, 4))
```

```
data[feature].value_counts().plot.bar(color=['blue', 'green'])
```

```
plt.ylabel('Count')
```

```
plt.xlabel(feature)
```

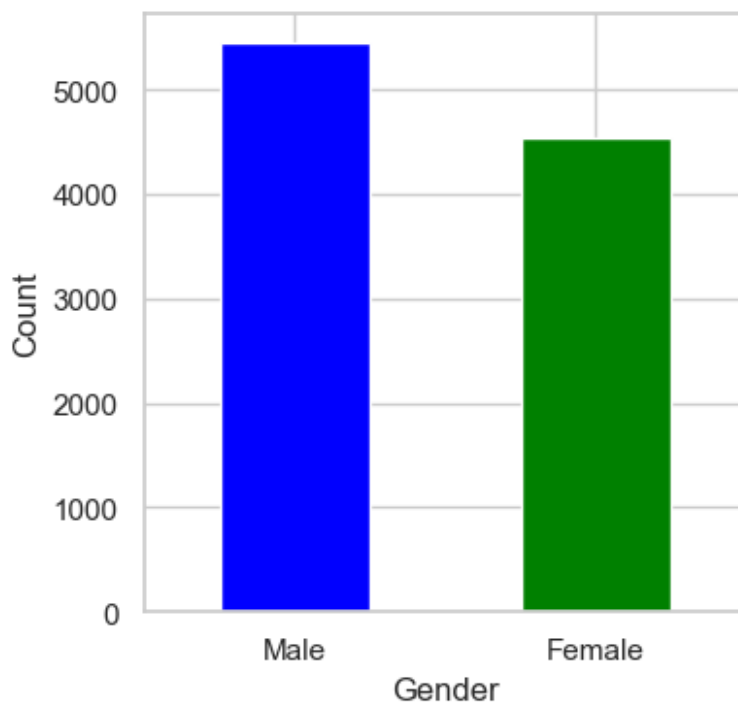
```
plt.xticks(rotation=0)
```

```
plt.show()
```

```
plot_bar_count(df, 'Gender')
```

Display the count of each class in the specified feature

```
Counter(df['Gender'])
```



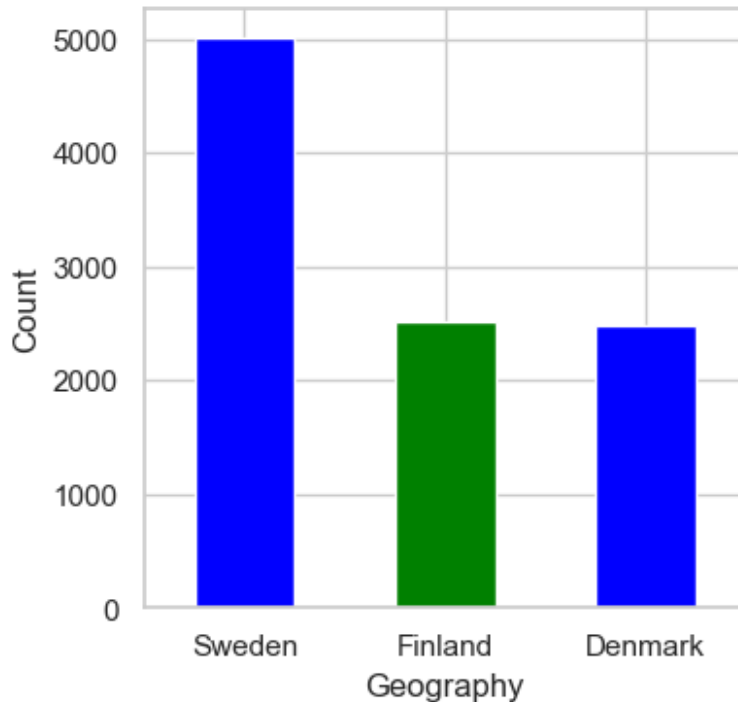
```
Counter({'Female': 4543, 'Male': 5457})
```

In our data sample there are more males than females.

```
plot_bar_count(df, 'Geography')
```

Display the count of each class in the specified feature

```
Counter(df['Geography'])
```

```
Counter({'Sweden': 5014, 'Denmark': 2477, 'Finland': 2509})
```

Majority of customers are from Sweden, about 50%, and from Denmark and Finland around 25% each.

Churn Segmentation analysis by Gender¶

```
def countplot_univariate(data, column, hue, label, max_sample,
num_x_ticks, x_ticks, width, height, y_title, orient, title):
    """
    Plot a countplot for univariate analysis.

    Parameters:
        data (DataFrame): The input data.
        column (str): The variable to be plotted on the x-axis (or y-
axis, based on the `orient` parameter).
        hue (str): The third variable to differentiate categories
(optional).
        label (str): The label for the variable on the x-axis (or y-
axis).
        max_sample (int): The maximum number of categories to be shown
on the plot.
        num_x_ticks (int): The number of x-axis ticks to be
customized.
        x_ticks (list): The list of x-axis tick labels to be
customized.
        width (float): The width of the plot.
        height (float): The height of the plot.
```

```

        y_title (float): The distance between the title and the plot.
        orient (str): The orientation of the plot ('vertical' or
'horizontal').
        title (str): The title of the plot.
    """
    # Create a new figure with the specified width, height, and title
    plt.figure(figsize=(width, height))
    plt.suptitle(f'{title}', y=y_title)

    # Determine the order of the categories based on the maximum
sample size
    order = data[column].value_counts().nlargest(max_sample).index if
max_sample > 0 else data[column].value_counts().index

    # Create a countplot based on the specified orientation
    if orient == 'vertical':
        g = sns.countplot(x=column, hue=hue, order=order, data=data,
palette='deep')
        g.set(xlabel=label, ylabel='Number')
    elif orient == 'horizontal':
        g = sns.countplot(y=column, hue=hue, order=order, data=data,
palette='deep')
        g.set(xlabel='Number', ylabel=label)

    plt.legend(title='Exited', labels=['Stay', 'Churn'], fontsize=11)

    # Customize the x-axis ticks if the number of ticks is specified
    if num_x_ticks > 0:
        x_ticks_list = list(range(num_x_ticks))
        plt.xticks(x_ticks_list, x_ticks, fontsize=11)

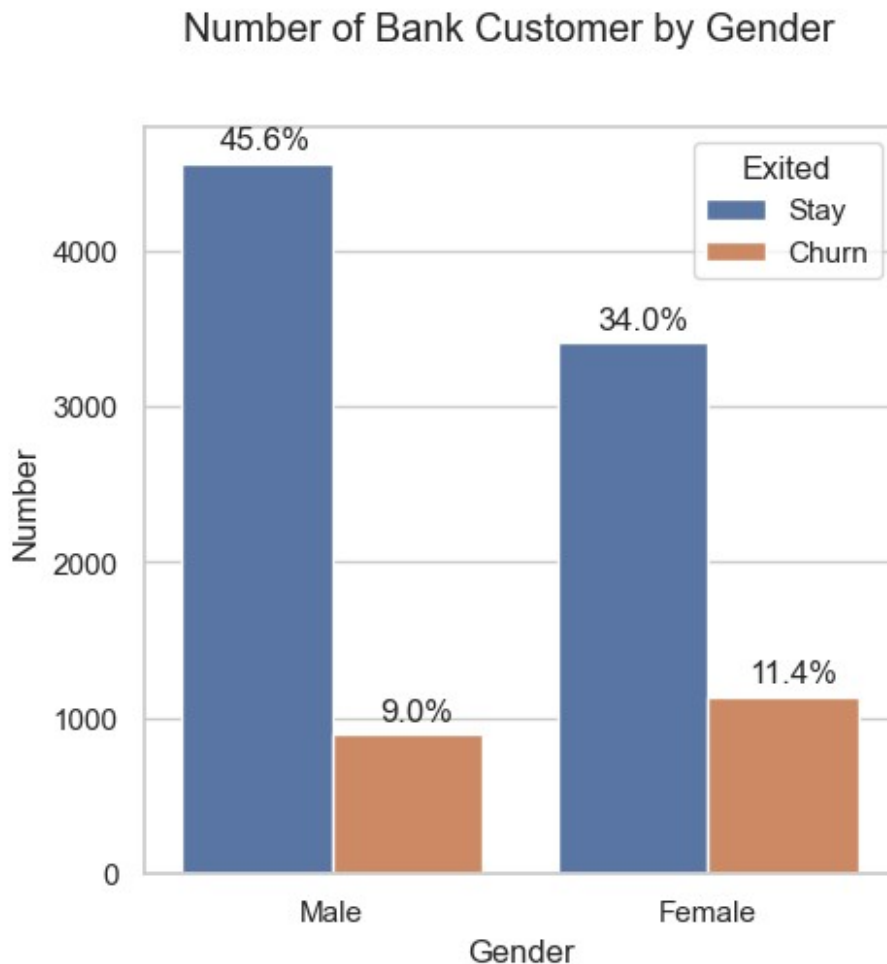
    # Calculate the total number of observations
    total = len(data[column])

    # Add percentage annotations to the bars
    for p in g.patches:
        if orient == 'vertical':
            height = p.get_height()
            percentage = (height / total) * 100
            g.annotate(f'{percentage:.1f}%', (p.get_x() +
(p.get_width() + 0.05) / 2, height + 50), \
                    ha='center', va='bottom', fontsize=12)
        elif orient == 'horizontal':
            width = p.get_width()
            percentage = (width / total) * 100
            g.annotate(f'{percentage:.1f}%', (width + 25, p.get_y() +
p.get_height() / 2), \
                    ha='left', va='center', fontsize=11)

    plt.show()

```

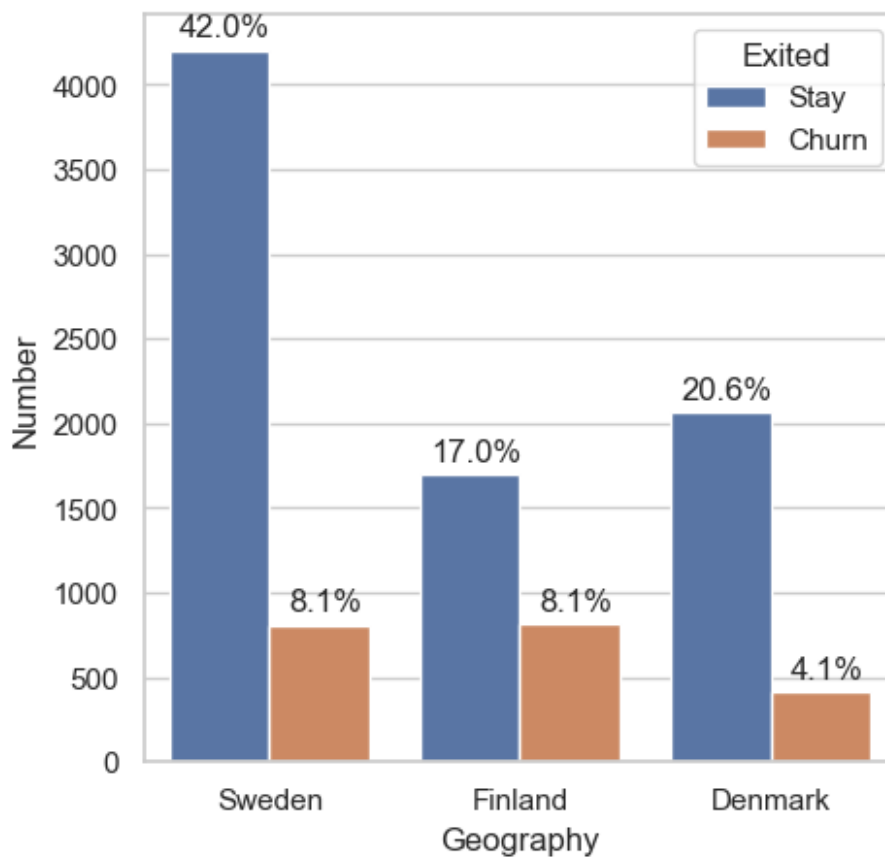
```
# applying the procedure to plot the chart
countplot_univariate(df, 'Gender', 'Exited', 'Gender', 0, 0, None, 5,
5, 1, \
                        'vertical', 'Number of Bank Customer by Gender')
```



The chart above illustrates the distribution of the target variable based on 'Gender.' Among bank customers, females exhibit the highest churn rate at 11.4%, surpassing males who have a churn rate of 9%.

```
# applying the procedure to plot the chart
countplot_univariate(df, 'Geography', 'Exited', 'Geography', 0, 0,
None, 5, 5, 1, \
                        'vertical', 'Number of Bank Customer by
Geography')
```

Number of Bank Customer by Geography



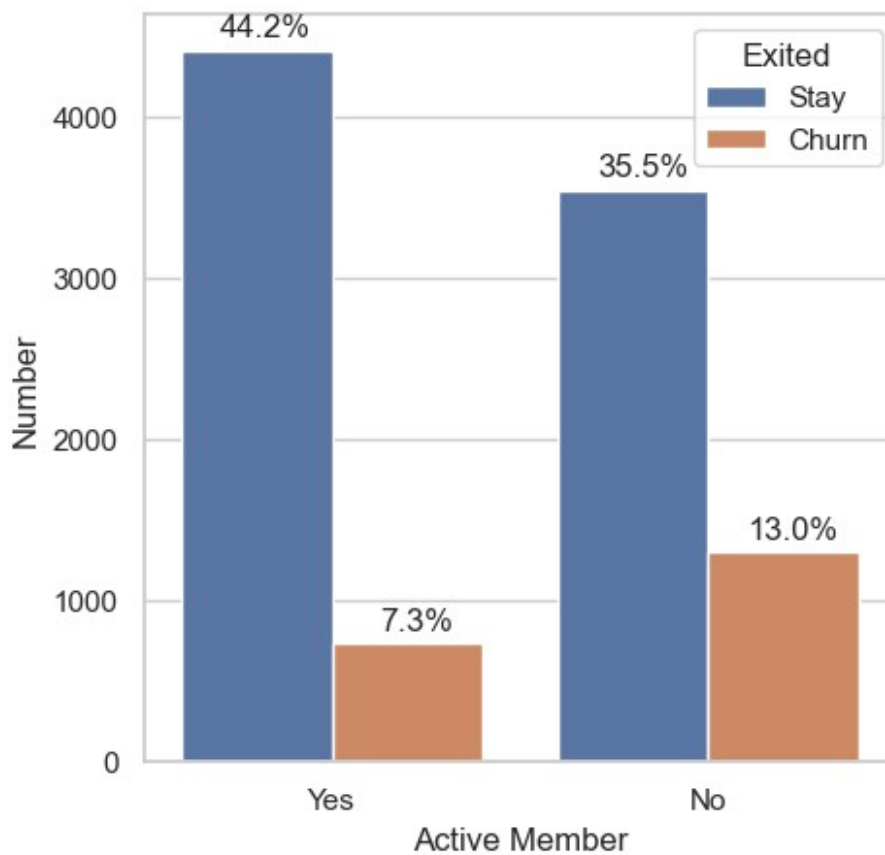
The chart above displays the distribution of target variables categorized by geography. Specifically, both Sweden and Finland demonstrate a churn percentage of 8.1%, while Denmark exhibits a churn percentage of 4.1%.

Churn Segmentation by Geography¶

The smallest number of customers are from Finland but it looks that they are most likely to leave the bank. Almost one third of Finnish customers in our sample left the bank.

```
# applying the procedure to plot the chart
countplot_univariate(df, 'IsActiveMember', 'Exited', 'Active Member',
0, 2, ['Yes', 'No'], 5, 5, 1, \
'vertical', 'Number of Bank Customer by Member
Activity Status')
```

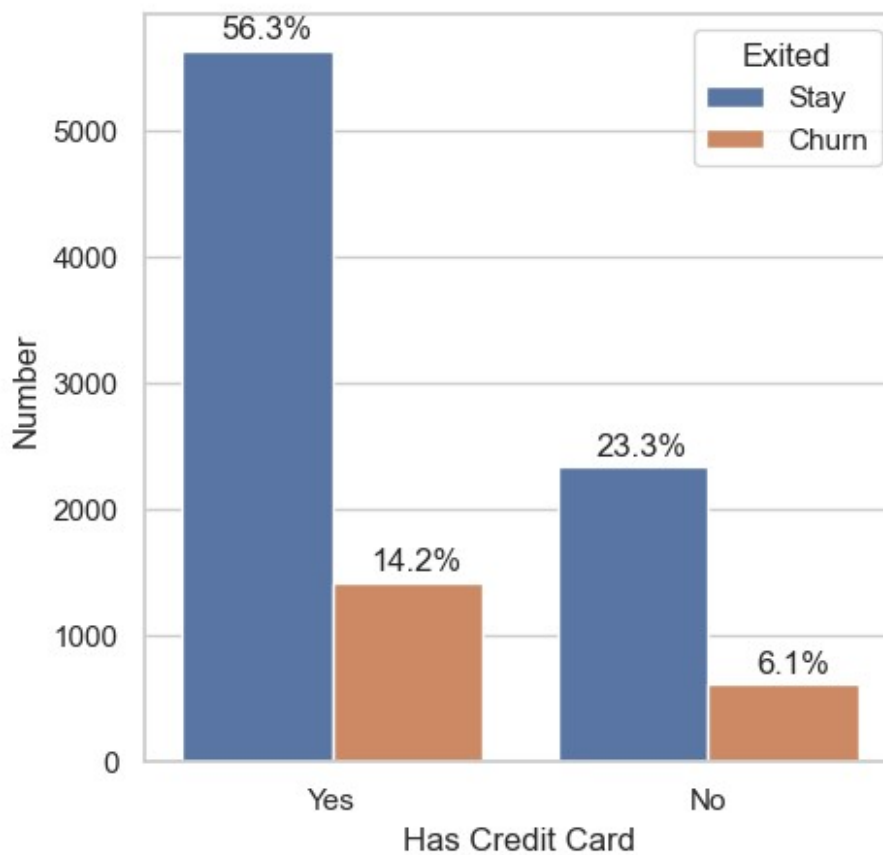
Number of Bank Customer by Member Activity Status



The graph above depicts the distribution of the target variable based on 'IsActiveMember.' Notably, bank customers who are not active members exhibit a higher churn percentage, totaling 13%, compared to active customers.

```
# applying the procedure to plot the chart
countplot_univariate(df, 'HasCrCard', 'Exited', 'Has Credit Card', 0,
2, ['Yes', 'No'], 5, 5, 1, \
'vertical', 'Number of Bank Customer by Credit
Card Ownership Status')
```

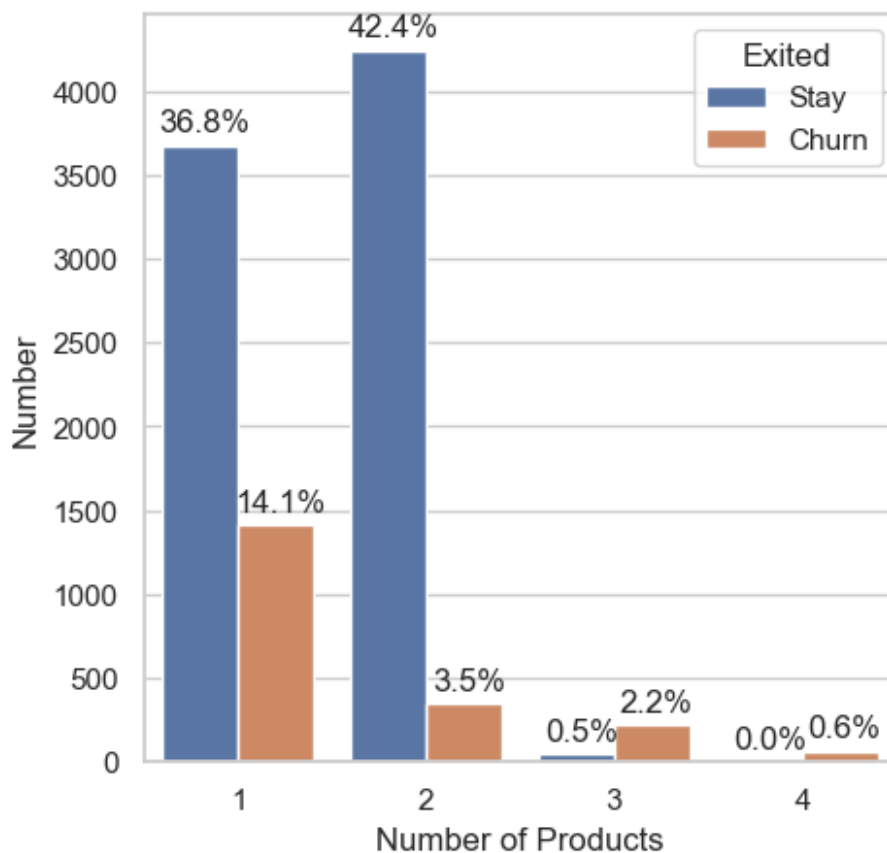
Number of Bank Customer by Credit Card Ownership Status



The graph above illustrates the distribution of target variables categorized by 'HasCrCard.' Notably, bank customers possessing a credit card have the highest churn rate at 14.2%, exceeding customers without a credit card, who have a churn percentage of 6.1%.

```
# applying the procedure to plot the chart
countplot_univariate(df, 'NumOfProducts', 'Exited', 'Number of
Products', 0, 0, None, 5, 5, 1, \
                        'vertical', 'Number of Bank Customer by Number of
Products')
```

Number of Bank Customer by Number of Products



The graph above displays the distribution of target variables based on 'HasCrCard.' Notably, bank customers who have made at least one purchase through the bank exhibit a higher churn percentage compared to other categories, standing at 14.1%.

Bivariate Analysis

Correlations

```
"""
Parameters:
    data (DataFrame): The input data.
    target_column (str): The target variable for which correlations
are calculated.
"""

def calculate_correlations(data, target_column):
    """
    Calculate correlations between numeric features and sort them
    based on their correlation with the target variable.
    """
```

```

Args:
    data (DataFrame): The input data.
    target_column (str): The target variable for which
correlations are calculated.

Returns:
    DataFrame: A DataFrame containing sorted correlations.
"""
correlations = data.corr()

# Sort features in order of their correlation with the target
variable
sort_corr_cols =
correlations[target_column].sort_values(ascending=False).keys()
sort_corr = correlations.loc[sort_corr_cols, sort_corr_cols]

return sort_corr

print(calculate_correlations(df, 'Exited'))

```

	Exited	Age	Balance	EstimatedSalary	
HasCrCard \					
Exited	1.000000	0.285323	0.118533	0.012097	-
0.007138					
Age	0.285323	1.000000	0.028308	-0.007201	-
0.011721					
Balance	0.118533	0.028308	1.000000	0.012797	-
0.014858					
EstimatedSalary	0.012097	-0.007201	0.012797	1.000000	-
0.009933					
HasCrCard	-0.007138	-0.011721	-0.014858	-0.009933	
1.000000					
Tenure	-0.014001	-0.009997	-0.012254	0.007784	
0.022583					
CreditScore	-0.027094	-0.003965	0.006268	-0.001384	-
0.005458					
NumOfProducts	-0.047820	-0.030680	-0.304180	0.014204	
0.003183					
IsActiveMember	-0.156128	0.085472	-0.010084	-0.011421	-
0.011866					
	Tenure	CreditScore	NumOfProducts	IsActiveMember	
Exited	-0.014001	-0.027094	-0.047820	-0.156128	
Age	-0.009997	-0.003965	-0.030680	0.085472	
Balance	-0.012254	0.006268	-0.304180	-0.010084	

EstimatedSalary	0.007784	-0.001384	0.014204	-0.011421
HasCrCard	0.022583	-0.005458	0.003183	-0.011866
Tenure	1.000000	0.000842	0.013444	-0.028362
CreditScore	0.000842	1.000000	0.012238	0.025651
NumOfProducts	0.013444	0.012238	1.000000	0.009612
IsActiveMember	-0.028362	0.025651	0.009612	1.000000

C:\Users\susha\AppData\Local\Temp\ipykernel_8732\36818490.py:18:
FutureWarning: The default value of numeric_only in DataFrame.corr is deprecated. In a future version, it will default to False. Select only valid columns or specify the value of numeric_only to silence this warning.

```
correlations = data.corr()
```

Let's use some visualizations to see the correlation grid.

```
"""
Parameters:
    data (DataFrame): The input data.
    title (str): The title of the heatmap.
"""

def plot_heatmap(data, title):
    """
    Plot a heatmap of feature correlation.

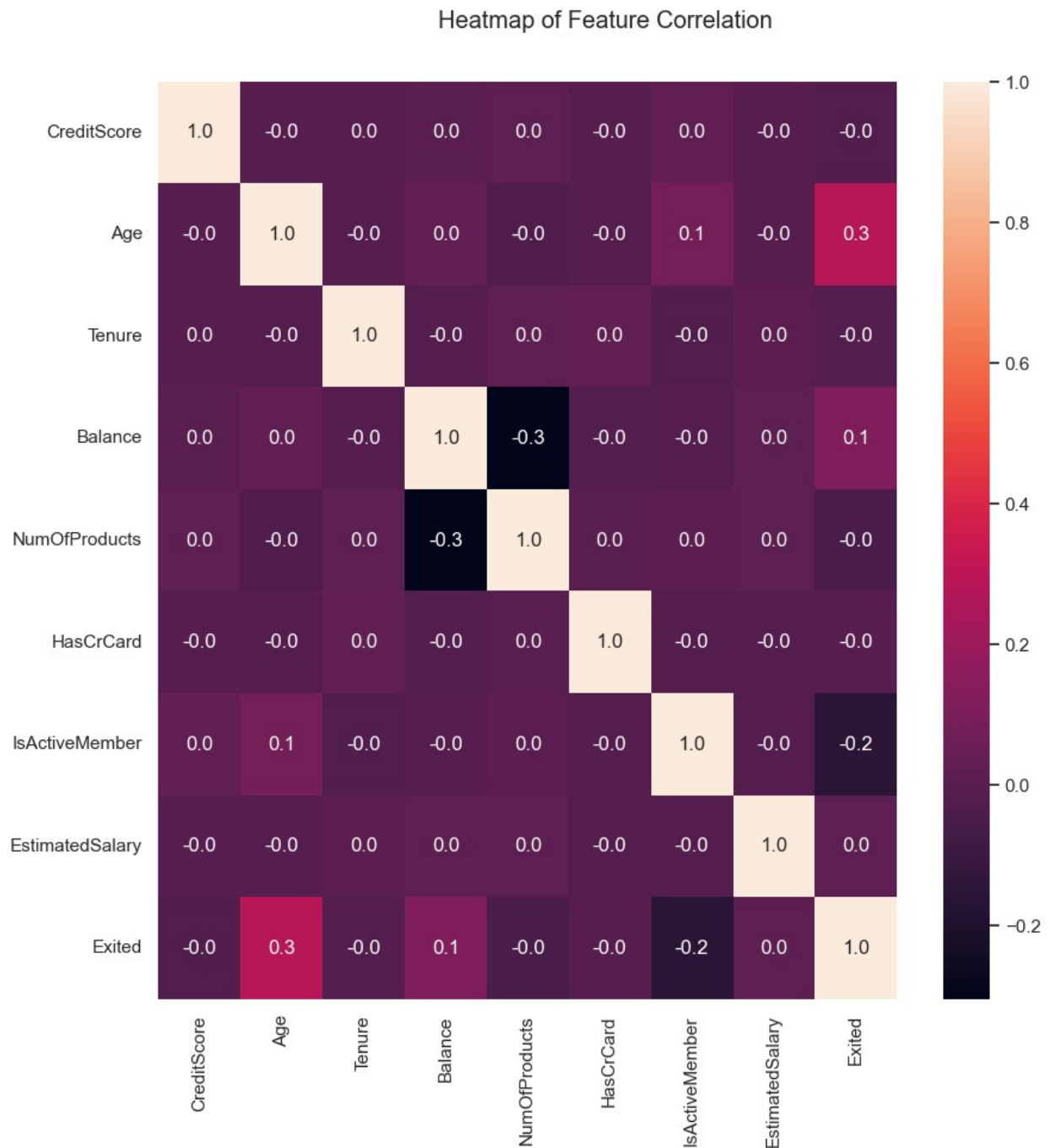
    Args:
        data (DataFrame): The input data.
        title (str): The title of the heatmap.
    """
    plt.figure(figsize=(10, 10))
    plt.suptitle(title, y=0.94)

    # Plot a heatmap of feature correlation
    sns.heatmap(data.corr(), annot=True, fmt='.1f')
    plt.show()
```

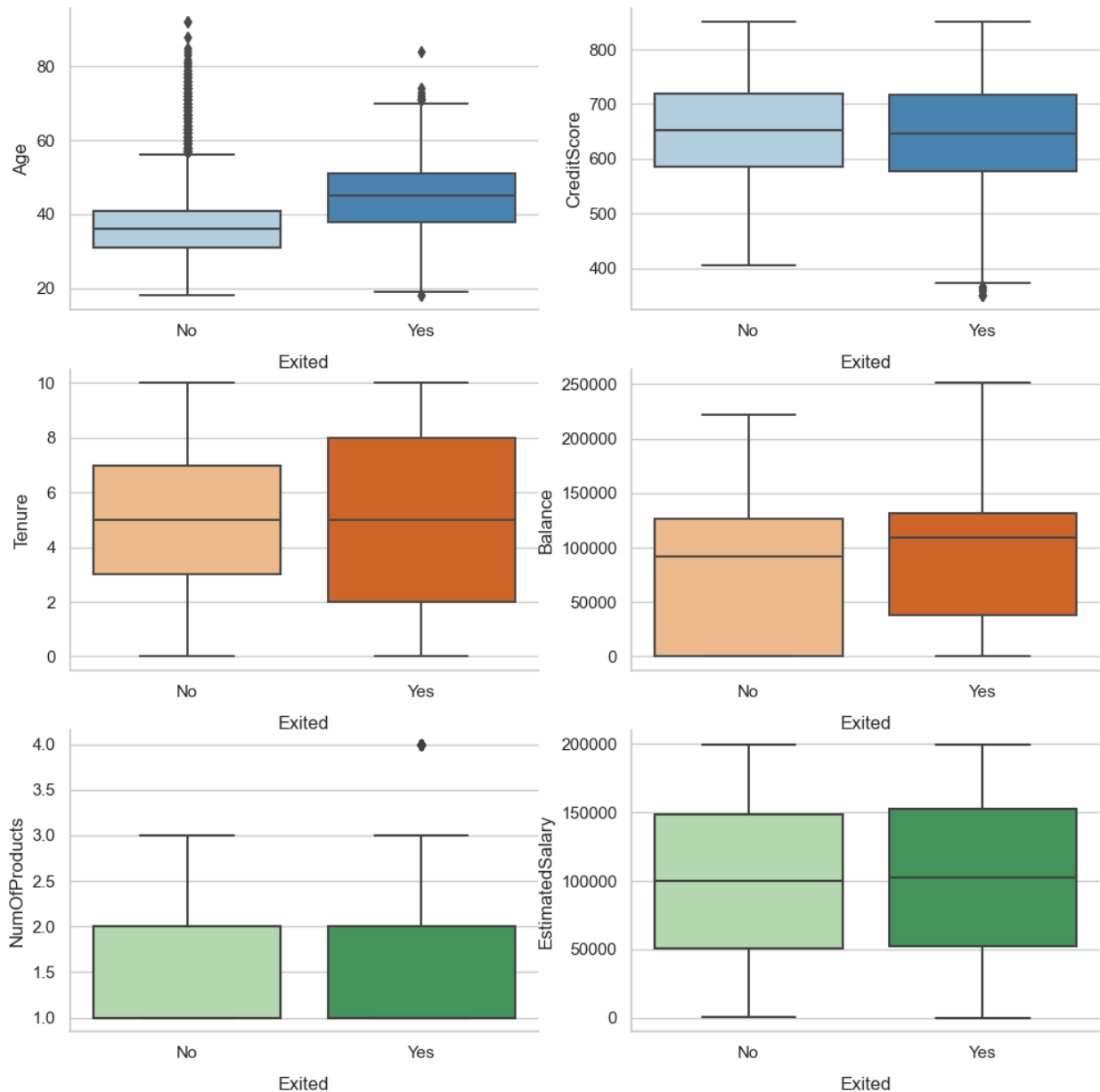
```
plot_heatmap(df, 'Heatmap of Feature Correlation')
```

C:\Users\susha\AppData\Local\Temp\ipykernel_8732\2987055385.py:19:
FutureWarning: The default value of numeric_only in DataFrame.corr is deprecated. In a future version, it will default to False. Select only valid columns or specify the value of numeric_only to silence this

```
warning.  
sns.heatmap(data.corr(), annot=True, fmt='.1f')
```



The correlations observed are generally weak. There is a weak positive correlation with age, a very weak positive correlation with balance, and very weak negative correlations with the number of products and membership. This suggests that many of the correlations within the dataset are non-linear. Consequently, a suitable model for this dataset would be one that



Analysis of the plots reveals the following observations:

- 1.Churning customers are typically older than those who remain with the bank.
- 2.No notable distinctions in median credit score or tenure are apparent between customers who churn and those who stay.
- 3.A considerable portion of customers who churn still maintains a substantial balance in their bank accounts.
- 4.Neither estimated salary nor the number of products appears to exert a significant influence on customer churn.

Pairplot

```
def plot_pairplot(df, hue_column='Exited', palette_colors={1: 'green',
0: 'red'},
                  plot_alpha=0.8, edge_color='b', line_width=0.5,
                  subtitle='Pairplot by "Exited" Classes',
                  title_fontsize=26, title_fontweight='bold',
                  legend_title='Churn Risk', legend_labels=['Stays',
'Exits']):
    """
    Plot Seaborn's pairplot for a DataFrame.

    Parameters:
        df (DataFrame): The input DataFrame.
        hue_column (str): The column to differentiate classes (default
is 'Exited').
        palette_colors (dict): Color palette for classes (default is
{1: 'green', 0: 'red'}).
        plot_alpha (float): Transparency of plot elements (default is
0.8).
        edge_color (str): Color of edges in the plot (default is 'b').
        line_width (float): Width of lines in the plot (default is
0.5).
        subtitle (str): Main title of the plot (default is 'Pairplot
by "Exited" Classes').
        title_fontsize (int): Font size of the main title (default is
26).
        title_fontweight (str): Font weight of the main title (default
is 'bold').
        legend_title (str): Title for the legend (default is 'Churn
Risk').
        legend_labels (list): Labels for legend items (default is
['Stays', 'Exits']).

    Returns:
        Seaborn PairGrid: The created pairplot.
    """
    # Plot Seaborn's pairplot
    pairplot = sns.pairplot(df, hue=hue_column,
palette=palette_colors,
                           plot_kws={'alpha': plot_alpha,
'edgecolor': edge_color, 'linewidth': line_width})

    # Adjust subplot parameters
    fig = pairplot.fig
    fig.subplots_adjust(top=0.95, wspace=0.2)
    fig.suptitle(subtitle, fontsize=title_fontsize,
fontweight=title_fontweight)

    # Update the legend
```

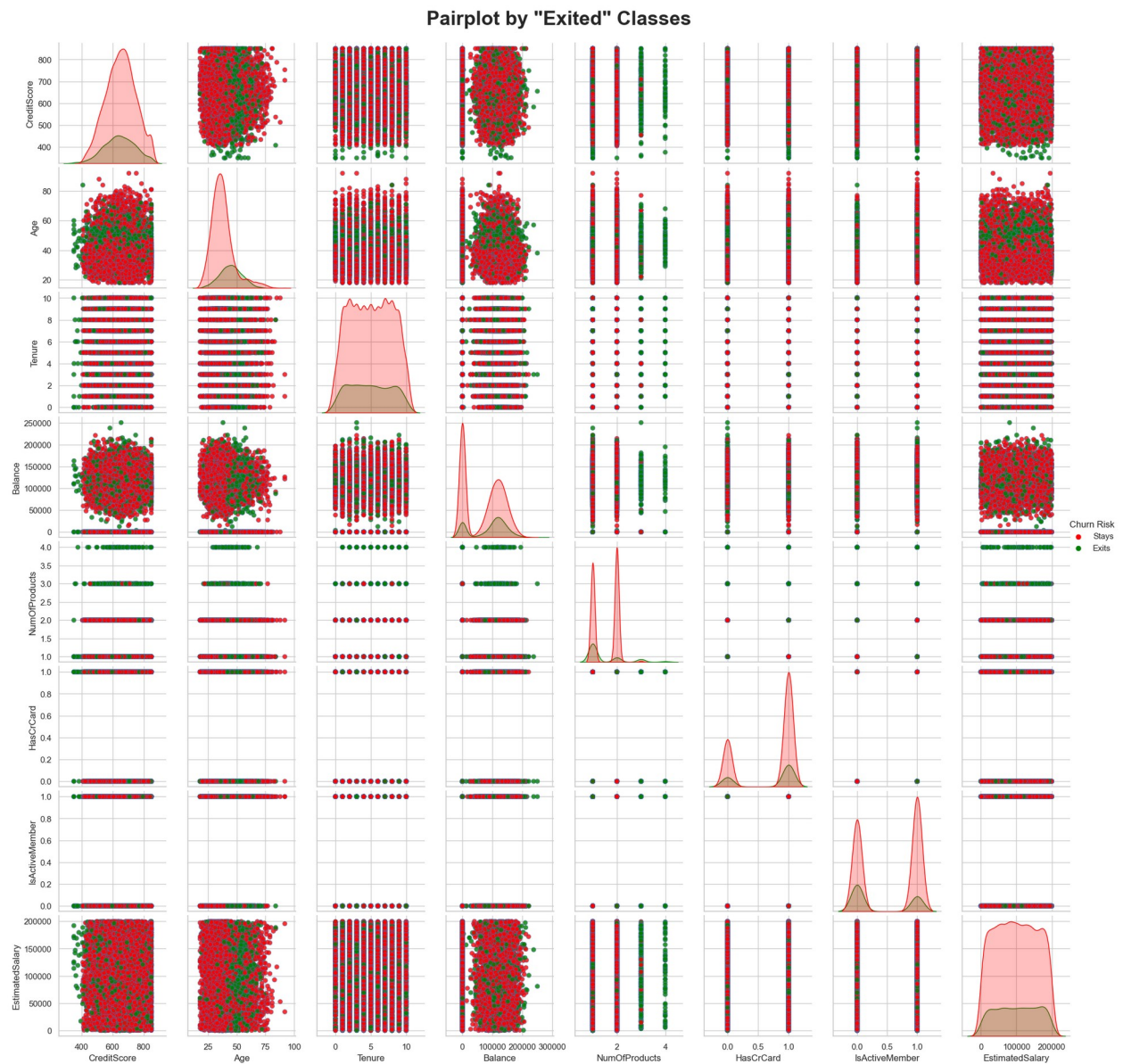
```
pairplot._legend.set_title(legend_title)
```

```
# Replace legend labels
```

```
for text, label in zip(pairplot._legend.texts, legend_labels):  
    text.set_text(label)
```

```
return pairplot
```

```
pairplot_example = plot_pairplot(df)  
plt.show()
```



The density plots on the diagonal make it easy to compare distributions. It's clear that only a few features show slightly different distributions. Specifically, the density plot for Age indicates that older individuals tend to have a slightly higher tendency to leave the bank.

Let's simplify the visualization by plotting only four features: Age, IsActiveMember, NumOfProducts, and Balance.

```
def plot_reduced_pairplot(dataframe, hue_column='Exited',
                          selected_features=['Age', 'IsActiveMember', 'NumOfProducts',
                          'Balance'],
                          palette_colors={0: 'green', 1: 'red'},
                          plot_alpha=0.8, edge_color='b', line_width=0.5,
                          subtitle='Reduced Plot by "Exited" Classes',
                          title_fontsize=14, title_fontweight='bold',
                          legend_title='Churn Risk',
                          legend_labels=['Stays', 'Exits']):
    """
    Create a Seaborn pairplot with reduced features.

    Parameters:
        dataframe (DataFrame): The input DataFrame.
        hue_column (str): The column to differentiate classes (default
        is 'Exited').
        selected_features (list): List of features to include in the
        pairplot (default is ['Age', 'IsActiveMember', 'NumOfProducts',
        'Balance']).
        palette_colors (dict): Color palette for classes (default is
        {0: 'green', 1: 'red'}).
        plot_alpha (float): Transparency of plot elements (default is
        0.8).
        edge_color (str): Color of edges in the plot (default is 'b').
        line_width (float): Width of lines in the plot (default is
        0.5).
        subtitle (str): Main title of the plot (default is 'Reduced
        Plot by "Exited" Classes').
        title_fontsize (int): Font size of the main title (default is
        14).
        title_fontweight (str): Font weight of the main title (default
        is 'bold').
        legend_title (str): Title for the legend (default is 'Churn
        Risk').
        legend_labels (list): Labels for legend items (default is
        ['Stays', 'Exits']).

    Returns:
        Seaborn PairGrid: The created pairplot.
    """
    # Create a Seaborn pairplot
    pairplot = sns.pairplot(dataframe, hue=hue_column,
    vars=selected_features, palette=palette_colors,
```

```

        plot_kws={'alpha': plot_alpha,
'edgecolor': edge_color, 'linewidth': line_width})

    # Adjust figure layout
    fig = pairplot.fig
    fig.subplots_adjust(top=0.95, wspace=0.2)
    fig.suptitle(suptitle, fontsize=title_fontsize,
fontweight=title_fontweight)

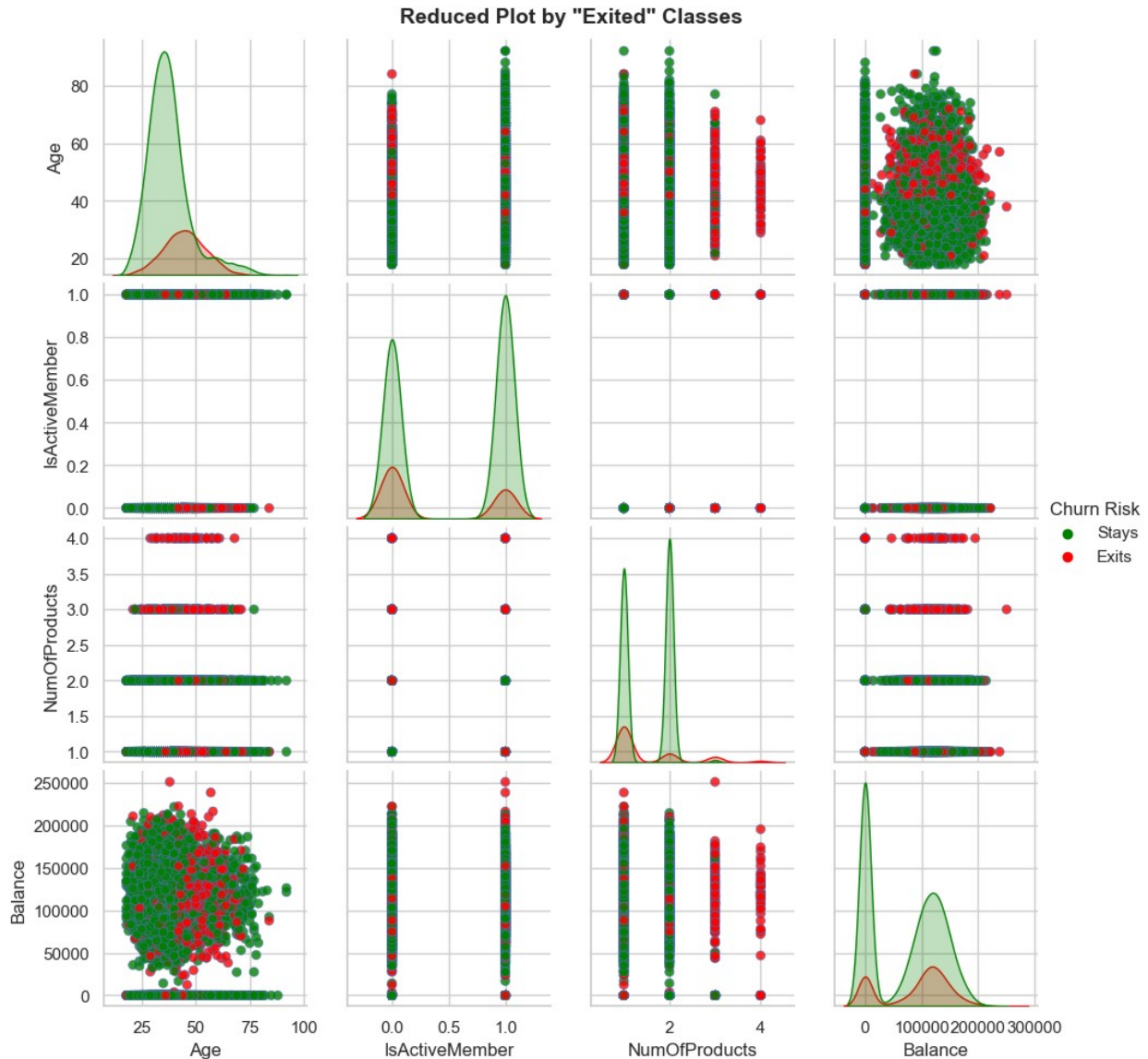
    # Update the legend
    pairplot._legend.set_title(legend_title)

    # Replace legend labels
    for text, label in zip(pairplot._legend.texts, legend_labels):
        text.set_text(label)

    return pairplot

reduced_pairplot_example = plot_reduced_pairplot(df)
plt.show()

```

Upon examining the density plots, it becomes evident that the bank encounters a higher frequency of customer churn among older individuals and those with a greater number of products.

Violin Plots

```
# Set the color palette
color_palette = {'Stays': 'green', 'Exits': 'red'}

# Map numeric classes to categorical classes
class_mapping = {0: 'Stays', 1: 'Exits'}
churn_categories = df['Exited'].map(class_mapping)

# Create subplots for violin plots
fig, axes = plt.subplots(3, 2, figsize=(15, 20))
```

```

fig.suptitle('Churn Risk vs. Different Attributes', fontsize=16)
fig.subplots_adjust(top=0.92, wspace=0.3, hspace=0.3)

# Violin plot for Age
sns.violinplot(x=churn_categories,
               y=df['Age'],
               order=['Stays', 'Exits'],
               palette=color_palette,
               ax=axes[0, 0])

axes[0, 0].set_title('Churn Risk vs. Age', fontsize=14, pad=10)
axes[0, 0].set_ylabel('Age', size=12)
axes[0, 0].set_xlabel('Churn Risk ("Exited")', size=12)

# Violin plot for Balance
sns.violinplot(x=churn_categories,
               y=df['Balance'],
               order=['Stays', 'Exits'],
               palette=color_palette,
               ax=axes[0, 1])

axes[0, 1].set_title('Churn Risk vs. Balance', fontsize=14, pad=10)
axes[0, 1].set_ylabel('Balance', size=12)
axes[0, 1].set_xlabel('Churn Risk ("Exited")', size=12)

# Violin plot for NumOfProducts
sns.violinplot(x=churn_categories,
               y=df['NumOfProducts'],
               order=['Stays', 'Exits'],
               palette=color_palette,
               ax=axes[1, 0])

axes[1, 0].set_title('Churn Risk vs. Number of Products', fontsize=14,
                    pad=10)
axes[1, 0].set_ylabel('NumOfProducts', size=12)
axes[1, 0].set_xlabel('Churn Risk ("Exited")', size=12)

# Violin plot for IsActiveMember
sns.violinplot(x=churn_categories,
               y=df['IsActiveMember'],
               order=['Stays', 'Exits'],
               palette=color_palette,
               ax=axes[1, 1])

axes[1, 1].set_title('Churn Risk vs. Active Membership', fontsize=14,
                    pad=10)
axes[1, 1].set_ylabel('IsActiveMember', size=12)
axes[1, 1].set_xlabel('Churn Risk ("Exited")', size=12)

# Violin plot for EstimatedSalary

```

```

sns.violinplot(x=churn_categories,
               y=df['EstimatedSalary'],
               order=['Stays', 'Exits'],
               palette=color_palette,
               ax=axes[2, 0])

axes[2, 0].set_title('Churn Risk vs. Estimated Salary', fontsize=14,
                    pad=10)
axes[2, 0].set_ylabel('Estimated Salary', size=12)
axes[2, 0].set_xlabel('Churn Risk ("Exited")', size=12)

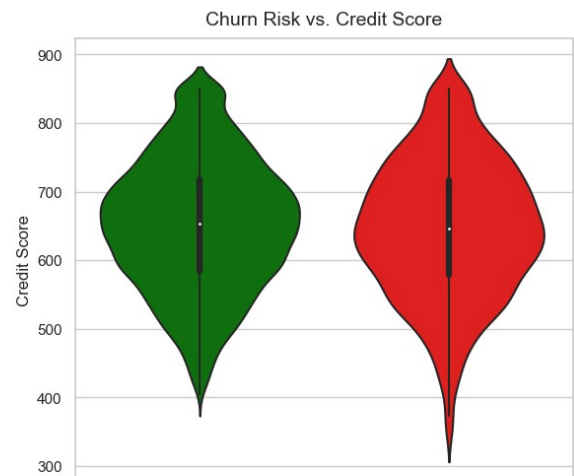
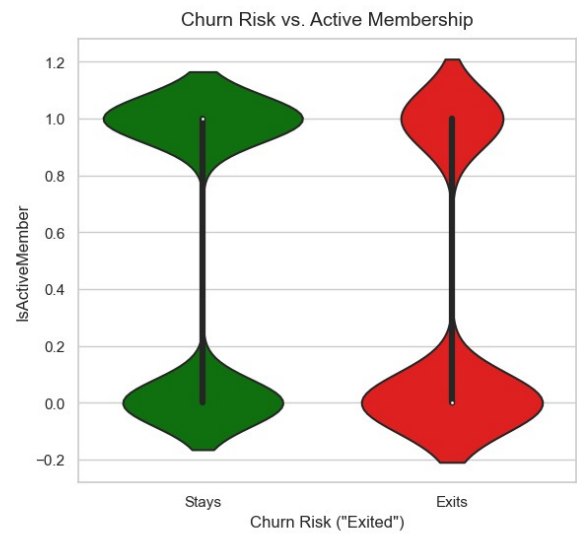
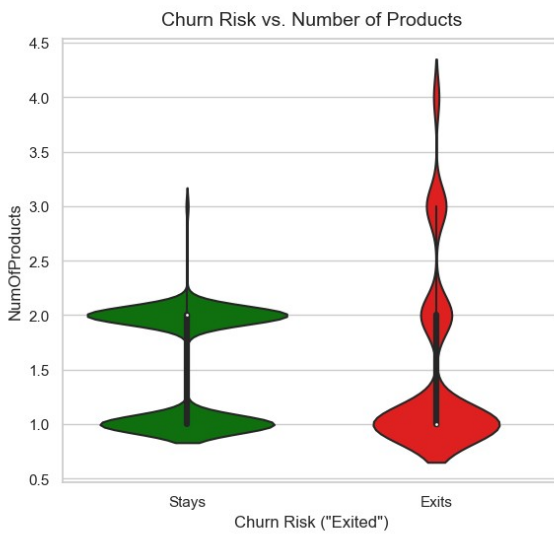
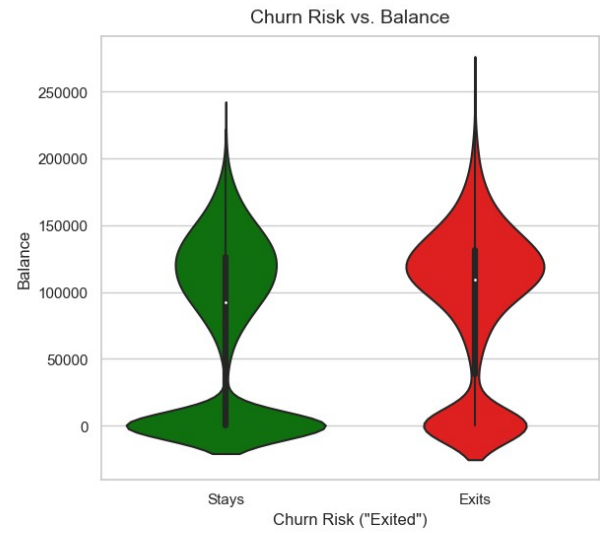
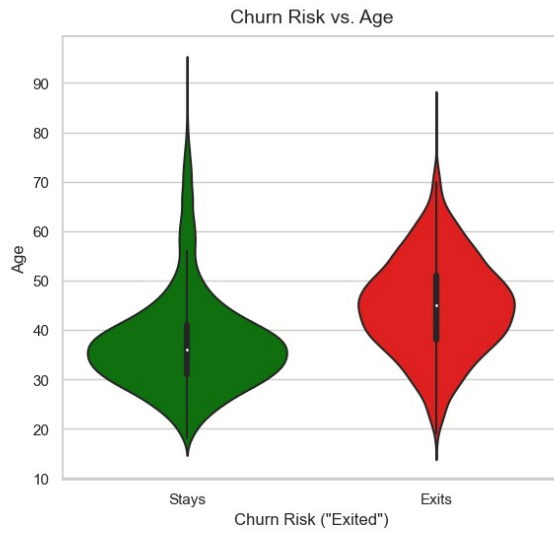
# Violin plot for CreditScore
sns.violinplot(x=churn_categories,
               y=df['CreditScore'],
               order=['Stays', 'Exits'],
               palette=color_palette,
               ax=axes[2, 1])

axes[2, 1].set_title('Churn Risk vs. Credit Score', fontsize=14,
                    pad=10)
axes[2, 1].set_ylabel('Credit Score', size=12)
axes[2, 1].set_xlabel('Churn Risk ("Exited")', size=12)

plt.show()

```

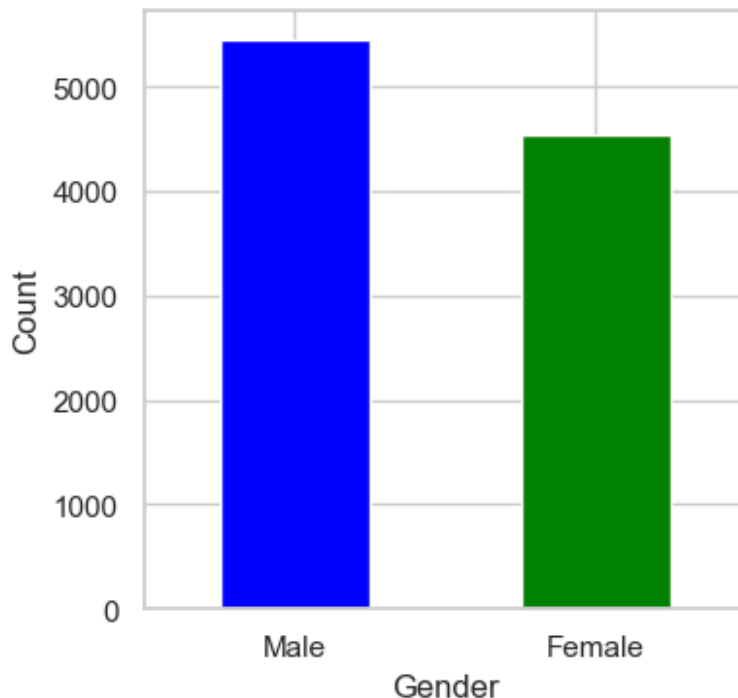
Churn Risk vs. Different Attributes



Violin plots provide further confirmation of the previously made observation that older customers and those with a higher number of products are more inclined to exit the bank.

Distributions of the Target Feature

```
plot_bar_count(df, 'Gender')
```

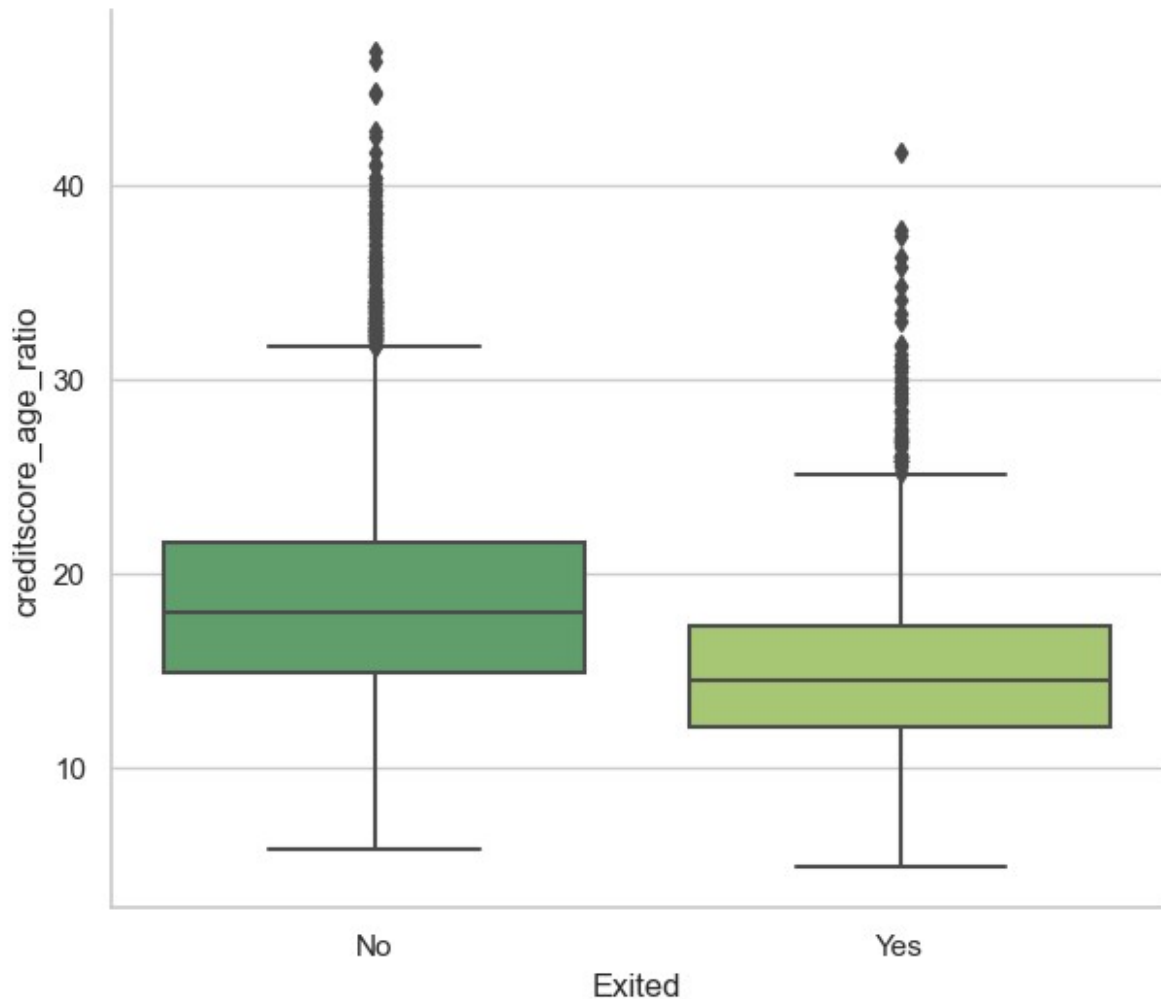


The dataset exhibits an imbalance, where the majority class, labeled "Stays" (0), constitutes approximately 80% of the data points, while the minority class, labeled "Exits" (1), comprises around 20% of the datapoints. To mitigate this imbalance in our machine learning algorithms, we will implement SMOTE (Synthetic Minority Over-sampling Technique).

Feature Engineering

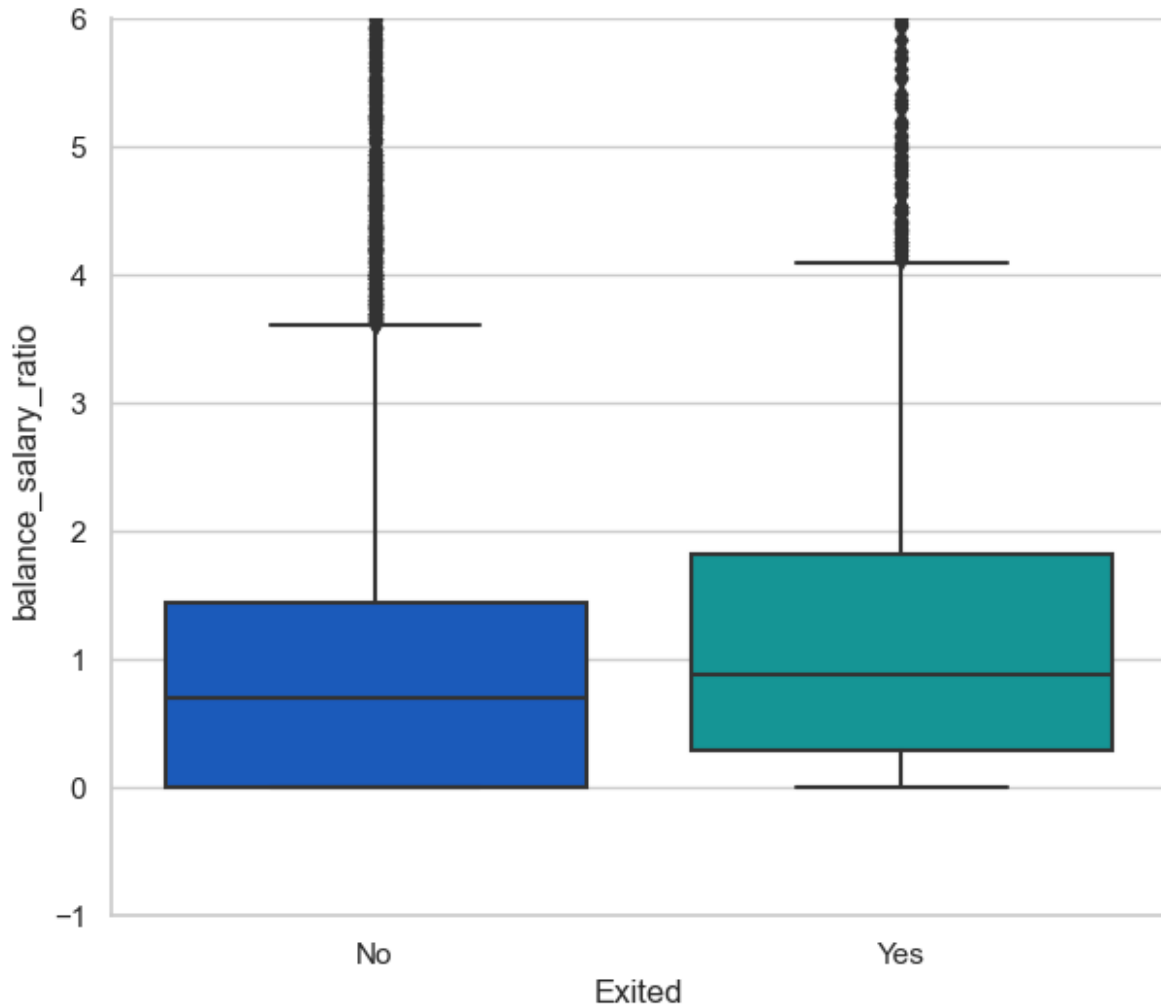
As observed earlier, the impact of credit score on churning was inconclusive, possibly because credit score often rises with time and, consequently, with age. To address this, I will create a new feature to capture the relationship between credit score and age.

```
df['creditscore_age_ratio'] = df['CreditScore'] / df['Age']  
  
fig, ax = plt.subplots(figsize=(7, 6))  
sns.boxplot(y='creditscore_age_ratio', x='Exited', palette='summer',  
data=df)  
ax.set_xticklabels(['No', 'Yes'])  
sns.despine()
```



It appears that customers who are churning tend to have a smaller credit score-to-age ratio. While the estimated salary was previously observed to have no significant effect on the likelihood of customer churn, exploring the ratio between balance and salary could be interesting. This ratio may provide an estimation of the percentage of a customer's salary being spent and could potentially serve as an indicator of churning.

```
df['balance_salary_ratio'] = df['Balance'] / df['EstimatedSalary']  
fig, ax = plt.subplots(figsize=(7, 6))  
sns.boxplot(y='balance_salary_ratio', x='Exited', palette='winter',  
data=df)  
ax.set_xticklabels(['No', 'Yes'])  
ax.set_ylim(-1, 6)  
sns.despine()
```



From the plot, we can learn that customers with a higher balance salary ratio churn more than those with a lower ratio.

```
X=df.drop('Exited',axis=1)
y=df.pop('Exited')

# List numerical features
num_columns = X.select_dtypes(include='number').columns.tolist()
num_columns

['CreditScore',
 'Age',
 'Tenure',
 'Balance',
 'NumOfProducts',
 'HasCrCard',
 'IsActiveMember',
 'EstimatedSalary',
```

```

'creditscore_age_ratio',
'balance_salary_ratio']

# List categorical features
cat_columns = X.select_dtypes(include='object').columns.tolist()
cat_columns

['Geography', 'Gender']

def class_count(a):
    counter=Counter(a)
    kv=[list(counter.keys()),list(counter.values())]
    dff = pd.DataFrame(np.array(kv).T, columns=['Exited','Count'])
    dff['Count'] = dff['Count'].astype('int64')
    dff['%'] = round(dff['Count'] / a.shape[0] * 100, 2)
    return dff.sort_values('Count',ascending=False)

class_count(y)

```

	Exited	Count	%
1	0	7963	79.63
0	1	2037	20.37

```

random_state = 10

# Split X and y into train and test sets
from sklearn.model_selection import train_test_split
X_train, X_test, y_train, y_test = train_test_split(X, y,
test_size=0.3,

random_state=random_state,

stratify=y)

# Print number of observations in X_train, X_test, y_train, and y_test
print(len(X_train), len(X_test), len(y_train), len(y_test))

7000 3000 7000 3000

X_train.info()
<class 'pandas.core.frame.DataFrame'>
Int64Index: 7000 entries, 8061 to 4741
Data columns (total 12 columns):
#   Column                Non-Null Count  Dtype
---  -
0   CreditScore            7000 non-null   int64
1   Geography              7000 non-null   object
2   Gender                 7000 non-null   object
3   Age                   7000 non-null   int64
4   Tenure                 7000 non-null   int64
5   Balance                7000 non-null   float64
6   NumOfProducts          7000 non-null   int64

```



```

7   HasCrCard          7000 non-null   int64
8   IsActiveMember     7000 non-null   int64
9   EstimatedSalary     7000 non-null   float64
10  creditscore_age_ratio 7000 non-null   float64
11  balance_salary_ratio 7000 non-null   float64
dtypes: float64(4), int64(6), object(2)
memory usage: 710.9+ KB

def plot_cm(cm, chart):

    # set figure size and title
    plt.figure(figsize=(6, 5))
    plt.suptitle(f'Confusion Matrix of {chart}', y=1)

    # initialize TP, TN, FN, and FP counts
    group_names = ['True Negative', 'False Negative', 'False
Positive', 'True Positive']
    group_initial = ['(TN)', '(FN)', '(FP)', '(TP)']
    group_percentages = ["{0:.2%}".format(value) for value in
cm.flatten()/np.sum(cm)]

    # create label strings with counts and percentages
    labels = [f"{v1}\n{v2}\n\n{v3}" for v1, v2, v3 in zip(group_names,
group_initial, group_percentages)]
    labels = np.asarray(labels).reshape(2,2)

    # plot heatmap of the confusion matrix
    g = sns.heatmap(cm, annot=labels, fmt='', cmap='Blues')
    g.set_xlabel('Actual')
    g.set_ylabel('Predicted')

    plt.show()

```

Pre-processing Pipeline

Scale numerical data and encode categorical data

Construct a pre-processing pipeline from the given transformers: MinMaxScaler and OneHotEncoder Creating lists of indexes from the list of column names

Need to be numeric not string to specify columns name in column transformer

```

num_features = []
for column_name in num_columns:
    index_location = X.columns.get_loc(column_name)
    num_features.append(index_location)
print(num_features)

[0, 3, 4, 5, 6, 7, 8, 9, 10, 11]

```

```

cat_features = []
for column_name in cat_columns:
    index_location = X.columns.get_loc(column_name)
    cat_features.append(index_location)
print(cat_features)

[1, 2]

# Define a column transformer
# Note: Columns need to be specified by index, not column names
from sklearn.compose import ColumnTransformer, make_column_transformer
from sklearn.preprocessing import MinMaxScaler, OneHotEncoder

# Create a column transformer for preprocessing
# Apply MinMaxScaler to numerical features (num_features) and
# OneHotEncoder to categorical features (cat_features)
preprocess = make_column_transformer(
    (MinMaxScaler(), num_features), # MinMax scaling for numerical
    features
    (OneHotEncoder(sparse=False), cat_features) # One-hot encoding
    for categorical features
)

# Display the preprocessing steps
preprocess

ColumnTransformer(transformers=[('minmaxscaler', MinMaxScaler(),
                                [0, 3, 4, 5, 6, 7, 8, 9, 10, 11]),
                                ('onehotencoder',
                                OneHotEncoder(sparse=False),
                                [1, 2])])

```

MinMaxScaler is applied to numerical features to ensure that they are on a similar scale, preventing any feature from dominating the others due to differences in magnitude. OneHotEncoder is used to transform categorical features into a numerical format (one-hot encoding). This is necessary because many machine learning algorithms require numerical input and cannot directly handle categorical data. The column transformer combines these preprocessing steps into a single transformation, making it easier to apply consistently across training and testing datasets

Building SVM Model Pipeline without SMOTE

To observe the influence of SMOTE on our results, we will initially construct our pipeline without incorporating SMOTE.

```

# Function for creating model pipelines - imbalanced-learn
from imblearn.pipeline import make_pipeline as imbl_pipe
# Import classifier
from sklearn.svm import SVC

```

```

# Define a model with a pipeline
model_SVM = imbl_pipe(preprocess,
                      SVC(random_state=random_state))

# Display the configured SVM model with the preprocessing pipeline
model_SVM

Pipeline(steps=[('columntransformer',
                  ColumnTransformer(transformers=[('minmaxscaler',
                                                  MinMaxScaler(),
                                                  [0, 3, 4, 5, 6, 7,
8, 9, 10,
                                                  11]),
                  ('onehotencoder',
                  OneHotEncoder(sparse=False),
                  [1, 2]))]),
              ('svc', SVC(random_state=10))])

# Create the GridSearchCV model
# Create the GridSearch estimator along with a parameter object
containing the values to adjust
from sklearn.model_selection import GridSearchCV

# Define the parameter grid for GridSearchCV
param_grid = {
    'svc__kernel': ['linear', 'rbf', 'poly', 'sigmoid'],
    'svc__C': [0.0005, 0.001, 0.01, 0.1, 0.5],
    'svc__gamma': [5, 1, 0.1, 0.01]
}

# Create a GridSearchCV object with the SVM model and parameter grid
grid = GridSearchCV(model_SVM, param_grid, verbose=3, cv=5, n_jobs=4)

```

This code snippet sets up a GridSearchCV model for fine-tuning the hyperparameters of the SVM model. The parameter grid (param_grid) specifies various values for the SVM kernel, regularization parameter (C), and gamma. The GridSearchCV object is created with the SVM model (model_SVM), the parameter grid, and additional settings such as verbosity, cross-validation folds (cv), and parallel processing (n_jobs).

```

X_train = X_train.values
X_test = X_test.values

# Train the model with GridSearch
grid.fit(X_train, y_train)

```

Fitting 5 folds for each of 80 candidates, totalling 400 fits

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to `sparse_output` in version 1.2 and will be removed in 1.4. `sparse_output` is ignored unless you leave `sparse` to its default value.
```

```
warnings.warn(
```

```
GridSearchCV(cv=5,  
             estimator=Pipeline(steps=[('columntransformer',
```

```
ColumnTransformer(transformers=[('minmaxscaler',
```

```
MinMaxScaler(),
```

```
[0, 3,
```

```
4, 5,
```

```
6, 7,
```

```
8, 9,
```

```
10,
```

```
11])),
```

```
('onehotencoder',
```

```
OneHotEncoder(sparse=False),
```

```
[1,
```

```
2])))),
```

```
('svc',
```

```
SVC(random_state=10))),
```

```
    n_jobs=4,
```

```
    param_grid={'svc__C': [0.0005, 0.001, 0.01, 0.1, 0.5],
```

```
                'svc__gamma': [5, 1, 0.1, 0.01],
```

```
                'svc__kernel': ['linear', 'rbf', 'poly',
```

```
'sigmoid']},
```

```
    verbose=3)
```

```
print(grid.best_params_)
```

```
{'svc__C': 0.5, 'svc__gamma': 5, 'svc__kernel': 'poly'}
```

```
# List the best score
```

```
print(grid.best_score_)
```

```
0.8565714285714285
```

```
print(f"Training Data Score: {grid.score(X_train, y_train)}")
print(f"Testing Data Score: {grid.score(X_test, y_test)}")
```

```
Training Data Score: 0.8752857142857143
Testing Data Score: 0.8666666666666667
```

The model demonstrates good performance on the training data, achieving an accuracy of approximately 87.53%. The testing data score is slightly lower but still respectable at around 86.67%, indicating that the model generalizes reasonably well to new, unseen data.

```
# Classification metrics
from sklearn.metrics import confusion_matrix, classification_report

# Make predictions with the hypertuned model
predictions = grid.predict(X_test)
cm1 = confusion_matrix(y_test, predictions)
print(cm1)

[[2309   80]
 [ 320  291]]
```

1 (Positive): Customer exited the bank. 0 (Negative): Customer is still with the bank. With this understanding, the confusion matrix can be interpreted as follows:

True Positives (TP): 291 customers correctly predicted as having exited the bank. True Negatives (TN): 2309 customers correctly predicted as still being with the bank. False Positives (FP): 80 customers incorrectly predicted as having exited when they are still with the bank. False Negatives (FN): 320 customers incorrectly predicted as still being with the bank when they have exited.

```
print(classification_report(y_test, predictions))
```

	precision	recall	f1-score	support
0	0.88	0.97	0.92	2389
1	0.78	0.48	0.59	611
accuracy			0.87	3000
macro avg	0.83	0.72	0.76	3000
weighted avg	0.86	0.87	0.85	3000

Building SVM Model Pipeline with SMOTE

Now, let's examine the impact of SMOTE on our results.

We will utilize the Pipeline from the imbalanced-learn (imblearn) package instead of the scikit-learn Pipeline.

This specialized pipeline automatically handles re-sampling during the fit() process and does not re-sample the test data when transform() or predict() is called.

```
# Import classifier
# Over-sampling using SMOTE
from imblearn.over_sampling import SMOTE
from sklearn.svm import SVC

# Define model with pipeline
model_SVM_with_SMOTE = imbl_pipe(preprocess,
                                  SMOTE(sampling_strategy='auto',
                                         random_state=random_state),
                                  SVC(random_state=random_state))

model_SVM_with_SMOTE

Pipeline(steps=[('columntransformer',
                 ColumnTransformer(transformers=[('minmaxscaler',
                                                  MinMaxScaler(),
                                                  [0, 3, 4, 5, 6, 7,
                                                  8, 9, 10,
                                                  11]),
                                                  ('onehotencoder',
                                                  OneHotEncoder(sparse=False),
                                                  [1, 2])])),
                ('smote', SMOTE(random_state=10)),
                ('svc', SVC(random_state=10))])

# Create the GridSearchCV model
# Create the GridSearch estimator along with a parameter object
# containing the values to adjust
from sklearn.model_selection import GridSearchCV

param_grid = {'svc__kernel': ['linear', 'rbf', 'poly', 'sigmoid'],
              'svc__C': [0.0005, 0.001, 0.01, 0.1, 0.5],
              'svc__gamma': [5, 1, 0.1, 0.01]}
grid_s = GridSearchCV(model_SVM_with_SMOTE, param_grid, verbose=3, cv=
5, n_jobs=4)

# Train the model with GridSearch
grid_s.fit(X_train, y_train)

Fitting 5 folds for each of 80 candidates, totalling 400 fits

C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\
preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to
`sparse_output` in version 1.2 and will be removed in 1.4.
`sparse_output` is ignored unless you leave `sparse` to its default
value.
  warnings.warn(
```

```

GridSearchCV(cv=5,
              estimator=Pipeline(steps=[('columntransformer',
ColumnTransformer(transformers=[('minmaxscaler',
MinMaxScaler(),
[0, 3,
4, 5,
6, 7,
8, 9,
10,
11]),
('onehotencoder',
OneHotEncoder(sparse=False),
[1,
2]))])),
              ('smote',
SMOTE(random_state=10)),
              ('svc',
SVC(random_state=10))),
              n_jobs=4,
              param_grid={'svc__C': [0.0005, 0.001, 0.01, 0.1, 0.5],
                           'svc__gamma': [5, 1, 0.1, 0.01],
                           'svc__kernel': ['linear', 'rbf', 'poly',
'sigmoid']},
              verbose=3)

print(grid_s.best_params_)
print(grid_s.best_score_)

{'svc__C': 0.5, 'svc__gamma': 5, 'svc__kernel': 'poly'}
0.8142857142857143

print(f"Training Data Score: {grid_s.score(X_train, y_train)}")
print(f"Testing Data Score: {grid_s.score(X_test, y_test)}")

Training Data Score: 0.846
Testing Data Score: 0.8143333333333334

```

The model exhibits a decent level of accuracy on both the training and testing datasets. The slight decrease in accuracy on the testing data suggests that the model may be slightly overfitting to the training data, but it still generalizes well to new data.

```
# Classification metrics
from sklearn.metrics import confusion_matrix, classification_report
# Make predictions with the hypertuned model
predictions_s = grid_s.predict(X_test)
predictions_s
cm2 = confusion_matrix(y_test, predictions_s)
print(cm2)

[[2028  361]
 [ 196  415]]
```

True Positives (TP): 415 instances correctly predicted as positive. True Negatives (TN): 2028 instances correctly predicted as negative. False Positives (FP): 361 instances incorrectly predicted as positive when they are actually negative. False Negatives (FN): 196 instances incorrectly predicted as negative when they are actually positive.

```
# Import classifier
from sklearn.ensemble import RandomForestClassifier

# Define model with pipeline
model_random_forest = imbl_pipe(preprocess,
                                SMOTE(sampling_strategy='auto',
                                random_state=random_state),
                                RandomForestClassifier())

model_random_forest

Pipeline(steps=[('columntransformer',
                 ColumnTransformer(transformers=[('minmaxscaler',
                                                  MinMaxScaler(),
                                                  [0, 3, 4, 5, 6, 7,
                                                  8, 9, 10,
                                                  11]),
                 ('onehotencoder',
                 OneHotEncoder(sparse=False),
                 [1, 2])])),
                ('smote', SMOTE(random_state=10)),
                ('randomforestclassifier', RandomForestClassifier())])

# Create the GridSearchCV model
# Create the GridSearch estimator along with a parameter object
containing the values to adjust
from sklearn.model_selection import GridSearchCV
rf_param_grid = {
    'randomforestclassifier__n_estimators' : [50, 100, 150],
```



```

    'randomforestclassifier__max_features' : ['sqrt', 0.33],
    'randomforestclassifier__min_samples_leaf' : [1, 5, 10, 15],
    'randomforestclassifier__criterion' : ['gini', 'entropy'],
    'randomforestclassifier__min_samples_split' : [2, 3, 4]
}
rf_grid = GridSearchCV(model_random_forest, rf_param_grid, verbose=3,
cv= 5, scoring='accuracy')

rf_grid.fit(X_train, y_train)

```

Fitting 5 folds for each of 144 candidates, totalling 720 fits

```

C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\
preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to
`sparse_output` in version 1.2 and will be removed in 1.4.
`sparse_output` is ignored unless you leave `sparse` to its default
value.
  warnings.warn(

```

```

[CV 1/5] END randomforestclassifier__criterion=gini,
randomforestclassifier__max_features=sqrt,
randomforestclassifier__min_samples_leaf=1,
randomforestclassifier__min_samples_split=2,
randomforestclassifier__n_estimators=50;; score=0.833 total time=
2.3s

```

```

C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\
preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to
`sparse_output` in version 1.2 and will be removed in 1.4.
`sparse_output` is ignored unless you leave `sparse` to its default
value.
  warnings.warn(

```

```

[CV 2/5] END randomforestclassifier__criterion=gini,
randomforestclassifier__max_features=sqrt,
randomforestclassifier__min_samples_leaf=1,
randomforestclassifier__min_samples_split=2,
randomforestclassifier__n_estimators=50;; score=0.831 total time=
2.3s

```

```

C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\
preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to
`sparse_output` in version 1.2 and will be removed in 1.4.
`sparse_output` is ignored unless you leave `sparse` to its default
value.
  warnings.warn(

```

```

[CV 3/5] END randomforestclassifier__criterion=gini,
randomforestclassifier__max_features=sqrt,
randomforestclassifier__min_samples_leaf=1,
randomforestclassifier__min_samples_split=2,

```

```
randomforestclassifier__n_estimators=50;; score=0.829 total time=2.3s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to `sparse_output` in version 1.2 and will be removed in 1.4. `sparse_output` is ignored unless you leave `sparse` to its default value.
```

```
warnings.warn(
```

```
[CV 4/5] END randomforestclassifier__criterion=gini, randomforestclassifier__max_features=sqrt, randomforestclassifier__min_samples_leaf=1, randomforestclassifier__min_samples_split=2, randomforestclassifier__n_estimators=50;; score=0.829 total time=2.3s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to `sparse_output` in version 1.2 and will be removed in 1.4. `sparse_output` is ignored unless you leave `sparse` to its default value.
```

```
warnings.warn(
```

```
[CV 5/5] END randomforestclassifier__criterion=gini, randomforestclassifier__max_features=sqrt, randomforestclassifier__min_samples_leaf=1, randomforestclassifier__min_samples_split=2, randomforestclassifier__n_estimators=50;; score=0.840 total time=2.4s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to `sparse_output` in version 1.2 and will be removed in 1.4. `sparse_output` is ignored unless you leave `sparse` to its default value.
```

```
warnings.warn(
```

```
[CV 1/5] END randomforestclassifier__criterion=gini, randomforestclassifier__max_features=sqrt, randomforestclassifier__min_samples_leaf=1, randomforestclassifier__min_samples_split=2, randomforestclassifier__n_estimators=100;; score=0.839 total time=4.8s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to `sparse_output` in version 1.2 and will be removed in 1.4. `sparse_output` is ignored unless you leave `sparse` to its default value.
```

```
warnings.warn(
```

```
[CV 2/5] END randomforestclassifier__criterion=gini,  
randomforestclassifier__max_features=sqrt,  
randomforestclassifier__min_samples_leaf=1,  
randomforestclassifier__min_samples_split=2,  
randomforestclassifier__n_estimators=100;; score=0.829 total time=  
4.6s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\  
preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to  
`sparse_output` in version 1.2 and will be removed in 1.4.  
`sparse_output` is ignored unless you leave `sparse` to its default  
value.
```

```
warnings.warn(
```

```
[CV 3/5] END randomforestclassifier__criterion=gini,  
randomforestclassifier__max_features=sqrt,  
randomforestclassifier__min_samples_leaf=1,  
randomforestclassifier__min_samples_split=2,  
randomforestclassifier__n_estimators=100;; score=0.825 total time=  
4.7s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\  
preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to  
`sparse_output` in version 1.2 and will be removed in 1.4.  
`sparse_output` is ignored unless you leave `sparse` to its default  
value.
```

```
warnings.warn(
```

```
[CV 4/5] END randomforestclassifier__criterion=gini,  
randomforestclassifier__max_features=sqrt,  
randomforestclassifier__min_samples_leaf=1,  
randomforestclassifier__min_samples_split=2,  
randomforestclassifier__n_estimators=100;; score=0.837 total time=  
4.9s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\  
preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to  
`sparse_output` in version 1.2 and will be removed in 1.4.  
`sparse_output` is ignored unless you leave `sparse` to its default  
value.
```

```
warnings.warn(
```

```
[CV 5/5] END randomforestclassifier__criterion=gini,  
randomforestclassifier__max_features=sqrt,  
randomforestclassifier__min_samples_leaf=1,  
randomforestclassifier__min_samples_split=2,  
randomforestclassifier__n_estimators=100;; score=0.842 total time=  
4.6s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\  
preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to
```

```
`sparse_output` in version 1.2 and will be removed in 1.4.  
`sparse_output` is ignored unless you leave `sparse` to its default  
value.
```

```
warnings.warn()
```

```
[CV 1/5] END randomforestclassifier__criterion=gini,  
randomforestclassifier__max_features=sqrt,  
randomforestclassifier__min_samples_leaf=1,  
randomforestclassifier__min_samples_split=2,  
randomforestclassifier__n_estimators=150;; score=0.846 total time=  
7.1s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\  
preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to  
`sparse_output` in version 1.2 and will be removed in 1.4.  
`sparse_output` is ignored unless you leave `sparse` to its default  
value.
```

```
warnings.warn()
```

```
[CV 2/5] END randomforestclassifier__criterion=gini,  
randomforestclassifier__max_features=sqrt,  
randomforestclassifier__min_samples_leaf=1,  
randomforestclassifier__min_samples_split=2,  
randomforestclassifier__n_estimators=150;; score=0.837 total time=  
7.2s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\  
preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to  
`sparse_output` in version 1.2 and will be removed in 1.4.  
`sparse_output` is ignored unless you leave `sparse` to its default  
value.
```

```
warnings.warn()
```

```
[CV 3/5] END randomforestclassifier__criterion=gini,  
randomforestclassifier__max_features=sqrt,  
randomforestclassifier__min_samples_leaf=1,  
randomforestclassifier__min_samples_split=2,  
randomforestclassifier__n_estimators=150;; score=0.826 total time=  
6.9s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\  
preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to  
`sparse_output` in version 1.2 and will be removed in 1.4.  
`sparse_output` is ignored unless you leave `sparse` to its default  
value.
```

```
warnings.warn()
```

```
[CV 4/5] END randomforestclassifier__criterion=gini,  
randomforestclassifier__max_features=sqrt,  
randomforestclassifier__min_samples_leaf=1,  
randomforestclassifier__min_samples_split=2,
```

```
randomforestclassifier__n_estimators=150;; score=0.833 total time=7.1s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to `sparse_output` in version 1.2 and will be removed in 1.4. `sparse_output` is ignored unless you leave `sparse` to its default value.
```

```
warnings.warn(
```

```
[CV 5/5] END randomforestclassifier__criterion=gini, randomforestclassifier__max_features=sqrt, randomforestclassifier__min_samples_leaf=1, randomforestclassifier__min_samples_split=2, randomforestclassifier__n_estimators=150;; score=0.836 total time=6.8s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to `sparse_output` in version 1.2 and will be removed in 1.4. `sparse_output` is ignored unless you leave `sparse` to its default value.
```

```
warnings.warn(
```

```
[CV 1/5] END randomforestclassifier__criterion=gini, randomforestclassifier__max_features=sqrt, randomforestclassifier__min_samples_leaf=1, randomforestclassifier__min_samples_split=3, randomforestclassifier__n_estimators=50;; score=0.833 total time=2.4s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to `sparse_output` in version 1.2 and will be removed in 1.4. `sparse_output` is ignored unless you leave `sparse` to its default value.
```

```
warnings.warn(
```

```
[CV 2/5] END randomforestclassifier__criterion=gini, randomforestclassifier__max_features=sqrt, randomforestclassifier__min_samples_leaf=1, randomforestclassifier__min_samples_split=3, randomforestclassifier__n_estimators=50;; score=0.829 total time=2.5s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to `sparse_output` in version 1.2 and will be removed in 1.4. `sparse_output` is ignored unless you leave `sparse` to its default value.
```

```
warnings.warn(
```

```
[CV 3/5] END randomforestclassifier__criterion=gini,  
randomforestclassifier__max_features=sqrt,  
randomforestclassifier__min_samples_leaf=1,  
randomforestclassifier__min_samples_split=3,  
randomforestclassifier__n_estimators=50;; score=0.819 total time=  
2.4s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\  
preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to  
`sparse_output` in version 1.2 and will be removed in 1.4.  
`sparse_output` is ignored unless you leave `sparse` to its default  
value.  
warnings.warn(
```

```
[CV 4/5] END randomforestclassifier__criterion=gini,  
randomforestclassifier__max_features=sqrt,  
randomforestclassifier__min_samples_leaf=1,  
randomforestclassifier__min_samples_split=3,  
randomforestclassifier__n_estimators=50;; score=0.831 total time=  
2.2s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\  
preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to  
`sparse_output` in version 1.2 and will be removed in 1.4.  
`sparse_output` is ignored unless you leave `sparse` to its default  
value.  
warnings.warn(
```

```
[CV 5/5] END randomforestclassifier__criterion=gini,  
randomforestclassifier__max_features=sqrt,  
randomforestclassifier__min_samples_leaf=1,  
randomforestclassifier__min_samples_split=3,  
randomforestclassifier__n_estimators=50;; score=0.836 total time=  
2.3s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\  
preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to  
`sparse_output` in version 1.2 and will be removed in 1.4.  
`sparse_output` is ignored unless you leave `sparse` to its default  
value.  
warnings.warn(
```

```
[CV 1/5] END randomforestclassifier__criterion=gini,  
randomforestclassifier__max_features=sqrt,  
randomforestclassifier__min_samples_leaf=1,  
randomforestclassifier__min_samples_split=3,  
randomforestclassifier__n_estimators=100;; score=0.837 total time=  
4.6s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\  
preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to
```

```
`sparse_output` in version 1.2 and will be removed in 1.4.  
`sparse_output` is ignored unless you leave `sparse` to its default  
value.
```

```
warnings.warn()
```

```
[CV 2/5] END randomforestclassifier__criterion=gini,  
randomforestclassifier__max_features=sqrt,  
randomforestclassifier__min_samples_leaf=1,  
randomforestclassifier__min_samples_split=3,  
randomforestclassifier__n_estimators=100;; score=0.831 total time=  
4.7s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\  
preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to  
`sparse_output` in version 1.2 and will be removed in 1.4.  
`sparse_output` is ignored unless you leave `sparse` to its default  
value.
```

```
warnings.warn()
```

```
[CV 3/5] END randomforestclassifier__criterion=gini,  
randomforestclassifier__max_features=sqrt,  
randomforestclassifier__min_samples_leaf=1,  
randomforestclassifier__min_samples_split=3,  
randomforestclassifier__n_estimators=100;; score=0.821 total time=  
4.7s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\  
preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to  
`sparse_output` in version 1.2 and will be removed in 1.4.  
`sparse_output` is ignored unless you leave `sparse` to its default  
value.
```

```
warnings.warn()
```

```
[CV 4/5] END randomforestclassifier__criterion=gini,  
randomforestclassifier__max_features=sqrt,  
randomforestclassifier__min_samples_leaf=1,  
randomforestclassifier__min_samples_split=3,  
randomforestclassifier__n_estimators=100;; score=0.829 total time=  
4.5s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\  
preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to  
`sparse_output` in version 1.2 and will be removed in 1.4.  
`sparse_output` is ignored unless you leave `sparse` to its default  
value.
```

```
warnings.warn()
```

```
[CV 5/5] END randomforestclassifier__criterion=gini,  
randomforestclassifier__max_features=sqrt,  
randomforestclassifier__min_samples_leaf=1,  
randomforestclassifier__min_samples_split=3,
```

```
randomforestclassifier__n_estimators=100;; score=0.846 total time=4.7s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to `sparse_output` in version 1.2 and will be removed in 1.4.
`sparse_output` is ignored unless you leave `sparse` to its default value.
```

```
warnings.warn(
```

```
[CV 1/5] END randomforestclassifier__criterion=gini,
randomforestclassifier__max_features=sqrt,
randomforestclassifier__min_samples_leaf=1,
randomforestclassifier__min_samples_split=3,
randomforestclassifier__n_estimators=150;; score=0.841 total time=7.1s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to `sparse_output` in version 1.2 and will be removed in 1.4.
`sparse_output` is ignored unless you leave `sparse` to its default value.
```

```
warnings.warn(
```

```
[CV 2/5] END randomforestclassifier__criterion=gini,
randomforestclassifier__max_features=sqrt,
randomforestclassifier__min_samples_leaf=1,
randomforestclassifier__min_samples_split=3,
randomforestclassifier__n_estimators=150;; score=0.831 total time=6.9s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to `sparse_output` in version 1.2 and will be removed in 1.4.
`sparse_output` is ignored unless you leave `sparse` to its default value.
```

```
warnings.warn(
```

```
[CV 3/5] END randomforestclassifier__criterion=gini,
randomforestclassifier__max_features=sqrt,
randomforestclassifier__min_samples_leaf=1,
randomforestclassifier__min_samples_split=3,
randomforestclassifier__n_estimators=150;; score=0.823 total time=7.0s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to `sparse_output` in version 1.2 and will be removed in 1.4.
`sparse_output` is ignored unless you leave `sparse` to its default value.
```

```
warnings.warn(
```



```
[CV 4/5] END randomforestclassifier__criterion=gini,  
randomforestclassifier__max_features=sqrt,  
randomforestclassifier__min_samples_leaf=1,  
randomforestclassifier__min_samples_split=3,  
randomforestclassifier__n_estimators=150;; score=0.829 total time=  
6.8s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\  
preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to  
`sparse_output` in version 1.2 and will be removed in 1.4.  
`sparse_output` is ignored unless you leave `sparse` to its default  
value.
```

```
warnings.warn(
```

```
[CV 5/5] END randomforestclassifier__criterion=gini,  
randomforestclassifier__max_features=sqrt,  
randomforestclassifier__min_samples_leaf=1,  
randomforestclassifier__min_samples_split=3,  
randomforestclassifier__n_estimators=150;; score=0.844 total time=  
7.2s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\  
preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to  
`sparse_output` in version 1.2 and will be removed in 1.4.  
`sparse_output` is ignored unless you leave `sparse` to its default  
value.
```

```
warnings.warn(
```

```
[CV 1/5] END randomforestclassifier__criterion=gini,  
randomforestclassifier__max_features=sqrt,  
randomforestclassifier__min_samples_leaf=1,  
randomforestclassifier__min_samples_split=4,  
randomforestclassifier__n_estimators=50;; score=0.835 total time=  
2.2s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\  
preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to  
`sparse_output` in version 1.2 and will be removed in 1.4.  
`sparse_output` is ignored unless you leave `sparse` to its default  
value.
```

```
warnings.warn(
```

```
[CV 2/5] END randomforestclassifier__criterion=gini,  
randomforestclassifier__max_features=sqrt,  
randomforestclassifier__min_samples_leaf=1,  
randomforestclassifier__min_samples_split=4,  
randomforestclassifier__n_estimators=50;; score=0.827 total time=  
2.4s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\  
preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to
```

```
`sparse_output` in version 1.2 and will be removed in 1.4.  
`sparse_output` is ignored unless you leave `sparse` to its default  
value.
```

```
warnings.warn()
```

```
[CV 3/5] END randomforestclassifier__criterion=gini,  
randomforestclassifier__max_features=sqrt,  
randomforestclassifier__min_samples_leaf=1,  
randomforestclassifier__min_samples_split=4,  
randomforestclassifier__n_estimators=50;; score=0.821 total time=  
2.3s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\  
preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to  
`sparse_output` in version 1.2 and will be removed in 1.4.  
`sparse_output` is ignored unless you leave `sparse` to its default  
value.
```

```
warnings.warn()
```

```
[CV 4/5] END randomforestclassifier__criterion=gini,  
randomforestclassifier__max_features=sqrt,  
randomforestclassifier__min_samples_leaf=1,  
randomforestclassifier__min_samples_split=4,  
randomforestclassifier__n_estimators=50;; score=0.821 total time=  
2.3s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\  
preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to  
`sparse_output` in version 1.2 and will be removed in 1.4.  
`sparse_output` is ignored unless you leave `sparse` to its default  
value.
```

```
warnings.warn()
```

```
[CV 5/5] END randomforestclassifier__criterion=gini,  
randomforestclassifier__max_features=sqrt,  
randomforestclassifier__min_samples_leaf=1,  
randomforestclassifier__min_samples_split=4,  
randomforestclassifier__n_estimators=50;; score=0.846 total time=  
2.3s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\  
preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to  
`sparse_output` in version 1.2 and will be removed in 1.4.  
`sparse_output` is ignored unless you leave `sparse` to its default  
value.
```

```
warnings.warn()
```

```
[CV 1/5] END randomforestclassifier__criterion=gini,  
randomforestclassifier__max_features=sqrt,  
randomforestclassifier__min_samples_leaf=1,  
randomforestclassifier__min_samples_split=4,
```

```
randomforestclassifier__n_estimators=100;; score=0.829 total time=4.8s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to `sparse_output` in version 1.2 and will be removed in 1.4. `sparse_output` is ignored unless you leave `sparse` to its default value.
```

```
warnings.warn(
```

```
[CV 2/5] END randomforestclassifier__criterion=gini, randomforestclassifier__max_features=sqrt, randomforestclassifier__min_samples_leaf=1, randomforestclassifier__min_samples_split=4, randomforestclassifier__n_estimators=100;; score=0.838 total time=4.5s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to `sparse_output` in version 1.2 and will be removed in 1.4. `sparse_output` is ignored unless you leave `sparse` to its default value.
```

```
warnings.warn(
```

```
[CV 3/5] END randomforestclassifier__criterion=gini, randomforestclassifier__max_features=sqrt, randomforestclassifier__min_samples_leaf=1, randomforestclassifier__min_samples_split=4, randomforestclassifier__n_estimators=100;; score=0.824 total time=4.5s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to `sparse_output` in version 1.2 and will be removed in 1.4. `sparse_output` is ignored unless you leave `sparse` to its default value.
```

```
warnings.warn(
```

```
[CV 4/5] END randomforestclassifier__criterion=gini, randomforestclassifier__max_features=sqrt, randomforestclassifier__min_samples_leaf=1, randomforestclassifier__min_samples_split=4, randomforestclassifier__n_estimators=100;; score=0.834 total time=4.6s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to `sparse_output` in version 1.2 and will be removed in 1.4. `sparse_output` is ignored unless you leave `sparse` to its default value.
```

```
warnings.warn(
```

```
[CV 5/5] END randomforestclassifier__criterion=gini,  
randomforestclassifier__max_features=sqrt,  
randomforestclassifier__min_samples_leaf=1,  
randomforestclassifier__min_samples_split=4,  
randomforestclassifier__n_estimators=100;; score=0.841 total time=  
4.5s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\  
preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to  
`sparse_output` in version 1.2 and will be removed in 1.4.  
`sparse_output` is ignored unless you leave `sparse` to its default  
value.
```

```
warnings.warn(
```

```
[CV 1/5] END randomforestclassifier__criterion=gini,  
randomforestclassifier__max_features=sqrt,  
randomforestclassifier__min_samples_leaf=1,  
randomforestclassifier__min_samples_split=4,  
randomforestclassifier__n_estimators=150;; score=0.832 total time=  
6.9s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\  
preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to  
`sparse_output` in version 1.2 and will be removed in 1.4.  
`sparse_output` is ignored unless you leave `sparse` to its default  
value.
```

```
warnings.warn(
```

```
[CV 2/5] END randomforestclassifier__criterion=gini,  
randomforestclassifier__max_features=sqrt,  
randomforestclassifier__min_samples_leaf=1,  
randomforestclassifier__min_samples_split=4,  
randomforestclassifier__n_estimators=150;; score=0.834 total time=  
7.1s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\  
preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to  
`sparse_output` in version 1.2 and will be removed in 1.4.  
`sparse_output` is ignored unless you leave `sparse` to its default  
value.
```

```
warnings.warn(
```

```
[CV 3/5] END randomforestclassifier__criterion=gini,  
randomforestclassifier__max_features=sqrt,  
randomforestclassifier__min_samples_leaf=1,  
randomforestclassifier__min_samples_split=4,  
randomforestclassifier__n_estimators=150;; score=0.823 total time=  
6.8s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\  
preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to
```

```
`sparse_output` in version 1.2 and will be removed in 1.4.  
`sparse_output` is ignored unless you leave `sparse` to its default  
value.
```

```
warnings.warn()
```

```
[CV 4/5] END randomforestclassifier__criterion=gini,  
randomforestclassifier__max_features=sqrt,  
randomforestclassifier__min_samples_leaf=1,  
randomforestclassifier__min_samples_split=4,  
randomforestclassifier__n_estimators=150;; score=0.831 total time=  
7.0s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\  
preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to  
`sparse_output` in version 1.2 and will be removed in 1.4.  
`sparse_output` is ignored unless you leave `sparse` to its default  
value.
```

```
warnings.warn()
```

```
[CV 5/5] END randomforestclassifier__criterion=gini,  
randomforestclassifier__max_features=sqrt,  
randomforestclassifier__min_samples_leaf=1,  
randomforestclassifier__min_samples_split=4,  
randomforestclassifier__n_estimators=150;; score=0.851 total time=  
6.7s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\  
preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to  
`sparse_output` in version 1.2 and will be removed in 1.4.  
`sparse_output` is ignored unless you leave `sparse` to its default  
value.
```

```
warnings.warn()
```

```
[CV 1/5] END randomforestclassifier__criterion=gini,  
randomforestclassifier__max_features=sqrt,  
randomforestclassifier__min_samples_leaf=5,  
randomforestclassifier__min_samples_split=2,  
randomforestclassifier__n_estimators=50;; score=0.832 total time=  
1.9s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\  
preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to  
`sparse_output` in version 1.2 and will be removed in 1.4.  
`sparse_output` is ignored unless you leave `sparse` to its default  
value.
```

```
warnings.warn()
```

```
[CV 2/5] END randomforestclassifier__criterion=gini,  
randomforestclassifier__max_features=sqrt,  
randomforestclassifier__min_samples_leaf=5,  
randomforestclassifier__min_samples_split=2,
```

```
randomforestclassifier__n_estimators=50;; score=0.824 total time=2.0s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to `sparse_output` in version 1.2 and will be removed in 1.4. `sparse_output` is ignored unless you leave `sparse` to its default value.
```

```
warnings.warn(
```

```
[CV 3/5] END randomforestclassifier__criterion=gini, randomforestclassifier__max_features=sqrt, randomforestclassifier__min_samples_leaf=5, randomforestclassifier__min_samples_split=2, randomforestclassifier__n_estimators=50;; score=0.807 total time=2.0s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to `sparse_output` in version 1.2 and will be removed in 1.4. `sparse_output` is ignored unless you leave `sparse` to its default value.
```

```
warnings.warn(
```

```
[CV 4/5] END randomforestclassifier__criterion=gini, randomforestclassifier__max_features=sqrt, randomforestclassifier__min_samples_leaf=5, randomforestclassifier__min_samples_split=2, randomforestclassifier__n_estimators=50;; score=0.823 total time=2.1s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to `sparse_output` in version 1.2 and will be removed in 1.4. `sparse_output` is ignored unless you leave `sparse` to its default value.
```

```
warnings.warn(
```

```
[CV 5/5] END randomforestclassifier__criterion=gini, randomforestclassifier__max_features=sqrt, randomforestclassifier__min_samples_leaf=5, randomforestclassifier__min_samples_split=2, randomforestclassifier__n_estimators=50;; score=0.834 total time=2.0s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to `sparse_output` in version 1.2 and will be removed in 1.4. `sparse_output` is ignored unless you leave `sparse` to its default value.
```

```
warnings.warn(
```

```
[CV 1/5] END randomforestclassifier__criterion=gini,  
randomforestclassifier__max_features=sqrt,  
randomforestclassifier__min_samples_leaf=5,  
randomforestclassifier__min_samples_split=2,  
randomforestclassifier__n_estimators=100;; score=0.833 total time=  
4.0s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\  
preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to  
`sparse_output` in version 1.2 and will be removed in 1.4.  
`sparse_output` is ignored unless you leave `sparse` to its default  
value.
```

```
warnings.warn(
```

```
[CV 2/5] END randomforestclassifier__criterion=gini,  
randomforestclassifier__max_features=sqrt,  
randomforestclassifier__min_samples_leaf=5,  
randomforestclassifier__min_samples_split=2,  
randomforestclassifier__n_estimators=100;; score=0.830 total time=  
3.9s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\  
preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to  
`sparse_output` in version 1.2 and will be removed in 1.4.  
`sparse_output` is ignored unless you leave `sparse` to its default  
value.
```

```
warnings.warn(
```

```
[CV 3/5] END randomforestclassifier__criterion=gini,  
randomforestclassifier__max_features=sqrt,  
randomforestclassifier__min_samples_leaf=5,  
randomforestclassifier__min_samples_split=2,  
randomforestclassifier__n_estimators=100;; score=0.805 total time=  
4.1s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\  
preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to  
`sparse_output` in version 1.2 and will be removed in 1.4.  
`sparse_output` is ignored unless you leave `sparse` to its default  
value.
```

```
warnings.warn(
```

```
[CV 4/5] END randomforestclassifier__criterion=gini,  
randomforestclassifier__max_features=sqrt,  
randomforestclassifier__min_samples_leaf=5,  
randomforestclassifier__min_samples_split=2,  
randomforestclassifier__n_estimators=100;; score=0.821 total time=  
4.0s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\  
preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to
```

```
`sparse_output` in version 1.2 and will be removed in 1.4.  
`sparse_output` is ignored unless you leave `sparse` to its default  
value.
```

```
warnings.warn()
```

```
[CV 5/5] END randomforestclassifier__criterion=gini,  
randomforestclassifier__max_features=sqrt,  
randomforestclassifier__min_samples_leaf=5,  
randomforestclassifier__min_samples_split=2,  
randomforestclassifier__n_estimators=100;; score=0.839 total time=  
4.1s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\  
preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to  
`sparse_output` in version 1.2 and will be removed in 1.4.  
`sparse_output` is ignored unless you leave `sparse` to its default  
value.
```

```
warnings.warn()
```

```
[CV 1/5] END randomforestclassifier__criterion=gini,  
randomforestclassifier__max_features=sqrt,  
randomforestclassifier__min_samples_leaf=5,  
randomforestclassifier__min_samples_split=2,  
randomforestclassifier__n_estimators=150;; score=0.835 total time=  
6.0s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\  
preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to  
`sparse_output` in version 1.2 and will be removed in 1.4.  
`sparse_output` is ignored unless you leave `sparse` to its default  
value.
```

```
warnings.warn()
```

```
[CV 2/5] END randomforestclassifier__criterion=gini,  
randomforestclassifier__max_features=sqrt,  
randomforestclassifier__min_samples_leaf=5,  
randomforestclassifier__min_samples_split=2,  
randomforestclassifier__n_estimators=150;; score=0.824 total time=  
6.3s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\  
preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to  
`sparse_output` in version 1.2 and will be removed in 1.4.  
`sparse_output` is ignored unless you leave `sparse` to its default  
value.
```

```
warnings.warn()
```

```
[CV 3/5] END randomforestclassifier__criterion=gini,  
randomforestclassifier__max_features=sqrt,  
randomforestclassifier__min_samples_leaf=5,  
randomforestclassifier__min_samples_split=2,
```



```
randomforestclassifier__n_estimators=150;; score=0.809 total time=5.9s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to `sparse_output` in version 1.2 and will be removed in 1.4. `sparse_output` is ignored unless you leave `sparse` to its default value.
```

```
warnings.warn(
```

```
[CV 4/5] END randomforestclassifier__criterion=gini, randomforestclassifier__max_features=sqrt, randomforestclassifier__min_samples_leaf=5, randomforestclassifier__min_samples_split=2, randomforestclassifier__n_estimators=150;; score=0.830 total time=6.0s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to `sparse_output` in version 1.2 and will be removed in 1.4. `sparse_output` is ignored unless you leave `sparse` to its default value.
```

```
warnings.warn(
```

```
[CV 5/5] END randomforestclassifier__criterion=gini, randomforestclassifier__max_features=sqrt, randomforestclassifier__min_samples_leaf=5, randomforestclassifier__min_samples_split=2, randomforestclassifier__n_estimators=150;; score=0.844 total time=5.9s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to `sparse_output` in version 1.2 and will be removed in 1.4. `sparse_output` is ignored unless you leave `sparse` to its default value.
```

```
warnings.warn(
```

```
[CV 1/5] END randomforestclassifier__criterion=gini, randomforestclassifier__max_features=sqrt, randomforestclassifier__min_samples_leaf=5, randomforestclassifier__min_samples_split=3, randomforestclassifier__n_estimators=50;; score=0.837 total time=2.0s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to `sparse_output` in version 1.2 and will be removed in 1.4. `sparse_output` is ignored unless you leave `sparse` to its default value.
```

```
warnings.warn(
```



```
`sparse_output` in version 1.2 and will be removed in 1.4.  
`sparse_output` is ignored unless you leave `sparse` to its default  
value.
```

```
warnings.warn()
```

```
[CV 1/5] END randomforestclassifier__criterion=gini,  
randomforestclassifier__max_features=sqrt,  
randomforestclassifier__min_samples_leaf=5,  
randomforestclassifier__min_samples_split=3,  
randomforestclassifier__n_estimators=100;; score=0.837 total time=  
4.0s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\  
preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to  
`sparse_output` in version 1.2 and will be removed in 1.4.  
`sparse_output` is ignored unless you leave `sparse` to its default  
value.
```

```
warnings.warn()
```

```
[CV 2/5] END randomforestclassifier__criterion=gini,  
randomforestclassifier__max_features=sqrt,  
randomforestclassifier__min_samples_leaf=5,  
randomforestclassifier__min_samples_split=3,  
randomforestclassifier__n_estimators=100;; score=0.825 total time=  
4.0s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\  
preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to  
`sparse_output` in version 1.2 and will be removed in 1.4.  
`sparse_output` is ignored unless you leave `sparse` to its default  
value.
```

```
warnings.warn()
```

```
[CV 3/5] END randomforestclassifier__criterion=gini,  
randomforestclassifier__max_features=sqrt,  
randomforestclassifier__min_samples_leaf=5,  
randomforestclassifier__min_samples_split=3,  
randomforestclassifier__n_estimators=100;; score=0.812 total time=  
3.9s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\  
preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to  
`sparse_output` in version 1.2 and will be removed in 1.4.  
`sparse_output` is ignored unless you leave `sparse` to its default  
value.
```

```
warnings.warn()
```

```
[CV 4/5] END randomforestclassifier__criterion=gini,  
randomforestclassifier__max_features=sqrt,  
randomforestclassifier__min_samples_leaf=5,  
randomforestclassifier__min_samples_split=3,
```

```
randomforestclassifier__n_estimators=100;; score=0.822 total time=4.1s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to `sparse_output` in version 1.2 and will be removed in 1.4.
`sparse_output` is ignored unless you leave `sparse` to its default value.
```

```
warnings.warn(
```

```
[CV 5/5] END randomforestclassifier__criterion=gini,
randomforestclassifier__max_features=sqrt,
randomforestclassifier__min_samples_leaf=5,
randomforestclassifier__min_samples_split=3,
randomforestclassifier__n_estimators=100;; score=0.838 total time=3.9s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to `sparse_output` in version 1.2 and will be removed in 1.4.
`sparse_output` is ignored unless you leave `sparse` to its default value.
```

```
warnings.warn(
```

```
[CV 1/5] END randomforestclassifier__criterion=gini,
randomforestclassifier__max_features=sqrt,
randomforestclassifier__min_samples_leaf=5,
randomforestclassifier__min_samples_split=3,
randomforestclassifier__n_estimators=150;; score=0.834 total time=6.0s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to `sparse_output` in version 1.2 and will be removed in 1.4.
`sparse_output` is ignored unless you leave `sparse` to its default value.
```

```
warnings.warn(
```

```
[CV 2/5] END randomforestclassifier__criterion=gini,
randomforestclassifier__max_features=sqrt,
randomforestclassifier__min_samples_leaf=5,
randomforestclassifier__min_samples_split=3,
randomforestclassifier__n_estimators=150;; score=0.827 total time=6.2s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to `sparse_output` in version 1.2 and will be removed in 1.4.
`sparse_output` is ignored unless you leave `sparse` to its default value.
```

```
warnings.warn(
```

```
[CV 3/5] END randomforestclassifier__criterion=gini,  
randomforestclassifier__max_features=sqrt,  
randomforestclassifier__min_samples_leaf=5,  
randomforestclassifier__min_samples_split=3,  
randomforestclassifier__n_estimators=150;; score=0.809 total time=  
5.8s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\  
preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to  
`sparse_output` in version 1.2 and will be removed in 1.4.  
`sparse_output` is ignored unless you leave `sparse` to its default  
value.
```

```
warnings.warn(
```

```
[CV 4/5] END randomforestclassifier__criterion=gini,  
randomforestclassifier__max_features=sqrt,  
randomforestclassifier__min_samples_leaf=5,  
randomforestclassifier__min_samples_split=3,  
randomforestclassifier__n_estimators=150;; score=0.820 total time=  
5.9s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\  
preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to  
`sparse_output` in version 1.2 and will be removed in 1.4.  
`sparse_output` is ignored unless you leave `sparse` to its default  
value.
```

```
warnings.warn(
```

```
[CV 5/5] END randomforestclassifier__criterion=gini,  
randomforestclassifier__max_features=sqrt,  
randomforestclassifier__min_samples_leaf=5,  
randomforestclassifier__min_samples_split=3,  
randomforestclassifier__n_estimators=150;; score=0.834 total time=  
6.1s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\  
preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to  
`sparse_output` in version 1.2 and will be removed in 1.4.  
`sparse_output` is ignored unless you leave `sparse` to its default  
value.
```

```
warnings.warn(
```

```
[CV 1/5] END randomforestclassifier__criterion=gini,  
randomforestclassifier__max_features=sqrt,  
randomforestclassifier__min_samples_leaf=5,  
randomforestclassifier__min_samples_split=4,  
randomforestclassifier__n_estimators=50;; score=0.838 total time=  
2.0s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\  
preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to
```

```
`sparse_output` in version 1.2 and will be removed in 1.4.  
`sparse_output` is ignored unless you leave `sparse` to its default  
value.
```

```
warnings.warn()
```

```
[CV 2/5] END randomforestclassifier__criterion=gini,  
randomforestclassifier__max_features=sqrt,  
randomforestclassifier__min_samples_leaf=5,  
randomforestclassifier__min_samples_split=4,  
randomforestclassifier__n_estimators=50;; score=0.827 total time=  
2.0s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\  
preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to  
`sparse_output` in version 1.2 and will be removed in 1.4.  
`sparse_output` is ignored unless you leave `sparse` to its default  
value.
```

```
warnings.warn()
```

```
[CV 3/5] END randomforestclassifier__criterion=gini,  
randomforestclassifier__max_features=sqrt,  
randomforestclassifier__min_samples_leaf=5,  
randomforestclassifier__min_samples_split=4,  
randomforestclassifier__n_estimators=50;; score=0.803 total time=  
1.9s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\  
preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to  
`sparse_output` in version 1.2 and will be removed in 1.4.  
`sparse_output` is ignored unless you leave `sparse` to its default  
value.
```

```
warnings.warn()
```

```
[CV 4/5] END randomforestclassifier__criterion=gini,  
randomforestclassifier__max_features=sqrt,  
randomforestclassifier__min_samples_leaf=5,  
randomforestclassifier__min_samples_split=4,  
randomforestclassifier__n_estimators=50;; score=0.819 total time=  
1.9s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\  
preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to  
`sparse_output` in version 1.2 and will be removed in 1.4.  
`sparse_output` is ignored unless you leave `sparse` to its default  
value.
```

```
warnings.warn()
```

```
[CV 5/5] END randomforestclassifier__criterion=gini,  
randomforestclassifier__max_features=sqrt,  
randomforestclassifier__min_samples_leaf=5,  
randomforestclassifier__min_samples_split=4,
```

```
randomforestclassifier__n_estimators=50;; score=0.830 total time=2.0s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to `sparse_output` in version 1.2 and will be removed in 1.4. `sparse_output` is ignored unless you leave `sparse` to its default value.
```

```
warnings.warn(
```

```
[CV 1/5] END randomforestclassifier__criterion=gini, randomforestclassifier__max_features=sqrt, randomforestclassifier__min_samples_leaf=5, randomforestclassifier__min_samples_split=4, randomforestclassifier__n_estimators=100;; score=0.838 total time=4.3s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to `sparse_output` in version 1.2 and will be removed in 1.4. `sparse_output` is ignored unless you leave `sparse` to its default value.
```

```
warnings.warn(
```

```
[CV 2/5] END randomforestclassifier__criterion=gini, randomforestclassifier__max_features=sqrt, randomforestclassifier__min_samples_leaf=5, randomforestclassifier__min_samples_split=4, randomforestclassifier__n_estimators=100;; score=0.831 total time=4.0s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to `sparse_output` in version 1.2 and will be removed in 1.4. `sparse_output` is ignored unless you leave `sparse` to its default value.
```

```
warnings.warn(
```

```
[CV 3/5] END randomforestclassifier__criterion=gini, randomforestclassifier__max_features=sqrt, randomforestclassifier__min_samples_leaf=5, randomforestclassifier__min_samples_split=4, randomforestclassifier__n_estimators=100;; score=0.809 total time=3.9s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to `sparse_output` in version 1.2 and will be removed in 1.4. `sparse_output` is ignored unless you leave `sparse` to its default value.
```

```
warnings.warn(
```

```
[CV 4/5] END randomforestclassifier__criterion=gini,  
randomforestclassifier__max_features=sqrt,  
randomforestclassifier__min_samples_leaf=5,  
randomforestclassifier__min_samples_split=4,  
randomforestclassifier__n_estimators=100;; score=0.829 total time=  
4.0s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\  
preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to  
`sparse_output` in version 1.2 and will be removed in 1.4.  
`sparse_output` is ignored unless you leave `sparse` to its default  
value.
```

```
warnings.warn(
```

```
[CV 5/5] END randomforestclassifier__criterion=gini,  
randomforestclassifier__max_features=sqrt,  
randomforestclassifier__min_samples_leaf=5,  
randomforestclassifier__min_samples_split=4,  
randomforestclassifier__n_estimators=100;; score=0.835 total time=  
4.0s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\  
preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to  
`sparse_output` in version 1.2 and will be removed in 1.4.  
`sparse_output` is ignored unless you leave `sparse` to its default  
value.
```

```
warnings.warn(
```

```
[CV 1/5] END randomforestclassifier__criterion=gini,  
randomforestclassifier__max_features=sqrt,  
randomforestclassifier__min_samples_leaf=5,  
randomforestclassifier__min_samples_split=4,  
randomforestclassifier__n_estimators=150;; score=0.840 total time=  
5.9s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\  
preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to  
`sparse_output` in version 1.2 and will be removed in 1.4.  
`sparse_output` is ignored unless you leave `sparse` to its default  
value.
```

```
warnings.warn(
```

```
[CV 2/5] END randomforestclassifier__criterion=gini,  
randomforestclassifier__max_features=sqrt,  
randomforestclassifier__min_samples_leaf=5,  
randomforestclassifier__min_samples_split=4,  
randomforestclassifier__n_estimators=150;; score=0.834 total time=  
6.0s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\  
preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to
```



```
`sparse_output` in version 1.2 and will be removed in 1.4.  
`sparse_output` is ignored unless you leave `sparse` to its default  
value.
```

```
warnings.warn()
```

```
[CV 3/5] END randomforestclassifier__criterion=gini,  
randomforestclassifier__max_features=sqrt,  
randomforestclassifier__min_samples_leaf=5,  
randomforestclassifier__min_samples_split=4,  
randomforestclassifier__n_estimators=150;; score=0.809 total time=  
5.9s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\  
preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to  
`sparse_output` in version 1.2 and will be removed in 1.4.  
`sparse_output` is ignored unless you leave `sparse` to its default  
value.
```

```
warnings.warn()
```

```
[CV 4/5] END randomforestclassifier__criterion=gini,  
randomforestclassifier__max_features=sqrt,  
randomforestclassifier__min_samples_leaf=5,  
randomforestclassifier__min_samples_split=4,  
randomforestclassifier__n_estimators=150;; score=0.821 total time=  
5.8s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\  
preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to  
`sparse_output` in version 1.2 and will be removed in 1.4.  
`sparse_output` is ignored unless you leave `sparse` to its default  
value.
```

```
warnings.warn()
```

```
[CV 5/5] END randomforestclassifier__criterion=gini,  
randomforestclassifier__max_features=sqrt,  
randomforestclassifier__min_samples_leaf=5,  
randomforestclassifier__min_samples_split=4,  
randomforestclassifier__n_estimators=150;; score=0.840 total time=  
6.2s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\  
preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to  
`sparse_output` in version 1.2 and will be removed in 1.4.  
`sparse_output` is ignored unless you leave `sparse` to its default  
value.
```

```
warnings.warn()
```

```
[CV 1/5] END randomforestclassifier__criterion=gini,  
randomforestclassifier__max_features=sqrt,  
randomforestclassifier__min_samples_leaf=10,  
randomforestclassifier__min_samples_split=2,
```

```
randomforestclassifier__n_estimators=50;; score=0.831 total time=1.9s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to `sparse_output` in version 1.2 and will be removed in 1.4. `sparse_output` is ignored unless you leave `sparse` to its default value.
```

```
warnings.warn(
```

```
[CV 2/5] END randomforestclassifier__criterion=gini, randomforestclassifier__max_features=sqrt, randomforestclassifier__min_samples_leaf=10, randomforestclassifier__min_samples_split=2, randomforestclassifier__n_estimators=50;; score=0.827 total time=1.7s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to `sparse_output` in version 1.2 and will be removed in 1.4. `sparse_output` is ignored unless you leave `sparse` to its default value.
```

```
warnings.warn(
```

```
[CV 3/5] END randomforestclassifier__criterion=gini, randomforestclassifier__max_features=sqrt, randomforestclassifier__min_samples_leaf=10, randomforestclassifier__min_samples_split=2, randomforestclassifier__n_estimators=50;; score=0.806 total time=1.8s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to `sparse_output` in version 1.2 and will be removed in 1.4. `sparse_output` is ignored unless you leave `sparse` to its default value.
```

```
warnings.warn(
```

```
[CV 4/5] END randomforestclassifier__criterion=gini, randomforestclassifier__max_features=sqrt, randomforestclassifier__min_samples_leaf=10, randomforestclassifier__min_samples_split=2, randomforestclassifier__n_estimators=50;; score=0.814 total time=1.7s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to `sparse_output` in version 1.2 and will be removed in 1.4. `sparse_output` is ignored unless you leave `sparse` to its default value.
```

```
warnings.warn(
```

```
[CV 5/5] END randomforestclassifier__criterion=gini,  
randomforestclassifier__max_features=sqrt,  
randomforestclassifier__min_samples_leaf=10,  
randomforestclassifier__min_samples_split=2,  
randomforestclassifier__n_estimators=50;; score=0.826 total time=  
1.8s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\  
preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to  
`sparse_output` in version 1.2 and will be removed in 1.4.  
`sparse_output` is ignored unless you leave `sparse` to its default  
value.
```

```
warnings.warn(
```

```
[CV 1/5] END randomforestclassifier__criterion=gini,  
randomforestclassifier__max_features=sqrt,  
randomforestclassifier__min_samples_leaf=10,  
randomforestclassifier__min_samples_split=2,  
randomforestclassifier__n_estimators=100;; score=0.829 total time=  
3.6s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\  
preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to  
`sparse_output` in version 1.2 and will be removed in 1.4.  
`sparse_output` is ignored unless you leave `sparse` to its default  
value.
```

```
warnings.warn(
```

```
[CV 2/5] END randomforestclassifier__criterion=gini,  
randomforestclassifier__max_features=sqrt,  
randomforestclassifier__min_samples_leaf=10,  
randomforestclassifier__min_samples_split=2,  
randomforestclassifier__n_estimators=100;; score=0.823 total time=  
3.7s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\  
preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to  
`sparse_output` in version 1.2 and will be removed in 1.4.  
`sparse_output` is ignored unless you leave `sparse` to its default  
value.
```

```
warnings.warn(
```

```
[CV 3/5] END randomforestclassifier__criterion=gini,  
randomforestclassifier__max_features=sqrt,  
randomforestclassifier__min_samples_leaf=10,  
randomforestclassifier__min_samples_split=2,  
randomforestclassifier__n_estimators=100;; score=0.804 total time=  
3.5s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\  
preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to
```

```
`sparse_output` in version 1.2 and will be removed in 1.4.  
`sparse_output` is ignored unless you leave `sparse` to its default  
value.
```

```
warnings.warn()
```

```
[CV 4/5] END randomforestclassifier__criterion=gini,  
randomforestclassifier__max_features=sqrt,  
randomforestclassifier__min_samples_leaf=10,  
randomforestclassifier__min_samples_split=2,  
randomforestclassifier__n_estimators=100;; score=0.820 total time=  
3.4s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\  
preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to  
`sparse_output` in version 1.2 and will be removed in 1.4.  
`sparse_output` is ignored unless you leave `sparse` to its default  
value.
```

```
warnings.warn()
```

```
[CV 5/5] END randomforestclassifier__criterion=gini,  
randomforestclassifier__max_features=sqrt,  
randomforestclassifier__min_samples_leaf=10,  
randomforestclassifier__min_samples_split=2,  
randomforestclassifier__n_estimators=100;; score=0.830 total time=  
3.6s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\  
preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to  
`sparse_output` in version 1.2 and will be removed in 1.4.  
`sparse_output` is ignored unless you leave `sparse` to its default  
value.
```

```
warnings.warn()
```

```
[CV 1/5] END randomforestclassifier__criterion=gini,  
randomforestclassifier__max_features=sqrt,  
randomforestclassifier__min_samples_leaf=10,  
randomforestclassifier__min_samples_split=2,  
randomforestclassifier__n_estimators=150;; score=0.831 total time=  
5.6s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\  
preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to  
`sparse_output` in version 1.2 and will be removed in 1.4.  
`sparse_output` is ignored unless you leave `sparse` to its default  
value.
```

```
warnings.warn()
```

```
[CV 2/5] END randomforestclassifier__criterion=gini,  
randomforestclassifier__max_features=sqrt,  
randomforestclassifier__min_samples_leaf=10,  
randomforestclassifier__min_samples_split=2,
```

```
randomforestclassifier__n_estimators=150;; score=0.821 total time=5.4s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to `sparse_output` in version 1.2 and will be removed in 1.4. `sparse_output` is ignored unless you leave `sparse` to its default value.
```

```
warnings.warn(
```

```
[CV 3/5] END randomforestclassifier__criterion=gini, randomforestclassifier__max_features=sqrt, randomforestclassifier__min_samples_leaf=10, randomforestclassifier__min_samples_split=2, randomforestclassifier__n_estimators=150;; score=0.809 total time=5.3s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to `sparse_output` in version 1.2 and will be removed in 1.4. `sparse_output` is ignored unless you leave `sparse` to its default value.
```

```
warnings.warn(
```

```
[CV 4/5] END randomforestclassifier__criterion=gini, randomforestclassifier__max_features=sqrt, randomforestclassifier__min_samples_leaf=10, randomforestclassifier__min_samples_split=2, randomforestclassifier__n_estimators=150;; score=0.820 total time=5.5s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to `sparse_output` in version 1.2 and will be removed in 1.4. `sparse_output` is ignored unless you leave `sparse` to its default value.
```

```
warnings.warn(
```

```
[CV 5/5] END randomforestclassifier__criterion=gini, randomforestclassifier__max_features=sqrt, randomforestclassifier__min_samples_leaf=10, randomforestclassifier__min_samples_split=2, randomforestclassifier__n_estimators=150;; score=0.836 total time=5.2s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to `sparse_output` in version 1.2 and will be removed in 1.4. `sparse_output` is ignored unless you leave `sparse` to its default value.
```

```
warnings.warn(
```

```
[CV 1/5] END randomforestclassifier__criterion=gini,  
randomforestclassifier__max_features=sqrt,  
randomforestclassifier__min_samples_leaf=10,  
randomforestclassifier__min_samples_split=3,  
randomforestclassifier__n_estimators=50;; score=0.831 total time=  
1.7s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\  
preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to  
`sparse_output` in version 1.2 and will be removed in 1.4.  
`sparse_output` is ignored unless you leave `sparse` to its default  
value.
```

```
warnings.warn(
```

```
[CV 2/5] END randomforestclassifier__criterion=gini,  
randomforestclassifier__max_features=sqrt,  
randomforestclassifier__min_samples_leaf=10,  
randomforestclassifier__min_samples_split=3,  
randomforestclassifier__n_estimators=50;; score=0.819 total time=  
1.9s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\  
preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to  
`sparse_output` in version 1.2 and will be removed in 1.4.  
`sparse_output` is ignored unless you leave `sparse` to its default  
value.
```

```
warnings.warn(
```

```
[CV 3/5] END randomforestclassifier__criterion=gini,  
randomforestclassifier__max_features=sqrt,  
randomforestclassifier__min_samples_leaf=10,  
randomforestclassifier__min_samples_split=3,  
randomforestclassifier__n_estimators=50;; score=0.809 total time=  
1.9s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\  
preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to  
`sparse_output` in version 1.2 and will be removed in 1.4.  
`sparse_output` is ignored unless you leave `sparse` to its default  
value.
```

```
warnings.warn(
```

```
[CV 4/5] END randomforestclassifier__criterion=gini,  
randomforestclassifier__max_features=sqrt,  
randomforestclassifier__min_samples_leaf=10,  
randomforestclassifier__min_samples_split=3,  
randomforestclassifier__n_estimators=50;; score=0.816 total time=  
1.8s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\  
preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to
```

```
`sparse_output` in version 1.2 and will be removed in 1.4.  
`sparse_output` is ignored unless you leave `sparse` to its default  
value.
```

```
warnings.warn()
```

```
[CV 5/5] END randomforestclassifier__criterion=gini,  
randomforestclassifier__max_features=sqrt,  
randomforestclassifier__min_samples_leaf=10,  
randomforestclassifier__min_samples_split=3,  
randomforestclassifier__n_estimators=50;; score=0.822 total time=  
1.8s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\  
preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to  
`sparse_output` in version 1.2 and will be removed in 1.4.  
`sparse_output` is ignored unless you leave `sparse` to its default  
value.
```

```
warnings.warn()
```

```
[CV 1/5] END randomforestclassifier__criterion=gini,  
randomforestclassifier__max_features=sqrt,  
randomforestclassifier__min_samples_leaf=10,  
randomforestclassifier__min_samples_split=3,  
randomforestclassifier__n_estimators=100;; score=0.826 total time=  
3.7s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\  
preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to  
`sparse_output` in version 1.2 and will be removed in 1.4.  
`sparse_output` is ignored unless you leave `sparse` to its default  
value.
```

```
warnings.warn()
```

```
[CV 2/5] END randomforestclassifier__criterion=gini,  
randomforestclassifier__max_features=sqrt,  
randomforestclassifier__min_samples_leaf=10,  
randomforestclassifier__min_samples_split=3,  
randomforestclassifier__n_estimators=100;; score=0.824 total time=  
3.5s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\  
preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to  
`sparse_output` in version 1.2 and will be removed in 1.4.  
`sparse_output` is ignored unless you leave `sparse` to its default  
value.
```

```
warnings.warn()
```

```
[CV 3/5] END randomforestclassifier__criterion=gini,  
randomforestclassifier__max_features=sqrt,  
randomforestclassifier__min_samples_leaf=10,  
randomforestclassifier__min_samples_split=3,
```

```
randomforestclassifier__n_estimators=100;; score=0.807 total time=3.5s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to `sparse_output` in version 1.2 and will be removed in 1.4. `sparse_output` is ignored unless you leave `sparse` to its default value.
```

```
warnings.warn(
```

```
[CV 4/5] END randomforestclassifier__criterion=gini, randomforestclassifier__max_features=sqrt, randomforestclassifier__min_samples_leaf=10, randomforestclassifier__min_samples_split=3, randomforestclassifier__n_estimators=100;; score=0.818 total time=3.7s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to `sparse_output` in version 1.2 and will be removed in 1.4. `sparse_output` is ignored unless you leave `sparse` to its default value.
```

```
warnings.warn(
```

```
[CV 5/5] END randomforestclassifier__criterion=gini, randomforestclassifier__max_features=sqrt, randomforestclassifier__min_samples_leaf=10, randomforestclassifier__min_samples_split=3, randomforestclassifier__n_estimators=100;; score=0.830 total time=3.6s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to `sparse_output` in version 1.2 and will be removed in 1.4. `sparse_output` is ignored unless you leave `sparse` to its default value.
```

```
warnings.warn(
```

```
[CV 1/5] END randomforestclassifier__criterion=gini, randomforestclassifier__max_features=sqrt, randomforestclassifier__min_samples_leaf=10, randomforestclassifier__min_samples_split=3, randomforestclassifier__n_estimators=150;; score=0.828 total time=5.3s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to `sparse_output` in version 1.2 and will be removed in 1.4. `sparse_output` is ignored unless you leave `sparse` to its default value.
```

```
warnings.warn(
```



```
[CV 2/5] END randomforestclassifier__criterion=gini,  
randomforestclassifier__max_features=sqrt,  
randomforestclassifier__min_samples_leaf=10,  
randomforestclassifier__min_samples_split=3,  
randomforestclassifier__n_estimators=150;; score=0.820 total time=  
5.5s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\  
preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to  
`sparse_output` in version 1.2 and will be removed in 1.4.  
`sparse_output` is ignored unless you leave `sparse` to its default  
value.
```

```
warnings.warn(
```

```
[CV 3/5] END randomforestclassifier__criterion=gini,  
randomforestclassifier__max_features=sqrt,  
randomforestclassifier__min_samples_leaf=10,  
randomforestclassifier__min_samples_split=3,  
randomforestclassifier__n_estimators=150;; score=0.808 total time=  
5.4s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\  
preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to  
`sparse_output` in version 1.2 and will be removed in 1.4.  
`sparse_output` is ignored unless you leave `sparse` to its default  
value.
```

```
warnings.warn(
```

```
[CV 4/5] END randomforestclassifier__criterion=gini,  
randomforestclassifier__max_features=sqrt,  
randomforestclassifier__min_samples_leaf=10,  
randomforestclassifier__min_samples_split=3,  
randomforestclassifier__n_estimators=150;; score=0.818 total time=  
5.2s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\  
preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to  
`sparse_output` in version 1.2 and will be removed in 1.4.  
`sparse_output` is ignored unless you leave `sparse` to its default  
value.
```

```
warnings.warn(
```

```
[CV 5/5] END randomforestclassifier__criterion=gini,  
randomforestclassifier__max_features=sqrt,  
randomforestclassifier__min_samples_leaf=10,  
randomforestclassifier__min_samples_split=3,  
randomforestclassifier__n_estimators=150;; score=0.824 total time=  
5.4s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\  
preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to
```

```
`sparse_output` in version 1.2 and will be removed in 1.4.  
`sparse_output` is ignored unless you leave `sparse` to its default  
value.
```

```
warnings.warn()
```

```
[CV 1/5] END randomforestclassifier__criterion=gini,  
randomforestclassifier__max_features=sqrt,  
randomforestclassifier__min_samples_leaf=10,  
randomforestclassifier__min_samples_split=4,  
randomforestclassifier__n_estimators=50;; score=0.827 total time=  
1.8s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\  
preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to  
`sparse_output` in version 1.2 and will be removed in 1.4.  
`sparse_output` is ignored unless you leave `sparse` to its default  
value.
```

```
warnings.warn()
```

```
[CV 2/5] END randomforestclassifier__criterion=gini,  
randomforestclassifier__max_features=sqrt,  
randomforestclassifier__min_samples_leaf=10,  
randomforestclassifier__min_samples_split=4,  
randomforestclassifier__n_estimators=50;; score=0.814 total time=  
1.8s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\  
preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to  
`sparse_output` in version 1.2 and will be removed in 1.4.  
`sparse_output` is ignored unless you leave `sparse` to its default  
value.
```

```
warnings.warn()
```

```
[CV 3/5] END randomforestclassifier__criterion=gini,  
randomforestclassifier__max_features=sqrt,  
randomforestclassifier__min_samples_leaf=10,  
randomforestclassifier__min_samples_split=4,  
randomforestclassifier__n_estimators=50;; score=0.800 total time=  
1.7s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\  
preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to  
`sparse_output` in version 1.2 and will be removed in 1.4.  
`sparse_output` is ignored unless you leave `sparse` to its default  
value.
```

```
warnings.warn()
```

```
[CV 4/5] END randomforestclassifier__criterion=gini,  
randomforestclassifier__max_features=sqrt,  
randomforestclassifier__min_samples_leaf=10,  
randomforestclassifier__min_samples_split=4,
```

```
randomforestclassifier__n_estimators=50;; score=0.816 total time=1.7s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to `sparse_output` in version 1.2 and will be removed in 1.4. `sparse_output` is ignored unless you leave `sparse` to its default value.
```

```
warnings.warn(
```

```
[CV 5/5] END randomforestclassifier__criterion=gini,  
randomforestclassifier__max_features=sqrt,  
randomforestclassifier__min_samples_leaf=10,  
randomforestclassifier__min_samples_split=4,  
randomforestclassifier__n_estimators=50;; score=0.831 total time=1.7s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to `sparse_output` in version 1.2 and will be removed in 1.4. `sparse_output` is ignored unless you leave `sparse` to its default value.
```

```
warnings.warn(
```

```
[CV 1/5] END randomforestclassifier__criterion=gini,  
randomforestclassifier__max_features=sqrt,  
randomforestclassifier__min_samples_leaf=10,  
randomforestclassifier__min_samples_split=4,  
randomforestclassifier__n_estimators=100;; score=0.828 total time=3.6s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to `sparse_output` in version 1.2 and will be removed in 1.4. `sparse_output` is ignored unless you leave `sparse` to its default value.
```

```
warnings.warn(
```

```
[CV 2/5] END randomforestclassifier__criterion=gini,  
randomforestclassifier__max_features=sqrt,  
randomforestclassifier__min_samples_leaf=10,  
randomforestclassifier__min_samples_split=4,  
randomforestclassifier__n_estimators=100;; score=0.816 total time=3.8s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to `sparse_output` in version 1.2 and will be removed in 1.4. `sparse_output` is ignored unless you leave `sparse` to its default value.
```

```
warnings.warn(
```

```
[CV 3/5] END randomforestclassifier__criterion=gini,  
randomforestclassifier__max_features=sqrt,  
randomforestclassifier__min_samples_leaf=10,  
randomforestclassifier__min_samples_split=4,  
randomforestclassifier__n_estimators=100;; score=0.808 total time=  
3.7s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\  
preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to  
`sparse_output` in version 1.2 and will be removed in 1.4.  
`sparse_output` is ignored unless you leave `sparse` to its default  
value.
```

```
warnings.warn(
```

```
[CV 4/5] END randomforestclassifier__criterion=gini,  
randomforestclassifier__max_features=sqrt,  
randomforestclassifier__min_samples_leaf=10,  
randomforestclassifier__min_samples_split=4,  
randomforestclassifier__n_estimators=100;; score=0.820 total time=  
3.5s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\  
preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to  
`sparse_output` in version 1.2 and will be removed in 1.4.  
`sparse_output` is ignored unless you leave `sparse` to its default  
value.
```

```
warnings.warn(
```

```
[CV 5/5] END randomforestclassifier__criterion=gini,  
randomforestclassifier__max_features=sqrt,  
randomforestclassifier__min_samples_leaf=10,  
randomforestclassifier__min_samples_split=4,  
randomforestclassifier__n_estimators=100;; score=0.831 total time=  
3.5s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\  
preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to  
`sparse_output` in version 1.2 and will be removed in 1.4.  
`sparse_output` is ignored unless you leave `sparse` to its default  
value.
```

```
warnings.warn(
```

```
[CV 1/5] END randomforestclassifier__criterion=gini,  
randomforestclassifier__max_features=sqrt,  
randomforestclassifier__min_samples_leaf=10,  
randomforestclassifier__min_samples_split=4,  
randomforestclassifier__n_estimators=150;; score=0.826 total time=  
5.7s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\  
preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to
```

```
`sparse_output` in version 1.2 and will be removed in 1.4.  
`sparse_output` is ignored unless you leave `sparse` to its default  
value.
```

```
warnings.warn()
```

```
[CV 2/5] END randomforestclassifier__criterion=gini,  
randomforestclassifier__max_features=sqrt,  
randomforestclassifier__min_samples_leaf=10,  
randomforestclassifier__min_samples_split=4,  
randomforestclassifier__n_estimators=150;; score=0.826 total time=  
5.5s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\  
preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to  
`sparse_output` in version 1.2 and will be removed in 1.4.  
`sparse_output` is ignored unless you leave `sparse` to its default  
value.
```

```
warnings.warn()
```

```
[CV 3/5] END randomforestclassifier__criterion=gini,  
randomforestclassifier__max_features=sqrt,  
randomforestclassifier__min_samples_leaf=10,  
randomforestclassifier__min_samples_split=4,  
randomforestclassifier__n_estimators=150;; score=0.806 total time=  
5.2s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\  
preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to  
`sparse_output` in version 1.2 and will be removed in 1.4.  
`sparse_output` is ignored unless you leave `sparse` to its default  
value.
```

```
warnings.warn()
```

```
[CV 4/5] END randomforestclassifier__criterion=gini,  
randomforestclassifier__max_features=sqrt,  
randomforestclassifier__min_samples_leaf=10,  
randomforestclassifier__min_samples_split=4,  
randomforestclassifier__n_estimators=150;; score=0.817 total time=  
5.6s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\  
preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to  
`sparse_output` in version 1.2 and will be removed in 1.4.  
`sparse_output` is ignored unless you leave `sparse` to its default  
value.
```

```
warnings.warn()
```

```
[CV 5/5] END randomforestclassifier__criterion=gini,  
randomforestclassifier__max_features=sqrt,  
randomforestclassifier__min_samples_leaf=10,  
randomforestclassifier__min_samples_split=4,
```

```
randomforestclassifier__n_estimators=150;; score=0.829 total time=5.2s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to `sparse_output` in version 1.2 and will be removed in 1.4. `sparse_output` is ignored unless you leave `sparse` to its default value.
```

```
warnings.warn(
```

```
[CV 1/5] END randomforestclassifier__criterion=gini,  
randomforestclassifier__max_features=sqrt,  
randomforestclassifier__min_samples_leaf=15,  
randomforestclassifier__min_samples_split=2,  
randomforestclassifier__n_estimators=50;; score=0.825 total time=1.7s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to `sparse_output` in version 1.2 and will be removed in 1.4. `sparse_output` is ignored unless you leave `sparse` to its default value.
```

```
warnings.warn(
```

```
[CV 2/5] END randomforestclassifier__criterion=gini,  
randomforestclassifier__max_features=sqrt,  
randomforestclassifier__min_samples_leaf=15,  
randomforestclassifier__min_samples_split=2,  
randomforestclassifier__n_estimators=50;; score=0.819 total time=1.6s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to `sparse_output` in version 1.2 and will be removed in 1.4. `sparse_output` is ignored unless you leave `sparse` to its default value.
```

```
warnings.warn(
```

```
[CV 3/5] END randomforestclassifier__criterion=gini,  
randomforestclassifier__max_features=sqrt,  
randomforestclassifier__min_samples_leaf=15,  
randomforestclassifier__min_samples_split=2,  
randomforestclassifier__n_estimators=50;; score=0.799 total time=1.6s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to `sparse_output` in version 1.2 and will be removed in 1.4. `sparse_output` is ignored unless you leave `sparse` to its default value.
```

```
warnings.warn(
```

```
[CV 4/5] END randomforestclassifier__criterion=gini,  
randomforestclassifier__max_features=sqrt,  
randomforestclassifier__min_samples_leaf=15,  
randomforestclassifier__min_samples_split=2,  
randomforestclassifier__n_estimators=50;; score=0.811 total time=  
1.7s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\  
preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to  
`sparse_output` in version 1.2 and will be removed in 1.4.  
`sparse_output` is ignored unless you leave `sparse` to its default  
value.
```

```
warnings.warn(
```

```
[CV 5/5] END randomforestclassifier__criterion=gini,  
randomforestclassifier__max_features=sqrt,  
randomforestclassifier__min_samples_leaf=15,  
randomforestclassifier__min_samples_split=2,  
randomforestclassifier__n_estimators=50;; score=0.824 total time=  
1.7s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\  
preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to  
`sparse_output` in version 1.2 and will be removed in 1.4.  
`sparse_output` is ignored unless you leave `sparse` to its default  
value.
```

```
warnings.warn(
```

```
[CV 1/5] END randomforestclassifier__criterion=gini,  
randomforestclassifier__max_features=sqrt,  
randomforestclassifier__min_samples_leaf=15,  
randomforestclassifier__min_samples_split=2,  
randomforestclassifier__n_estimators=100;; score=0.825 total time=  
3.4s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\  
preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to  
`sparse_output` in version 1.2 and will be removed in 1.4.  
`sparse_output` is ignored unless you leave `sparse` to its default  
value.
```

```
warnings.warn(
```

```
[CV 2/5] END randomforestclassifier__criterion=gini,  
randomforestclassifier__max_features=sqrt,  
randomforestclassifier__min_samples_leaf=15,  
randomforestclassifier__min_samples_split=2,  
randomforestclassifier__n_estimators=100;; score=0.816 total time=  
3.2s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\  
preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to
```

```
`sparse_output` in version 1.2 and will be removed in 1.4.  
`sparse_output` is ignored unless you leave `sparse` to its default  
value.
```

```
warnings.warn()
```

```
[CV 3/5] END randomforestclassifier__criterion=gini,  
randomforestclassifier__max_features=sqrt,  
randomforestclassifier__min_samples_leaf=15,  
randomforestclassifier__min_samples_split=2,  
randomforestclassifier__n_estimators=100;; score=0.803 total time=  
3.2s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\  
preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to  
`sparse_output` in version 1.2 and will be removed in 1.4.  
`sparse_output` is ignored unless you leave `sparse` to its default  
value.
```

```
warnings.warn()
```

```
[CV 4/5] END randomforestclassifier__criterion=gini,  
randomforestclassifier__max_features=sqrt,  
randomforestclassifier__min_samples_leaf=15,  
randomforestclassifier__min_samples_split=2,  
randomforestclassifier__n_estimators=100;; score=0.809 total time=  
3.3s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\  
preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to  
`sparse_output` in version 1.2 and will be removed in 1.4.  
`sparse_output` is ignored unless you leave `sparse` to its default  
value.
```

```
warnings.warn()
```

```
[CV 5/5] END randomforestclassifier__criterion=gini,  
randomforestclassifier__max_features=sqrt,  
randomforestclassifier__min_samples_leaf=15,  
randomforestclassifier__min_samples_split=2,  
randomforestclassifier__n_estimators=100;; score=0.823 total time=  
3.4s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\  
preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to  
`sparse_output` in version 1.2 and will be removed in 1.4.  
`sparse_output` is ignored unless you leave `sparse` to its default  
value.
```

```
warnings.warn()
```

```
[CV 1/5] END randomforestclassifier__criterion=gini,  
randomforestclassifier__max_features=sqrt,  
randomforestclassifier__min_samples_leaf=15,  
randomforestclassifier__min_samples_split=2,
```



```
randomforestclassifier__n_estimators=150;; score=0.826 total time=5.0s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to `sparse_output` in version 1.2 and will be removed in 1.4. `sparse_output` is ignored unless you leave `sparse` to its default value.
```

```
warnings.warn(
```

```
[CV 2/5] END randomforestclassifier__criterion=gini, randomforestclassifier__max_features=sqrt, randomforestclassifier__min_samples_leaf=15, randomforestclassifier__min_samples_split=2, randomforestclassifier__n_estimators=150;; score=0.814 total time=4.8s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to `sparse_output` in version 1.2 and will be removed in 1.4. `sparse_output` is ignored unless you leave `sparse` to its default value.
```

```
warnings.warn(
```

```
[CV 3/5] END randomforestclassifier__criterion=gini, randomforestclassifier__max_features=sqrt, randomforestclassifier__min_samples_leaf=15, randomforestclassifier__min_samples_split=2, randomforestclassifier__n_estimators=150;; score=0.804 total time=5.0s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to `sparse_output` in version 1.2 and will be removed in 1.4. `sparse_output` is ignored unless you leave `sparse` to its default value.
```

```
warnings.warn(
```

```
[CV 4/5] END randomforestclassifier__criterion=gini, randomforestclassifier__max_features=sqrt, randomforestclassifier__min_samples_leaf=15, randomforestclassifier__min_samples_split=2, randomforestclassifier__n_estimators=150;; score=0.814 total time=5.0s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to `sparse_output` in version 1.2 and will be removed in 1.4. `sparse_output` is ignored unless you leave `sparse` to its default value.
```

```
warnings.warn(
```

```
[CV 5/5] END randomforestclassifier__criterion=gini,  
randomforestclassifier__max_features=sqrt,  
randomforestclassifier__min_samples_leaf=15,  
randomforestclassifier__min_samples_split=2,  
randomforestclassifier__n_estimators=150;; score=0.824 total time=  
4.8s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\  
preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to  
`sparse_output` in version 1.2 and will be removed in 1.4.  
`sparse_output` is ignored unless you leave `sparse` to its default  
value.
```

```
warnings.warn(
```

```
[CV 1/5] END randomforestclassifier__criterion=gini,  
randomforestclassifier__max_features=sqrt,  
randomforestclassifier__min_samples_leaf=15,  
randomforestclassifier__min_samples_split=3,  
randomforestclassifier__n_estimators=50;; score=0.821 total time=  
1.6s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\  
preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to  
`sparse_output` in version 1.2 and will be removed in 1.4.  
`sparse_output` is ignored unless you leave `sparse` to its default  
value.
```

```
warnings.warn(
```

```
[CV 2/5] END randomforestclassifier__criterion=gini,  
randomforestclassifier__max_features=sqrt,  
randomforestclassifier__min_samples_leaf=15,  
randomforestclassifier__min_samples_split=3,  
randomforestclassifier__n_estimators=50;; score=0.819 total time=  
1.7s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\  
preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to  
`sparse_output` in version 1.2 and will be removed in 1.4.  
`sparse_output` is ignored unless you leave `sparse` to its default  
value.
```

```
warnings.warn(
```

```
[CV 3/5] END randomforestclassifier__criterion=gini,  
randomforestclassifier__max_features=sqrt,  
randomforestclassifier__min_samples_leaf=15,  
randomforestclassifier__min_samples_split=3,  
randomforestclassifier__n_estimators=50;; score=0.801 total time=  
1.8s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\  
preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to
```

```
`sparse_output` in version 1.2 and will be removed in 1.4.  
`sparse_output` is ignored unless you leave `sparse` to its default  
value.
```

```
warnings.warn()
```

```
[CV 4/5] END randomforestclassifier__criterion=gini,  
randomforestclassifier__max_features=sqrt,  
randomforestclassifier__min_samples_leaf=15,  
randomforestclassifier__min_samples_split=3,  
randomforestclassifier__n_estimators=50;; score=0.806 total time=  
1.7s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\  
preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to  
`sparse_output` in version 1.2 and will be removed in 1.4.  
`sparse_output` is ignored unless you leave `sparse` to its default  
value.
```

```
warnings.warn()
```

```
[CV 5/5] END randomforestclassifier__criterion=gini,  
randomforestclassifier__max_features=sqrt,  
randomforestclassifier__min_samples_leaf=15,  
randomforestclassifier__min_samples_split=3,  
randomforestclassifier__n_estimators=50;; score=0.818 total time=  
1.6s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\  
preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to  
`sparse_output` in version 1.2 and will be removed in 1.4.  
`sparse_output` is ignored unless you leave `sparse` to its default  
value.
```

```
warnings.warn()
```

```
[CV 1/5] END randomforestclassifier__criterion=gini,  
randomforestclassifier__max_features=sqrt,  
randomforestclassifier__min_samples_leaf=15,  
randomforestclassifier__min_samples_split=3,  
randomforestclassifier__n_estimators=100;; score=0.821 total time=  
3.3s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\  
preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to  
`sparse_output` in version 1.2 and will be removed in 1.4.  
`sparse_output` is ignored unless you leave `sparse` to its default  
value.
```

```
warnings.warn()
```

```
[CV 2/5] END randomforestclassifier__criterion=gini,  
randomforestclassifier__max_features=sqrt,  
randomforestclassifier__min_samples_leaf=15,  
randomforestclassifier__min_samples_split=3,
```

```
randomforestclassifier__n_estimators=100;; score=0.815 total time=3.3s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to `sparse_output` in version 1.2 and will be removed in 1.4.
`sparse_output` is ignored unless you leave `sparse` to its default value.
```

```
warnings.warn(
```

```
[CV 3/5] END randomforestclassifier__criterion=gini,
randomforestclassifier__max_features=sqrt,
randomforestclassifier__min_samples_leaf=15,
randomforestclassifier__min_samples_split=3,
randomforestclassifier__n_estimators=100;; score=0.796 total time=3.3s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to `sparse_output` in version 1.2 and will be removed in 1.4.
`sparse_output` is ignored unless you leave `sparse` to its default value.
```

```
warnings.warn(
```

```
[CV 4/5] END randomforestclassifier__criterion=gini,
randomforestclassifier__max_features=sqrt,
randomforestclassifier__min_samples_leaf=15,
randomforestclassifier__min_samples_split=3,
randomforestclassifier__n_estimators=100;; score=0.820 total time=3.5s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to `sparse_output` in version 1.2 and will be removed in 1.4.
`sparse_output` is ignored unless you leave `sparse` to its default value.
```

```
warnings.warn(
```

```
[CV 5/5] END randomforestclassifier__criterion=gini,
randomforestclassifier__max_features=sqrt,
randomforestclassifier__min_samples_leaf=15,
randomforestclassifier__min_samples_split=3,
randomforestclassifier__n_estimators=100;; score=0.822 total time=3.3s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to `sparse_output` in version 1.2 and will be removed in 1.4.
`sparse_output` is ignored unless you leave `sparse` to its default value.
```

```
warnings.warn(
```

```
[CV 1/5] END randomforestclassifier__criterion=gini,  
randomforestclassifier__max_features=sqrt,  
randomforestclassifier__min_samples_leaf=15,  
randomforestclassifier__min_samples_split=3,  
randomforestclassifier__n_estimators=150;; score=0.825 total time=  
5.0s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\  
preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to  
`sparse_output` in version 1.2 and will be removed in 1.4.  
`sparse_output` is ignored unless you leave `sparse` to its default  
value.
```

```
warnings.warn(
```

```
[CV 2/5] END randomforestclassifier__criterion=gini,  
randomforestclassifier__max_features=sqrt,  
randomforestclassifier__min_samples_leaf=15,  
randomforestclassifier__min_samples_split=3,  
randomforestclassifier__n_estimators=150;; score=0.817 total time=  
5.0s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\  
preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to  
`sparse_output` in version 1.2 and will be removed in 1.4.  
`sparse_output` is ignored unless you leave `sparse` to its default  
value.
```

```
warnings.warn(
```

```
[CV 3/5] END randomforestclassifier__criterion=gini,  
randomforestclassifier__max_features=sqrt,  
randomforestclassifier__min_samples_leaf=15,  
randomforestclassifier__min_samples_split=3,  
randomforestclassifier__n_estimators=150;; score=0.803 total time=  
5.0s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\  
preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to  
`sparse_output` in version 1.2 and will be removed in 1.4.  
`sparse_output` is ignored unless you leave `sparse` to its default  
value.
```

```
warnings.warn(
```

```
[CV 4/5] END randomforestclassifier__criterion=gini,  
randomforestclassifier__max_features=sqrt,  
randomforestclassifier__min_samples_leaf=15,  
randomforestclassifier__min_samples_split=3,  
randomforestclassifier__n_estimators=150;; score=0.810 total time=  
4.8s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\  
preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to
```

```
`sparse_output` in version 1.2 and will be removed in 1.4.  
`sparse_output` is ignored unless you leave `sparse` to its default  
value.
```

```
warnings.warn()
```

```
[CV 5/5] END randomforestclassifier__criterion=gini,  
randomforestclassifier__max_features=sqrt,  
randomforestclassifier__min_samples_leaf=15,  
randomforestclassifier__min_samples_split=3,  
randomforestclassifier__n_estimators=150;; score=0.823 total time=  
4.9s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\  
preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to  
`sparse_output` in version 1.2 and will be removed in 1.4.  
`sparse_output` is ignored unless you leave `sparse` to its default  
value.
```

```
warnings.warn()
```

```
[CV 1/5] END randomforestclassifier__criterion=gini,  
randomforestclassifier__max_features=sqrt,  
randomforestclassifier__min_samples_leaf=15,  
randomforestclassifier__min_samples_split=4,  
randomforestclassifier__n_estimators=50;; score=0.821 total time=  
1.7s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\  
preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to  
`sparse_output` in version 1.2 and will be removed in 1.4.  
`sparse_output` is ignored unless you leave `sparse` to its default  
value.
```

```
warnings.warn()
```

```
[CV 2/5] END randomforestclassifier__criterion=gini,  
randomforestclassifier__max_features=sqrt,  
randomforestclassifier__min_samples_leaf=15,  
randomforestclassifier__min_samples_split=4,  
randomforestclassifier__n_estimators=50;; score=0.817 total time=  
1.7s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\  
preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to  
`sparse_output` in version 1.2 and will be removed in 1.4.  
`sparse_output` is ignored unless you leave `sparse` to its default  
value.
```

```
warnings.warn()
```

```
[CV 3/5] END randomforestclassifier__criterion=gini,  
randomforestclassifier__max_features=sqrt,  
randomforestclassifier__min_samples_leaf=15,  
randomforestclassifier__min_samples_split=4,
```

```
randomforestclassifier__n_estimators=50;; score=0.798 total time=1.7s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to `sparse_output` in version 1.2 and will be removed in 1.4. `sparse_output` is ignored unless you leave `sparse` to its default value.
```

```
warnings.warn(
```

```
[CV 4/5] END randomforestclassifier__criterion=gini,  
randomforestclassifier__max_features=sqrt,  
randomforestclassifier__min_samples_leaf=15,  
randomforestclassifier__min_samples_split=4,  
randomforestclassifier__n_estimators=50;; score=0.803 total time=1.6s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to `sparse_output` in version 1.2 and will be removed in 1.4. `sparse_output` is ignored unless you leave `sparse` to its default value.
```

```
warnings.warn(
```

```
[CV 5/5] END randomforestclassifier__criterion=gini,  
randomforestclassifier__max_features=sqrt,  
randomforestclassifier__min_samples_leaf=15,  
randomforestclassifier__min_samples_split=4,  
randomforestclassifier__n_estimators=50;; score=0.819 total time=1.7s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to `sparse_output` in version 1.2 and will be removed in 1.4. `sparse_output` is ignored unless you leave `sparse` to its default value.
```

```
warnings.warn(
```

```
[CV 1/5] END randomforestclassifier__criterion=gini,  
randomforestclassifier__max_features=sqrt,  
randomforestclassifier__min_samples_leaf=15,  
randomforestclassifier__min_samples_split=4,  
randomforestclassifier__n_estimators=100;; score=0.829 total time=3.2s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to `sparse_output` in version 1.2 and will be removed in 1.4. `sparse_output` is ignored unless you leave `sparse` to its default value.
```

```
warnings.warn(
```

```
[CV 2/5] END randomforestclassifier__criterion=gini,  
randomforestclassifier__max_features=sqrt,  
randomforestclassifier__min_samples_leaf=15,  
randomforestclassifier__min_samples_split=4,  
randomforestclassifier__n_estimators=100;; score=0.815 total time=  
3.3s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\  
preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to  
`sparse_output` in version 1.2 and will be removed in 1.4.  
`sparse_output` is ignored unless you leave `sparse` to its default  
value.
```

```
warnings.warn(
```

```
[CV 3/5] END randomforestclassifier__criterion=gini,  
randomforestclassifier__max_features=sqrt,  
randomforestclassifier__min_samples_leaf=15,  
randomforestclassifier__min_samples_split=4,  
randomforestclassifier__n_estimators=100;; score=0.807 total time=  
3.4s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\  
preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to  
`sparse_output` in version 1.2 and will be removed in 1.4.  
`sparse_output` is ignored unless you leave `sparse` to its default  
value.
```

```
warnings.warn(
```

```
[CV 4/5] END randomforestclassifier__criterion=gini,  
randomforestclassifier__max_features=sqrt,  
randomforestclassifier__min_samples_leaf=15,  
randomforestclassifier__min_samples_split=4,  
randomforestclassifier__n_estimators=100;; score=0.811 total time=  
3.3s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\  
preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to  
`sparse_output` in version 1.2 and will be removed in 1.4.  
`sparse_output` is ignored unless you leave `sparse` to its default  
value.
```

```
warnings.warn(
```

```
[CV 5/5] END randomforestclassifier__criterion=gini,  
randomforestclassifier__max_features=sqrt,  
randomforestclassifier__min_samples_leaf=15,  
randomforestclassifier__min_samples_split=4,  
randomforestclassifier__n_estimators=100;; score=0.827 total time=  
3.3s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\  
preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to
```



```
`sparse_output` in version 1.2 and will be removed in 1.4.  
`sparse_output` is ignored unless you leave `sparse` to its default  
value.
```

```
warnings.warn()
```

```
[CV 1/5] END randomforestclassifier__criterion=gini,  
randomforestclassifier__max_features=sqrt,  
randomforestclassifier__min_samples_leaf=15,  
randomforestclassifier__min_samples_split=4,  
randomforestclassifier__n_estimators=150;; score=0.823 total time=  
5.0s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\  
preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to  
`sparse_output` in version 1.2 and will be removed in 1.4.  
`sparse_output` is ignored unless you leave `sparse` to its default  
value.
```

```
warnings.warn()
```

```
[CV 2/5] END randomforestclassifier__criterion=gini,  
randomforestclassifier__max_features=sqrt,  
randomforestclassifier__min_samples_leaf=15,  
randomforestclassifier__min_samples_split=4,  
randomforestclassifier__n_estimators=150;; score=0.818 total time=  
5.2s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\  
preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to  
`sparse_output` in version 1.2 and will be removed in 1.4.  
`sparse_output` is ignored unless you leave `sparse` to its default  
value.
```

```
warnings.warn()
```

```
[CV 3/5] END randomforestclassifier__criterion=gini,  
randomforestclassifier__max_features=sqrt,  
randomforestclassifier__min_samples_leaf=15,  
randomforestclassifier__min_samples_split=4,  
randomforestclassifier__n_estimators=150;; score=0.801 total time=  
5.0s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\  
preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to  
`sparse_output` in version 1.2 and will be removed in 1.4.  
`sparse_output` is ignored unless you leave `sparse` to its default  
value.
```

```
warnings.warn()
```

```
[CV 4/5] END randomforestclassifier__criterion=gini,  
randomforestclassifier__max_features=sqrt,  
randomforestclassifier__min_samples_leaf=15,  
randomforestclassifier__min_samples_split=4,
```

```
randomforestclassifier__n_estimators=150;; score=0.808 total time=4.9s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to `sparse_output` in version 1.2 and will be removed in 1.4. `sparse_output` is ignored unless you leave `sparse` to its default value.
```

```
warnings.warn(
```

```
[CV 5/5] END randomforestclassifier__criterion=gini, randomforestclassifier__max_features=sqrt, randomforestclassifier__min_samples_leaf=15, randomforestclassifier__min_samples_split=4, randomforestclassifier__n_estimators=150;; score=0.825 total time=5.0s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to `sparse_output` in version 1.2 and will be removed in 1.4. `sparse_output` is ignored unless you leave `sparse` to its default value.
```

```
warnings.warn(
```

```
[CV 1/5] END randomforestclassifier__criterion=gini, randomforestclassifier__max_features=0.33, randomforestclassifier__min_samples_leaf=1, randomforestclassifier__min_samples_split=2, randomforestclassifier__n_estimators=50;; score=0.829 total time=2.9s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to `sparse_output` in version 1.2 and will be removed in 1.4. `sparse_output` is ignored unless you leave `sparse` to its default value.
```

```
warnings.warn(
```

```
[CV 2/5] END randomforestclassifier__criterion=gini, randomforestclassifier__max_features=0.33, randomforestclassifier__min_samples_leaf=1, randomforestclassifier__min_samples_split=2, randomforestclassifier__n_estimators=50;; score=0.831 total time=2.8s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to `sparse_output` in version 1.2 and will be removed in 1.4. `sparse_output` is ignored unless you leave `sparse` to its default value.
```

```
warnings.warn(
```

```
[CV 3/5] END randomforestclassifier__criterion=gini,  
randomforestclassifier__max_features=0.33,  
randomforestclassifier__min_samples_leaf=1,  
randomforestclassifier__min_samples_split=2,  
randomforestclassifier__n_estimators=50;; score=0.826 total time=  
2.9s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\  
preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to  
`sparse_output` in version 1.2 and will be removed in 1.4.  
`sparse_output` is ignored unless you leave `sparse` to its default  
value.
```

```
warnings.warn(
```

```
[CV 4/5] END randomforestclassifier__criterion=gini,  
randomforestclassifier__max_features=0.33,  
randomforestclassifier__min_samples_leaf=1,  
randomforestclassifier__min_samples_split=2,  
randomforestclassifier__n_estimators=50;; score=0.838 total time=  
2.8s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\  
preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to  
`sparse_output` in version 1.2 and will be removed in 1.4.  
`sparse_output` is ignored unless you leave `sparse` to its default  
value.
```

```
warnings.warn(
```

```
[CV 5/5] END randomforestclassifier__criterion=gini,  
randomforestclassifier__max_features=0.33,  
randomforestclassifier__min_samples_leaf=1,  
randomforestclassifier__min_samples_split=2,  
randomforestclassifier__n_estimators=50;; score=0.844 total time=  
3.0s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\  
preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to  
`sparse_output` in version 1.2 and will be removed in 1.4.  
`sparse_output` is ignored unless you leave `sparse` to its default  
value.
```

```
warnings.warn(
```

```
[CV 1/5] END randomforestclassifier__criterion=gini,  
randomforestclassifier__max_features=0.33,  
randomforestclassifier__min_samples_leaf=1,  
randomforestclassifier__min_samples_split=2,  
randomforestclassifier__n_estimators=100;; score=0.836 total time=  
5.8s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\  
preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to
```

```
`sparse_output` in version 1.2 and will be removed in 1.4.  
`sparse_output` is ignored unless you leave `sparse` to its default  
value.
```

```
warnings.warn()
```

```
[CV 2/5] END randomforestclassifier__criterion=gini,  
randomforestclassifier__max_features=0.33,  
randomforestclassifier__min_samples_leaf=1,  
randomforestclassifier__min_samples_split=2,  
randomforestclassifier__n_estimators=100;; score=0.834 total time=  
5.6s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\  
preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to  
`sparse_output` in version 1.2 and will be removed in 1.4.  
`sparse_output` is ignored unless you leave `sparse` to its default  
value.
```

```
warnings.warn()
```

```
[CV 3/5] END randomforestclassifier__criterion=gini,  
randomforestclassifier__max_features=0.33,  
randomforestclassifier__min_samples_leaf=1,  
randomforestclassifier__min_samples_split=2,  
randomforestclassifier__n_estimators=100;; score=0.826 total time=  
6.0s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\  
preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to  
`sparse_output` in version 1.2 and will be removed in 1.4.  
`sparse_output` is ignored unless you leave `sparse` to its default  
value.
```

```
warnings.warn()
```

```
[CV 4/5] END randomforestclassifier__criterion=gini,  
randomforestclassifier__max_features=0.33,  
randomforestclassifier__min_samples_leaf=1,  
randomforestclassifier__min_samples_split=2,  
randomforestclassifier__n_estimators=100;; score=0.835 total time=  
5.6s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\  
preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to  
`sparse_output` in version 1.2 and will be removed in 1.4.  
`sparse_output` is ignored unless you leave `sparse` to its default  
value.
```

```
warnings.warn()
```

```
[CV 5/5] END randomforestclassifier__criterion=gini,  
randomforestclassifier__max_features=0.33,  
randomforestclassifier__min_samples_leaf=1,  
randomforestclassifier__min_samples_split=2,
```

```
randomforestclassifier__n_estimators=100;; score=0.850 total time=5.7s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to `sparse_output` in version 1.2 and will be removed in 1.4. `sparse_output` is ignored unless you leave `sparse` to its default value.
```

```
warnings.warn(
```

```
[CV 1/5] END randomforestclassifier__criterion=gini, randomforestclassifier__max_features=0.33, randomforestclassifier__min_samples_leaf=1, randomforestclassifier__min_samples_split=2, randomforestclassifier__n_estimators=150;; score=0.833 total time=8.8s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to `sparse_output` in version 1.2 and will be removed in 1.4. `sparse_output` is ignored unless you leave `sparse` to its default value.
```

```
warnings.warn(
```

```
[CV 2/5] END randomforestclassifier__criterion=gini, randomforestclassifier__max_features=0.33, randomforestclassifier__min_samples_leaf=1, randomforestclassifier__min_samples_split=2, randomforestclassifier__n_estimators=150;; score=0.833 total time=8.6s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to `sparse_output` in version 1.2 and will be removed in 1.4. `sparse_output` is ignored unless you leave `sparse` to its default value.
```

```
warnings.warn(
```

```
[CV 3/5] END randomforestclassifier__criterion=gini, randomforestclassifier__max_features=0.33, randomforestclassifier__min_samples_leaf=1, randomforestclassifier__min_samples_split=2, randomforestclassifier__n_estimators=150;; score=0.824 total time=8.5s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to `sparse_output` in version 1.2 and will be removed in 1.4. `sparse_output` is ignored unless you leave `sparse` to its default value.
```

```
warnings.warn(
```

```
[CV 4/5] END randomforestclassifier__criterion=gini,  
randomforestclassifier__max_features=0.33,  
randomforestclassifier__min_samples_leaf=1,  
randomforestclassifier__min_samples_split=2,  
randomforestclassifier__n_estimators=150;; score=0.833 total time=  
8.7s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\  
preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to  
`sparse_output` in version 1.2 and will be removed in 1.4.  
`sparse_output` is ignored unless you leave `sparse` to its default  
value.
```

```
warnings.warn(
```

```
[CV 5/5] END randomforestclassifier__criterion=gini,  
randomforestclassifier__max_features=0.33,  
randomforestclassifier__min_samples_leaf=1,  
randomforestclassifier__min_samples_split=2,  
randomforestclassifier__n_estimators=150;; score=0.845 total time=  
8.5s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\  
preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to  
`sparse_output` in version 1.2 and will be removed in 1.4.  
`sparse_output` is ignored unless you leave `sparse` to its default  
value.
```

```
warnings.warn(
```

```
[CV 1/5] END randomforestclassifier__criterion=gini,  
randomforestclassifier__max_features=0.33,  
randomforestclassifier__min_samples_leaf=1,  
randomforestclassifier__min_samples_split=3,  
randomforestclassifier__n_estimators=50;; score=0.833 total time=  
2.8s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\  
preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to  
`sparse_output` in version 1.2 and will be removed in 1.4.  
`sparse_output` is ignored unless you leave `sparse` to its default  
value.
```

```
warnings.warn(
```

```
[CV 2/5] END randomforestclassifier__criterion=gini,  
randomforestclassifier__max_features=0.33,  
randomforestclassifier__min_samples_leaf=1,  
randomforestclassifier__min_samples_split=3,  
randomforestclassifier__n_estimators=50;; score=0.824 total time=  
3.0s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\  
preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to
```

```
`sparse_output` in version 1.2 and will be removed in 1.4.  
`sparse_output` is ignored unless you leave `sparse` to its default  
value.
```

```
warnings.warn()
```

```
[CV 3/5] END randomforestclassifier__criterion=gini,  
randomforestclassifier__max_features=0.33,  
randomforestclassifier__min_samples_leaf=1,  
randomforestclassifier__min_samples_split=3,  
randomforestclassifier__n_estimators=50;; score=0.823 total time=  
3.0s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\  
preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to  
`sparse_output` in version 1.2 and will be removed in 1.4.  
`sparse_output` is ignored unless you leave `sparse` to its default  
value.
```

```
warnings.warn()
```

```
[CV 4/5] END randomforestclassifier__criterion=gini,  
randomforestclassifier__max_features=0.33,  
randomforestclassifier__min_samples_leaf=1,  
randomforestclassifier__min_samples_split=3,  
randomforestclassifier__n_estimators=50;; score=0.824 total time=  
2.7s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\  
preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to  
`sparse_output` in version 1.2 and will be removed in 1.4.  
`sparse_output` is ignored unless you leave `sparse` to its default  
value.
```

```
warnings.warn()
```

```
[CV 5/5] END randomforestclassifier__criterion=gini,  
randomforestclassifier__max_features=0.33,  
randomforestclassifier__min_samples_leaf=1,  
randomforestclassifier__min_samples_split=3,  
randomforestclassifier__n_estimators=50;; score=0.843 total time=  
2.8s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\  
preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to  
`sparse_output` in version 1.2 and will be removed in 1.4.  
`sparse_output` is ignored unless you leave `sparse` to its default  
value.
```

```
warnings.warn()
```

```
[CV 1/5] END randomforestclassifier__criterion=gini,  
randomforestclassifier__max_features=0.33,  
randomforestclassifier__min_samples_leaf=1,  
randomforestclassifier__min_samples_split=3,
```

```
randomforestclassifier__n_estimators=100;; score=0.837 total time=5.7s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to `sparse_output` in version 1.2 and will be removed in 1.4. `sparse_output` is ignored unless you leave `sparse` to its default value.
```

```
warnings.warn(
```

```
[CV 2/5] END randomforestclassifier__criterion=gini, randomforestclassifier__max_features=0.33, randomforestclassifier__min_samples_leaf=1, randomforestclassifier__min_samples_split=3, randomforestclassifier__n_estimators=100;; score=0.833 total time=5.8s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to `sparse_output` in version 1.2 and will be removed in 1.4. `sparse_output` is ignored unless you leave `sparse` to its default value.
```

```
warnings.warn(
```

```
[CV 3/5] END randomforestclassifier__criterion=gini, randomforestclassifier__max_features=0.33, randomforestclassifier__min_samples_leaf=1, randomforestclassifier__min_samples_split=3, randomforestclassifier__n_estimators=100;; score=0.828 total time=5.6s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to `sparse_output` in version 1.2 and will be removed in 1.4. `sparse_output` is ignored unless you leave `sparse` to its default value.
```

```
warnings.warn(
```

```
[CV 4/5] END randomforestclassifier__criterion=gini, randomforestclassifier__max_features=0.33, randomforestclassifier__min_samples_leaf=1, randomforestclassifier__min_samples_split=3, randomforestclassifier__n_estimators=100;; score=0.831 total time=5.7s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to `sparse_output` in version 1.2 and will be removed in 1.4. `sparse_output` is ignored unless you leave `sparse` to its default value.
```

```
warnings.warn(
```



```
[CV 5/5] END randomforestclassifier__criterion=gini,  
randomforestclassifier__max_features=0.33,  
randomforestclassifier__min_samples_leaf=1,  
randomforestclassifier__min_samples_split=3,  
randomforestclassifier__n_estimators=100;; score=0.844 total time=  
5.8s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\  
preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to  
`sparse_output` in version 1.2 and will be removed in 1.4.  
`sparse_output` is ignored unless you leave `sparse` to its default  
value.
```

```
warnings.warn(
```

```
[CV 1/5] END randomforestclassifier__criterion=gini,  
randomforestclassifier__max_features=0.33,  
randomforestclassifier__min_samples_leaf=1,  
randomforestclassifier__min_samples_split=3,  
randomforestclassifier__n_estimators=150;; score=0.829 total time=  
8.6s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\  
preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to  
`sparse_output` in version 1.2 and will be removed in 1.4.  
`sparse_output` is ignored unless you leave `sparse` to its default  
value.
```

```
warnings.warn(
```

```
[CV 2/5] END randomforestclassifier__criterion=gini,  
randomforestclassifier__max_features=0.33,  
randomforestclassifier__min_samples_leaf=1,  
randomforestclassifier__min_samples_split=3,  
randomforestclassifier__n_estimators=150;; score=0.836 total time=  
8.6s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\  
preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to  
`sparse_output` in version 1.2 and will be removed in 1.4.  
`sparse_output` is ignored unless you leave `sparse` to its default  
value.
```

```
warnings.warn(
```

```
[CV 3/5] END randomforestclassifier__criterion=gini,  
randomforestclassifier__max_features=0.33,  
randomforestclassifier__min_samples_leaf=1,  
randomforestclassifier__min_samples_split=3,  
randomforestclassifier__n_estimators=150;; score=0.830 total time=  
8.7s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\  
preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to
```

```
`sparse_output` in version 1.2 and will be removed in 1.4.  
`sparse_output` is ignored unless you leave `sparse` to its default  
value.
```

```
warnings.warn()
```

```
[CV 4/5] END randomforestclassifier__criterion=gini,  
randomforestclassifier__max_features=0.33,  
randomforestclassifier__min_samples_leaf=1,  
randomforestclassifier__min_samples_split=3,  
randomforestclassifier__n_estimators=150;; score=0.834 total time=  
8.5s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\  
preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to  
`sparse_output` in version 1.2 and will be removed in 1.4.  
`sparse_output` is ignored unless you leave `sparse` to its default  
value.
```

```
warnings.warn()
```

```
[CV 5/5] END randomforestclassifier__criterion=gini,  
randomforestclassifier__max_features=0.33,  
randomforestclassifier__min_samples_leaf=1,  
randomforestclassifier__min_samples_split=3,  
randomforestclassifier__n_estimators=150;; score=0.849 total time=  
8.7s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\  
preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to  
`sparse_output` in version 1.2 and will be removed in 1.4.  
`sparse_output` is ignored unless you leave `sparse` to its default  
value.
```

```
warnings.warn()
```

```
[CV 1/5] END randomforestclassifier__criterion=gini,  
randomforestclassifier__max_features=0.33,  
randomforestclassifier__min_samples_leaf=1,  
randomforestclassifier__min_samples_split=4,  
randomforestclassifier__n_estimators=50;; score=0.839 total time=  
2.9s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\  
preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to  
`sparse_output` in version 1.2 and will be removed in 1.4.  
`sparse_output` is ignored unless you leave `sparse` to its default  
value.
```

```
warnings.warn()
```

```
[CV 2/5] END randomforestclassifier__criterion=gini,  
randomforestclassifier__max_features=0.33,  
randomforestclassifier__min_samples_leaf=1,  
randomforestclassifier__min_samples_split=4,
```

```
randomforestclassifier__n_estimators=50;; score=0.827 total time=2.8s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to `sparse_output` in version 1.2 and will be removed in 1.4. `sparse_output` is ignored unless you leave `sparse` to its default value.
```

```
warnings.warn(
```

```
[CV 3/5] END randomforestclassifier__criterion=gini, randomforestclassifier__max_features=0.33, randomforestclassifier__min_samples_leaf=1, randomforestclassifier__min_samples_split=4, randomforestclassifier__n_estimators=50;; score=0.821 total time=2.7s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to `sparse_output` in version 1.2 and will be removed in 1.4. `sparse_output` is ignored unless you leave `sparse` to its default value.
```

```
warnings.warn(
```

```
[CV 4/5] END randomforestclassifier__criterion=gini, randomforestclassifier__max_features=0.33, randomforestclassifier__min_samples_leaf=1, randomforestclassifier__min_samples_split=4, randomforestclassifier__n_estimators=50;; score=0.829 total time=2.7s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to `sparse_output` in version 1.2 and will be removed in 1.4. `sparse_output` is ignored unless you leave `sparse` to its default value.
```

```
warnings.warn(
```

```
[CV 5/5] END randomforestclassifier__criterion=gini, randomforestclassifier__max_features=0.33, randomforestclassifier__min_samples_leaf=1, randomforestclassifier__min_samples_split=4, randomforestclassifier__n_estimators=50;; score=0.841 total time=3.0s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to `sparse_output` in version 1.2 and will be removed in 1.4. `sparse_output` is ignored unless you leave `sparse` to its default value.
```

```
warnings.warn(
```

```
[CV 1/5] END randomforestclassifier__criterion=gini,  
randomforestclassifier__max_features=0.33,  
randomforestclassifier__min_samples_leaf=1,  
randomforestclassifier__min_samples_split=4,  
randomforestclassifier__n_estimators=100;; score=0.842 total time=  
5.9s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\  
preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to  
`sparse_output` in version 1.2 and will be removed in 1.4.  
`sparse_output` is ignored unless you leave `sparse` to its default  
value.
```

```
warnings.warn(
```

```
[CV 2/5] END randomforestclassifier__criterion=gini,  
randomforestclassifier__max_features=0.33,  
randomforestclassifier__min_samples_leaf=1,  
randomforestclassifier__min_samples_split=4,  
randomforestclassifier__n_estimators=100;; score=0.832 total time=  
5.8s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\  
preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to  
`sparse_output` in version 1.2 and will be removed in 1.4.  
`sparse_output` is ignored unless you leave `sparse` to its default  
value.
```

```
warnings.warn(
```

```
[CV 3/5] END randomforestclassifier__criterion=gini,  
randomforestclassifier__max_features=0.33,  
randomforestclassifier__min_samples_leaf=1,  
randomforestclassifier__min_samples_split=4,  
randomforestclassifier__n_estimators=100;; score=0.824 total time=  
5.8s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\  
preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to  
`sparse_output` in version 1.2 and will be removed in 1.4.  
`sparse_output` is ignored unless you leave `sparse` to its default  
value.
```

```
warnings.warn(
```

```
[CV 4/5] END randomforestclassifier__criterion=gini,  
randomforestclassifier__max_features=0.33,  
randomforestclassifier__min_samples_leaf=1,  
randomforestclassifier__min_samples_split=4,  
randomforestclassifier__n_estimators=100;; score=0.829 total time=  
5.5s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\  
preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to
```

```
`sparse_output` in version 1.2 and will be removed in 1.4.  
`sparse_output` is ignored unless you leave `sparse` to its default  
value.
```

```
warnings.warn()
```

```
[CV 5/5] END randomforestclassifier__criterion=gini,  
randomforestclassifier__max_features=0.33,  
randomforestclassifier__min_samples_leaf=1,  
randomforestclassifier__min_samples_split=4,  
randomforestclassifier__n_estimators=100;; score=0.841 total time=  
5.5s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\  
preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to  
`sparse_output` in version 1.2 and will be removed in 1.4.  
`sparse_output` is ignored unless you leave `sparse` to its default  
value.
```

```
warnings.warn()
```

```
[CV 1/5] END randomforestclassifier__criterion=gini,  
randomforestclassifier__max_features=0.33,  
randomforestclassifier__min_samples_leaf=1,  
randomforestclassifier__min_samples_split=4,  
randomforestclassifier__n_estimators=150;; score=0.837 total time=  
8.7s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\  
preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to  
`sparse_output` in version 1.2 and will be removed in 1.4.  
`sparse_output` is ignored unless you leave `sparse` to its default  
value.
```

```
warnings.warn()
```

```
[CV 2/5] END randomforestclassifier__criterion=gini,  
randomforestclassifier__max_features=0.33,  
randomforestclassifier__min_samples_leaf=1,  
randomforestclassifier__min_samples_split=4,  
randomforestclassifier__n_estimators=150;; score=0.831 total time=  
8.5s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\  
preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to  
`sparse_output` in version 1.2 and will be removed in 1.4.  
`sparse_output` is ignored unless you leave `sparse` to its default  
value.
```

```
warnings.warn()
```

```
[CV 3/5] END randomforestclassifier__criterion=gini,  
randomforestclassifier__max_features=0.33,  
randomforestclassifier__min_samples_leaf=1,  
randomforestclassifier__min_samples_split=4,
```

```
randomforestclassifier__n_estimators=150;; score=0.826 total time=8.4s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to `sparse_output` in version 1.2 and will be removed in 1.4.
`sparse_output` is ignored unless you leave `sparse` to its default value.
```

```
warnings.warn(
```

```
[CV 4/5] END randomforestclassifier__criterion=gini,
randomforestclassifier__max_features=0.33,
randomforestclassifier__min_samples_leaf=1,
randomforestclassifier__min_samples_split=4,
randomforestclassifier__n_estimators=150;; score=0.833 total time=8.4s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to `sparse_output` in version 1.2 and will be removed in 1.4.
`sparse_output` is ignored unless you leave `sparse` to its default value.
```

```
warnings.warn(
```

```
[CV 5/5] END randomforestclassifier__criterion=gini,
randomforestclassifier__max_features=0.33,
randomforestclassifier__min_samples_leaf=1,
randomforestclassifier__min_samples_split=4,
randomforestclassifier__n_estimators=150;; score=0.849 total time=8.5s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to `sparse_output` in version 1.2 and will be removed in 1.4.
`sparse_output` is ignored unless you leave `sparse` to its default value.
```

```
warnings.warn(
```

```
[CV 1/5] END randomforestclassifier__criterion=gini,
randomforestclassifier__max_features=0.33,
randomforestclassifier__min_samples_leaf=5,
randomforestclassifier__min_samples_split=2,
randomforestclassifier__n_estimators=50;; score=0.840 total time=2.4s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to `sparse_output` in version 1.2 and will be removed in 1.4.
`sparse_output` is ignored unless you leave `sparse` to its default value.
```

```
warnings.warn(
```

```
[CV 2/5] END randomforestclassifier__criterion=gini,  
randomforestclassifier__max_features=0.33,  
randomforestclassifier__min_samples_leaf=5,  
randomforestclassifier__min_samples_split=2,  
randomforestclassifier__n_estimators=50;; score=0.831 total time=  
2.4s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\  
preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to  
`sparse_output` in version 1.2 and will be removed in 1.4.  
`sparse_output` is ignored unless you leave `sparse` to its default  
value.
```

```
warnings.warn(
```

```
[CV 3/5] END randomforestclassifier__criterion=gini,  
randomforestclassifier__max_features=0.33,  
randomforestclassifier__min_samples_leaf=5,  
randomforestclassifier__min_samples_split=2,  
randomforestclassifier__n_estimators=50;; score=0.811 total time=  
2.6s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\  
preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to  
`sparse_output` in version 1.2 and will be removed in 1.4.  
`sparse_output` is ignored unless you leave `sparse` to its default  
value.
```

```
warnings.warn(
```

```
[CV 4/5] END randomforestclassifier__criterion=gini,  
randomforestclassifier__max_features=0.33,  
randomforestclassifier__min_samples_leaf=5,  
randomforestclassifier__min_samples_split=2,  
randomforestclassifier__n_estimators=50;; score=0.823 total time=  
2.6s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\  
preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to  
`sparse_output` in version 1.2 and will be removed in 1.4.  
`sparse_output` is ignored unless you leave `sparse` to its default  
value.
```

```
warnings.warn(
```

```
[CV 5/5] END randomforestclassifier__criterion=gini,  
randomforestclassifier__max_features=0.33,  
randomforestclassifier__min_samples_leaf=5,  
randomforestclassifier__min_samples_split=2,  
randomforestclassifier__n_estimators=50;; score=0.839 total time=  
2.5s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\  
preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to
```

```
`sparse_output` in version 1.2 and will be removed in 1.4.  
`sparse_output` is ignored unless you leave `sparse` to its default  
value.
```

```
warnings.warn()
```

```
[CV 1/5] END randomforestclassifier__criterion=gini,  
randomforestclassifier__max_features=0.33,  
randomforestclassifier__min_samples_leaf=5,  
randomforestclassifier__min_samples_split=2,  
randomforestclassifier__n_estimators=100;; score=0.835 total time=  
5.0s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\  
preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to  
`sparse_output` in version 1.2 and will be removed in 1.4.  
`sparse_output` is ignored unless you leave `sparse` to its default  
value.
```

```
warnings.warn()
```

```
[CV 2/5] END randomforestclassifier__criterion=gini,  
randomforestclassifier__max_features=0.33,  
randomforestclassifier__min_samples_leaf=5,  
randomforestclassifier__min_samples_split=2,  
randomforestclassifier__n_estimators=100;; score=0.831 total time=  
5.1s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\  
preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to  
`sparse_output` in version 1.2 and will be removed in 1.4.  
`sparse_output` is ignored unless you leave `sparse` to its default  
value.
```

```
warnings.warn()
```

```
[CV 3/5] END randomforestclassifier__criterion=gini,  
randomforestclassifier__max_features=0.33,  
randomforestclassifier__min_samples_leaf=5,  
randomforestclassifier__min_samples_split=2,  
randomforestclassifier__n_estimators=100;; score=0.813 total time=  
5.1s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\  
preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to  
`sparse_output` in version 1.2 and will be removed in 1.4.  
`sparse_output` is ignored unless you leave `sparse` to its default  
value.
```

```
warnings.warn()
```

```
[CV 4/5] END randomforestclassifier__criterion=gini,  
randomforestclassifier__max_features=0.33,  
randomforestclassifier__min_samples_leaf=5,  
randomforestclassifier__min_samples_split=2,
```



```
randomforestclassifier__n_estimators=100;; score=0.824 total time=4.9s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to `sparse_output` in version 1.2 and will be removed in 1.4. `sparse_output` is ignored unless you leave `sparse` to its default value.
```

```
warnings.warn(
```

```
[CV 5/5] END randomforestclassifier__criterion=gini, randomforestclassifier__max_features=0.33, randomforestclassifier__min_samples_leaf=5, randomforestclassifier__min_samples_split=2, randomforestclassifier__n_estimators=100;; score=0.839 total time=5.0s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to `sparse_output` in version 1.2 and will be removed in 1.4. `sparse_output` is ignored unless you leave `sparse` to its default value.
```

```
warnings.warn(
```

```
[CV 1/5] END randomforestclassifier__criterion=gini, randomforestclassifier__max_features=0.33, randomforestclassifier__min_samples_leaf=5, randomforestclassifier__min_samples_split=2, randomforestclassifier__n_estimators=150;; score=0.836 total time=7.7s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to `sparse_output` in version 1.2 and will be removed in 1.4. `sparse_output` is ignored unless you leave `sparse` to its default value.
```

```
warnings.warn(
```

```
[CV 2/5] END randomforestclassifier__criterion=gini, randomforestclassifier__max_features=0.33, randomforestclassifier__min_samples_leaf=5, randomforestclassifier__min_samples_split=2, randomforestclassifier__n_estimators=150;; score=0.833 total time=7.5s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to `sparse_output` in version 1.2 and will be removed in 1.4. `sparse_output` is ignored unless you leave `sparse` to its default value.
```

```
warnings.warn(
```

```
[CV 3/5] END randomforestclassifier__criterion=gini,  
randomforestclassifier__max_features=0.33,  
randomforestclassifier__min_samples_leaf=5,  
randomforestclassifier__min_samples_split=2,  
randomforestclassifier__n_estimators=150;; score=0.813 total time=  
7.6s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\  
preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to  
`sparse_output` in version 1.2 and will be removed in 1.4.  
`sparse_output` is ignored unless you leave `sparse` to its default  
value.
```

```
warnings.warn(
```

```
[CV 4/5] END randomforestclassifier__criterion=gini,  
randomforestclassifier__max_features=0.33,  
randomforestclassifier__min_samples_leaf=5,  
randomforestclassifier__min_samples_split=2,  
randomforestclassifier__n_estimators=150;; score=0.831 total time=  
7.3s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\  
preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to  
`sparse_output` in version 1.2 and will be removed in 1.4.  
`sparse_output` is ignored unless you leave `sparse` to its default  
value.
```

```
warnings.warn(
```

```
[CV 5/5] END randomforestclassifier__criterion=gini,  
randomforestclassifier__max_features=0.33,  
randomforestclassifier__min_samples_leaf=5,  
randomforestclassifier__min_samples_split=2,  
randomforestclassifier__n_estimators=150;; score=0.836 total time=  
7.7s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\  
preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to  
`sparse_output` in version 1.2 and will be removed in 1.4.  
`sparse_output` is ignored unless you leave `sparse` to its default  
value.
```

```
warnings.warn(
```

```
[CV 1/5] END randomforestclassifier__criterion=gini,  
randomforestclassifier__max_features=0.33,  
randomforestclassifier__min_samples_leaf=5,  
randomforestclassifier__min_samples_split=3,  
randomforestclassifier__n_estimators=50;; score=0.839 total time=  
2.5s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\  
preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to
```

```
`sparse_output` in version 1.2 and will be removed in 1.4.  
`sparse_output` is ignored unless you leave `sparse` to its default  
value.
```

```
warnings.warn()
```

```
[CV 2/5] END randomforestclassifier__criterion=gini,  
randomforestclassifier__max_features=0.33,  
randomforestclassifier__min_samples_leaf=5,  
randomforestclassifier__min_samples_split=3,  
randomforestclassifier__n_estimators=50;; score=0.821 total time=  
2.5s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\  
preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to  
`sparse_output` in version 1.2 and will be removed in 1.4.  
`sparse_output` is ignored unless you leave `sparse` to its default  
value.
```

```
warnings.warn()
```

```
[CV 3/5] END randomforestclassifier__criterion=gini,  
randomforestclassifier__max_features=0.33,  
randomforestclassifier__min_samples_leaf=5,  
randomforestclassifier__min_samples_split=3,  
randomforestclassifier__n_estimators=50;; score=0.812 total time=  
2.4s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\  
preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to  
`sparse_output` in version 1.2 and will be removed in 1.4.  
`sparse_output` is ignored unless you leave `sparse` to its default  
value.
```

```
warnings.warn()
```

```
[CV 4/5] END randomforestclassifier__criterion=gini,  
randomforestclassifier__max_features=0.33,  
randomforestclassifier__min_samples_leaf=5,  
randomforestclassifier__min_samples_split=3,  
randomforestclassifier__n_estimators=50;; score=0.825 total time=  
2.6s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\  
preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to  
`sparse_output` in version 1.2 and will be removed in 1.4.  
`sparse_output` is ignored unless you leave `sparse` to its default  
value.
```

```
warnings.warn()
```

```
[CV 5/5] END randomforestclassifier__criterion=gini,  
randomforestclassifier__max_features=0.33,  
randomforestclassifier__min_samples_leaf=5,  
randomforestclassifier__min_samples_split=3,
```

```
randomforestclassifier__n_estimators=50;; score=0.840 total time=2.5s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to `sparse_output` in version 1.2 and will be removed in 1.4. `sparse_output` is ignored unless you leave `sparse` to its default value.
```

```
warnings.warn(
```

```
[CV 1/5] END randomforestclassifier__criterion=gini, randomforestclassifier__max_features=0.33, randomforestclassifier__min_samples_leaf=5, randomforestclassifier__min_samples_split=3, randomforestclassifier__n_estimators=100;; score=0.839 total time=5.0s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to `sparse_output` in version 1.2 and will be removed in 1.4. `sparse_output` is ignored unless you leave `sparse` to its default value.
```

```
warnings.warn(
```

```
[CV 2/5] END randomforestclassifier__criterion=gini, randomforestclassifier__max_features=0.33, randomforestclassifier__min_samples_leaf=5, randomforestclassifier__min_samples_split=3, randomforestclassifier__n_estimators=100;; score=0.831 total time=4.9s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to `sparse_output` in version 1.2 and will be removed in 1.4. `sparse_output` is ignored unless you leave `sparse` to its default value.
```

```
warnings.warn(
```

```
[CV 3/5] END randomforestclassifier__criterion=gini, randomforestclassifier__max_features=0.33, randomforestclassifier__min_samples_leaf=5, randomforestclassifier__min_samples_split=3, randomforestclassifier__n_estimators=100;; score=0.809 total time=5.1s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to `sparse_output` in version 1.2 and will be removed in 1.4. `sparse_output` is ignored unless you leave `sparse` to its default value.
```

```
warnings.warn(
```

```
[CV 4/5] END randomforestclassifier__criterion=gini,  
randomforestclassifier__max_features=0.33,  
randomforestclassifier__min_samples_leaf=5,  
randomforestclassifier__min_samples_split=3,  
randomforestclassifier__n_estimators=100;; score=0.829 total time=  
4.9s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\  
preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to  
`sparse_output` in version 1.2 and will be removed in 1.4.  
`sparse_output` is ignored unless you leave `sparse` to its default  
value.
```

```
warnings.warn(
```

```
[CV 5/5] END randomforestclassifier__criterion=gini,  
randomforestclassifier__max_features=0.33,  
randomforestclassifier__min_samples_leaf=5,  
randomforestclassifier__min_samples_split=3,  
randomforestclassifier__n_estimators=100;; score=0.841 total time=  
4.8s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\  
preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to  
`sparse_output` in version 1.2 and will be removed in 1.4.  
`sparse_output` is ignored unless you leave `sparse` to its default  
value.
```

```
warnings.warn(
```

```
[CV 1/5] END randomforestclassifier__criterion=gini,  
randomforestclassifier__max_features=0.33,  
randomforestclassifier__min_samples_leaf=5,  
randomforestclassifier__min_samples_split=3,  
randomforestclassifier__n_estimators=150;; score=0.836 total time=  
7.8s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\  
preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to  
`sparse_output` in version 1.2 and will be removed in 1.4.  
`sparse_output` is ignored unless you leave `sparse` to its default  
value.
```

```
warnings.warn(
```

```
[CV 2/5] END randomforestclassifier__criterion=gini,  
randomforestclassifier__max_features=0.33,  
randomforestclassifier__min_samples_leaf=5,  
randomforestclassifier__min_samples_split=3,  
randomforestclassifier__n_estimators=150;; score=0.830 total time=  
7.4s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\  
preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to
```

```
`sparse_output` in version 1.2 and will be removed in 1.4.  
`sparse_output` is ignored unless you leave `sparse` to its default  
value.
```

```
warnings.warn()
```

```
[CV 3/5] END randomforestclassifier__criterion=gini,  
randomforestclassifier__max_features=0.33,  
randomforestclassifier__min_samples_leaf=5,  
randomforestclassifier__min_samples_split=3,  
randomforestclassifier__n_estimators=150;; score=0.811 total time=  
7.6s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\  
preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to  
`sparse_output` in version 1.2 and will be removed in 1.4.  
`sparse_output` is ignored unless you leave `sparse` to its default  
value.
```

```
warnings.warn()
```

```
[CV 4/5] END randomforestclassifier__criterion=gini,  
randomforestclassifier__max_features=0.33,  
randomforestclassifier__min_samples_leaf=5,  
randomforestclassifier__min_samples_split=3,  
randomforestclassifier__n_estimators=150;; score=0.832 total time=  
7.3s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\  
preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to  
`sparse_output` in version 1.2 and will be removed in 1.4.  
`sparse_output` is ignored unless you leave `sparse` to its default  
value.
```

```
warnings.warn()
```

```
[CV 5/5] END randomforestclassifier__criterion=gini,  
randomforestclassifier__max_features=0.33,  
randomforestclassifier__min_samples_leaf=5,  
randomforestclassifier__min_samples_split=3,  
randomforestclassifier__n_estimators=150;; score=0.836 total time=  
7.6s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\  
preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to  
`sparse_output` in version 1.2 and will be removed in 1.4.  
`sparse_output` is ignored unless you leave `sparse` to its default  
value.
```

```
warnings.warn()
```

```
[CV 1/5] END randomforestclassifier__criterion=gini,  
randomforestclassifier__max_features=0.33,  
randomforestclassifier__min_samples_leaf=5,  
randomforestclassifier__min_samples_split=4,
```

```
randomforestclassifier__n_estimators=50;; score=0.834 total time=2.5s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to `sparse_output` in version 1.2 and will be removed in 1.4. `sparse_output` is ignored unless you leave `sparse` to its default value.
```

```
warnings.warn(
```

```
[CV 2/5] END randomforestclassifier__criterion=gini, randomforestclassifier__max_features=0.33, randomforestclassifier__min_samples_leaf=5, randomforestclassifier__min_samples_split=4, randomforestclassifier__n_estimators=50;; score=0.824 total time=2.4s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to `sparse_output` in version 1.2 and will be removed in 1.4. `sparse_output` is ignored unless you leave `sparse` to its default value.
```

```
warnings.warn(
```

```
[CV 3/5] END randomforestclassifier__criterion=gini, randomforestclassifier__max_features=0.33, randomforestclassifier__min_samples_leaf=5, randomforestclassifier__min_samples_split=4, randomforestclassifier__n_estimators=50;; score=0.811 total time=2.4s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to `sparse_output` in version 1.2 and will be removed in 1.4. `sparse_output` is ignored unless you leave `sparse` to its default value.
```

```
warnings.warn(
```

```
[CV 4/5] END randomforestclassifier__criterion=gini, randomforestclassifier__max_features=0.33, randomforestclassifier__min_samples_leaf=5, randomforestclassifier__min_samples_split=4, randomforestclassifier__n_estimators=50;; score=0.825 total time=2.4s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to `sparse_output` in version 1.2 and will be removed in 1.4. `sparse_output` is ignored unless you leave `sparse` to its default value.
```

```
warnings.warn(
```

```
[CV 5/5] END randomforestclassifier__criterion=gini,  
randomforestclassifier__max_features=0.33,  
randomforestclassifier__min_samples_leaf=5,  
randomforestclassifier__min_samples_split=4,  
randomforestclassifier__n_estimators=50;; score=0.836 total time=  
2.5s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\  
preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to  
`sparse_output` in version 1.2 and will be removed in 1.4.  
`sparse_output` is ignored unless you leave `sparse` to its default  
value.
```

```
warnings.warn(
```

```
[CV 1/5] END randomforestclassifier__criterion=gini,  
randomforestclassifier__max_features=0.33,  
randomforestclassifier__min_samples_leaf=5,  
randomforestclassifier__min_samples_split=4,  
randomforestclassifier__n_estimators=100;; score=0.840 total time=  
5.2s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\  
preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to  
`sparse_output` in version 1.2 and will be removed in 1.4.  
`sparse_output` is ignored unless you leave `sparse` to its default  
value.
```

```
warnings.warn(
```

```
[CV 2/5] END randomforestclassifier__criterion=gini,  
randomforestclassifier__max_features=0.33,  
randomforestclassifier__min_samples_leaf=5,  
randomforestclassifier__min_samples_split=4,  
randomforestclassifier__n_estimators=100;; score=0.826 total time=  
5.1s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\  
preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to  
`sparse_output` in version 1.2 and will be removed in 1.4.  
`sparse_output` is ignored unless you leave `sparse` to its default  
value.
```

```
warnings.warn(
```

```
[CV 3/5] END randomforestclassifier__criterion=gini,  
randomforestclassifier__max_features=0.33,  
randomforestclassifier__min_samples_leaf=5,  
randomforestclassifier__min_samples_split=4,  
randomforestclassifier__n_estimators=100;; score=0.815 total time=  
4.9s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\  
preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to
```



```
`sparse_output` in version 1.2 and will be removed in 1.4.  
`sparse_output` is ignored unless you leave `sparse` to its default  
value.
```

```
warnings.warn()
```

```
[CV 4/5] END randomforestclassifier__criterion=gini,  
randomforestclassifier__max_features=0.33,  
randomforestclassifier__min_samples_leaf=5,  
randomforestclassifier__min_samples_split=4,  
randomforestclassifier__n_estimators=100;; score=0.822 total time=  
5.2s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\  
preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to  
`sparse_output` in version 1.2 and will be removed in 1.4.  
`sparse_output` is ignored unless you leave `sparse` to its default  
value.
```

```
warnings.warn()
```

```
[CV 5/5] END randomforestclassifier__criterion=gini,  
randomforestclassifier__max_features=0.33,  
randomforestclassifier__min_samples_leaf=5,  
randomforestclassifier__min_samples_split=4,  
randomforestclassifier__n_estimators=100;; score=0.839 total time=  
4.9s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\  
preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to  
`sparse_output` in version 1.2 and will be removed in 1.4.  
`sparse_output` is ignored unless you leave `sparse` to its default  
value.
```

```
warnings.warn()
```

```
[CV 1/5] END randomforestclassifier__criterion=gini,  
randomforestclassifier__max_features=0.33,  
randomforestclassifier__min_samples_leaf=5,  
randomforestclassifier__min_samples_split=4,  
randomforestclassifier__n_estimators=150;; score=0.840 total time=  
7.5s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\  
preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to  
`sparse_output` in version 1.2 and will be removed in 1.4.  
`sparse_output` is ignored unless you leave `sparse` to its default  
value.
```

```
warnings.warn()
```

```
[CV 2/5] END randomforestclassifier__criterion=gini,  
randomforestclassifier__max_features=0.33,  
randomforestclassifier__min_samples_leaf=5,  
randomforestclassifier__min_samples_split=4,
```

```
randomforestclassifier__n_estimators=150;; score=0.829 total time=7.5s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to `sparse_output` in version 1.2 and will be removed in 1.4. `sparse_output` is ignored unless you leave `sparse` to its default value.
```

```
warnings.warn(
```

```
[CV 3/5] END randomforestclassifier__criterion=gini, randomforestclassifier__max_features=0.33, randomforestclassifier__min_samples_leaf=5, randomforestclassifier__min_samples_split=4, randomforestclassifier__n_estimators=150;; score=0.812 total time=7.4s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to `sparse_output` in version 1.2 and will be removed in 1.4. `sparse_output` is ignored unless you leave `sparse` to its default value.
```

```
warnings.warn(
```

```
[CV 4/5] END randomforestclassifier__criterion=gini, randomforestclassifier__max_features=0.33, randomforestclassifier__min_samples_leaf=5, randomforestclassifier__min_samples_split=4, randomforestclassifier__n_estimators=150;; score=0.831 total time=7.6s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to `sparse_output` in version 1.2 and will be removed in 1.4. `sparse_output` is ignored unless you leave `sparse` to its default value.
```

```
warnings.warn(
```

```
[CV 5/5] END randomforestclassifier__criterion=gini, randomforestclassifier__max_features=0.33, randomforestclassifier__min_samples_leaf=5, randomforestclassifier__min_samples_split=4, randomforestclassifier__n_estimators=150;; score=0.844 total time=7.4s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to `sparse_output` in version 1.2 and will be removed in 1.4. `sparse_output` is ignored unless you leave `sparse` to its default value.
```

```
warnings.warn(
```

```
[CV 1/5] END randomforestclassifier__criterion=gini,  
randomforestclassifier__max_features=0.33,  
randomforestclassifier__min_samples_leaf=10,  
randomforestclassifier__min_samples_split=2,  
randomforestclassifier__n_estimators=50;; score=0.829 total time=  
2.4s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\  
preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to  
`sparse_output` in version 1.2 and will be removed in 1.4.  
`sparse_output` is ignored unless you leave `sparse` to its default  
value.  
  warnings.warn(
```

```
[CV 2/5] END randomforestclassifier__criterion=gini,  
randomforestclassifier__max_features=0.33,  
randomforestclassifier__min_samples_leaf=10,  
randomforestclassifier__min_samples_split=2,  
randomforestclassifier__n_estimators=50;; score=0.819 total time=  
2.4s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\  
preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to  
`sparse_output` in version 1.2 and will be removed in 1.4.  
`sparse_output` is ignored unless you leave `sparse` to its default  
value.  
  warnings.warn(
```

```
[CV 3/5] END randomforestclassifier__criterion=gini,  
randomforestclassifier__max_features=0.33,  
randomforestclassifier__min_samples_leaf=10,  
randomforestclassifier__min_samples_split=2,  
randomforestclassifier__n_estimators=50;; score=0.809 total time=  
2.1s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\  
preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to  
`sparse_output` in version 1.2 and will be removed in 1.4.  
`sparse_output` is ignored unless you leave `sparse` to its default  
value.  
  warnings.warn(
```

```
[CV 4/5] END randomforestclassifier__criterion=gini,  
randomforestclassifier__max_features=0.33,  
randomforestclassifier__min_samples_leaf=10,  
randomforestclassifier__min_samples_split=2,  
randomforestclassifier__n_estimators=50;; score=0.819 total time=  
2.2s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\  
preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to
```

```
`sparse_output` in version 1.2 and will be removed in 1.4.  
`sparse_output` is ignored unless you leave `sparse` to its default  
value.
```

```
warnings.warn()
```

```
[CV 5/5] END randomforestclassifier__criterion=gini,  
randomforestclassifier__max_features=0.33,  
randomforestclassifier__min_samples_leaf=10,  
randomforestclassifier__min_samples_split=2,  
randomforestclassifier__n_estimators=50;; score=0.826 total time=  
2.1s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\  
preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to  
`sparse_output` in version 1.2 and will be removed in 1.4.  
`sparse_output` is ignored unless you leave `sparse` to its default  
value.
```

```
warnings.warn()
```

```
[CV 1/5] END randomforestclassifier__criterion=gini,  
randomforestclassifier__max_features=0.33,  
randomforestclassifier__min_samples_leaf=10,  
randomforestclassifier__min_samples_split=2,  
randomforestclassifier__n_estimators=100;; score=0.834 total time=  
4.5s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\  
preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to  
`sparse_output` in version 1.2 and will be removed in 1.4.  
`sparse_output` is ignored unless you leave `sparse` to its default  
value.
```

```
warnings.warn()
```

```
[CV 2/5] END randomforestclassifier__criterion=gini,  
randomforestclassifier__max_features=0.33,  
randomforestclassifier__min_samples_leaf=10,  
randomforestclassifier__min_samples_split=2,  
randomforestclassifier__n_estimators=100;; score=0.821 total time=  
4.7s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\  
preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to  
`sparse_output` in version 1.2 and will be removed in 1.4.  
`sparse_output` is ignored unless you leave `sparse` to its default  
value.
```

```
warnings.warn()
```

```
[CV 3/5] END randomforestclassifier__criterion=gini,  
randomforestclassifier__max_features=0.33,  
randomforestclassifier__min_samples_leaf=10,  
randomforestclassifier__min_samples_split=2,
```

```
randomforestclassifier__n_estimators=100;; score=0.804 total time=4.3s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to `sparse_output` in version 1.2 and will be removed in 1.4.
`sparse_output` is ignored unless you leave `sparse` to its default value.
```

```
warnings.warn(
```

```
[CV 4/5] END randomforestclassifier__criterion=gini,
randomforestclassifier__max_features=0.33,
randomforestclassifier__min_samples_leaf=10,
randomforestclassifier__min_samples_split=2,
randomforestclassifier__n_estimators=100;; score=0.827 total time=4.4s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to `sparse_output` in version 1.2 and will be removed in 1.4.
`sparse_output` is ignored unless you leave `sparse` to its default value.
```

```
warnings.warn(
```

```
[CV 5/5] END randomforestclassifier__criterion=gini,
randomforestclassifier__max_features=0.33,
randomforestclassifier__min_samples_leaf=10,
randomforestclassifier__min_samples_split=2,
randomforestclassifier__n_estimators=100;; score=0.824 total time=4.5s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to `sparse_output` in version 1.2 and will be removed in 1.4.
`sparse_output` is ignored unless you leave `sparse` to its default value.
```

```
warnings.warn(
```

```
[CV 1/5] END randomforestclassifier__criterion=gini,
randomforestclassifier__max_features=0.33,
randomforestclassifier__min_samples_leaf=10,
randomforestclassifier__min_samples_split=2,
randomforestclassifier__n_estimators=150;; score=0.835 total time=7.0s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to `sparse_output` in version 1.2 and will be removed in 1.4.
`sparse_output` is ignored unless you leave `sparse` to its default value.
```

```
warnings.warn(
```

```
[CV 2/5] END randomforestclassifier__criterion=gini,  
randomforestclassifier__max_features=0.33,  
randomforestclassifier__min_samples_leaf=10,  
randomforestclassifier__min_samples_split=2,  
randomforestclassifier__n_estimators=150;; score=0.820 total time=  
6.7s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\  
preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to  
`sparse_output` in version 1.2 and will be removed in 1.4.  
`sparse_output` is ignored unless you leave `sparse` to its default  
value.
```

```
warnings.warn(
```

```
[CV 3/5] END randomforestclassifier__criterion=gini,  
randomforestclassifier__max_features=0.33,  
randomforestclassifier__min_samples_leaf=10,  
randomforestclassifier__min_samples_split=2,  
randomforestclassifier__n_estimators=150;; score=0.806 total time=  
6.8s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\  
preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to  
`sparse_output` in version 1.2 and will be removed in 1.4.  
`sparse_output` is ignored unless you leave `sparse` to its default  
value.
```

```
warnings.warn(
```

```
[CV 4/5] END randomforestclassifier__criterion=gini,  
randomforestclassifier__max_features=0.33,  
randomforestclassifier__min_samples_leaf=10,  
randomforestclassifier__min_samples_split=2,  
randomforestclassifier__n_estimators=150;; score=0.820 total time=  
6.5s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\  
preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to  
`sparse_output` in version 1.2 and will be removed in 1.4.  
`sparse_output` is ignored unless you leave `sparse` to its default  
value.
```

```
warnings.warn(
```

```
[CV 5/5] END randomforestclassifier__criterion=gini,  
randomforestclassifier__max_features=0.33,  
randomforestclassifier__min_samples_leaf=10,  
randomforestclassifier__min_samples_split=2,  
randomforestclassifier__n_estimators=150;; score=0.829 total time=  
7.0s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\  
preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to
```

```
`sparse_output` in version 1.2 and will be removed in 1.4.  
`sparse_output` is ignored unless you leave `sparse` to its default  
value.
```

```
warnings.warn()
```

```
[CV 1/5] END randomforestclassifier__criterion=gini,  
randomforestclassifier__max_features=0.33,  
randomforestclassifier__min_samples_leaf=10,  
randomforestclassifier__min_samples_split=3,  
randomforestclassifier__n_estimators=50;; score=0.829 total time=  
2.2s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\  
preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to  
`sparse_output` in version 1.2 and will be removed in 1.4.  
`sparse_output` is ignored unless you leave `sparse` to its default  
value.
```

```
warnings.warn()
```

```
[CV 2/5] END randomforestclassifier__criterion=gini,  
randomforestclassifier__max_features=0.33,  
randomforestclassifier__min_samples_leaf=10,  
randomforestclassifier__min_samples_split=3,  
randomforestclassifier__n_estimators=50;; score=0.817 total time=  
2.2s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\  
preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to  
`sparse_output` in version 1.2 and will be removed in 1.4.  
`sparse_output` is ignored unless you leave `sparse` to its default  
value.
```

```
warnings.warn()
```

```
[CV 3/5] END randomforestclassifier__criterion=gini,  
randomforestclassifier__max_features=0.33,  
randomforestclassifier__min_samples_leaf=10,  
randomforestclassifier__min_samples_split=3,  
randomforestclassifier__n_estimators=50;; score=0.811 total time=  
2.2s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\  
preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to  
`sparse_output` in version 1.2 and will be removed in 1.4.  
`sparse_output` is ignored unless you leave `sparse` to its default  
value.
```

```
warnings.warn()
```

```
[CV 4/5] END randomforestclassifier__criterion=gini,  
randomforestclassifier__max_features=0.33,  
randomforestclassifier__min_samples_leaf=10,  
randomforestclassifier__min_samples_split=3,
```

```
randomforestclassifier__n_estimators=50;; score=0.814 total time=2.2s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to `sparse_output` in version 1.2 and will be removed in 1.4. `sparse_output` is ignored unless you leave `sparse` to its default value.
```

```
warnings.warn(
```

```
[CV 5/5] END randomforestclassifier__criterion=gini, randomforestclassifier__max_features=0.33, randomforestclassifier__min_samples_leaf=10, randomforestclassifier__min_samples_split=3, randomforestclassifier__n_estimators=50;; score=0.829 total time=2.2s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to `sparse_output` in version 1.2 and will be removed in 1.4. `sparse_output` is ignored unless you leave `sparse` to its default value.
```

```
warnings.warn(
```

```
[CV 1/5] END randomforestclassifier__criterion=gini, randomforestclassifier__max_features=0.33, randomforestclassifier__min_samples_leaf=10, randomforestclassifier__min_samples_split=3, randomforestclassifier__n_estimators=100;; score=0.829 total time=4.7s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to `sparse_output` in version 1.2 and will be removed in 1.4. `sparse_output` is ignored unless you leave `sparse` to its default value.
```

```
warnings.warn(
```

```
[CV 2/5] END randomforestclassifier__criterion=gini, randomforestclassifier__max_features=0.33, randomforestclassifier__min_samples_leaf=10, randomforestclassifier__min_samples_split=3, randomforestclassifier__n_estimators=100;; score=0.821 total time=4.3s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to `sparse_output` in version 1.2 and will be removed in 1.4. `sparse_output` is ignored unless you leave `sparse` to its default value.
```

```
warnings.warn(
```



```
[CV 3/5] END randomforestclassifier__criterion=gini,  
randomforestclassifier__max_features=0.33,  
randomforestclassifier__min_samples_leaf=10,  
randomforestclassifier__min_samples_split=3,  
randomforestclassifier__n_estimators=100;; score=0.809 total time=  
4.4s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\  
preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to  
`sparse_output` in version 1.2 and will be removed in 1.4.  
`sparse_output` is ignored unless you leave `sparse` to its default  
value.
```

```
warnings.warn(
```

```
[CV 4/5] END randomforestclassifier__criterion=gini,  
randomforestclassifier__max_features=0.33,  
randomforestclassifier__min_samples_leaf=10,  
randomforestclassifier__min_samples_split=3,  
randomforestclassifier__n_estimators=100;; score=0.823 total time=  
4.6s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\  
preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to  
`sparse_output` in version 1.2 and will be removed in 1.4.  
`sparse_output` is ignored unless you leave `sparse` to its default  
value.
```

```
warnings.warn(
```

```
[CV 5/5] END randomforestclassifier__criterion=gini,  
randomforestclassifier__max_features=0.33,  
randomforestclassifier__min_samples_leaf=10,  
randomforestclassifier__min_samples_split=3,  
randomforestclassifier__n_estimators=100;; score=0.830 total time=  
4.5s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\  
preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to  
`sparse_output` in version 1.2 and will be removed in 1.4.  
`sparse_output` is ignored unless you leave `sparse` to its default  
value.
```

```
warnings.warn(
```

```
[CV 1/5] END randomforestclassifier__criterion=gini,  
randomforestclassifier__max_features=0.33,  
randomforestclassifier__min_samples_leaf=10,  
randomforestclassifier__min_samples_split=3,  
randomforestclassifier__n_estimators=150;; score=0.830 total time=  
6.7s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\  
preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to
```

```
`sparse_output` in version 1.2 and will be removed in 1.4.  
`sparse_output` is ignored unless you leave `sparse` to its default  
value.
```

```
warnings.warn()
```

```
[CV 2/5] END randomforestclassifier__criterion=gini,  
randomforestclassifier__max_features=0.33,  
randomforestclassifier__min_samples_leaf=10,  
randomforestclassifier__min_samples_split=3,  
randomforestclassifier__n_estimators=150;; score=0.822 total time=  
7.0s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\  
preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to  
`sparse_output` in version 1.2 and will be removed in 1.4.  
`sparse_output` is ignored unless you leave `sparse` to its default  
value.
```

```
warnings.warn()
```

```
[CV 3/5] END randomforestclassifier__criterion=gini,  
randomforestclassifier__max_features=0.33,  
randomforestclassifier__min_samples_leaf=10,  
randomforestclassifier__min_samples_split=3,  
randomforestclassifier__n_estimators=150;; score=0.807 total time=  
6.6s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\  
preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to  
`sparse_output` in version 1.2 and will be removed in 1.4.  
`sparse_output` is ignored unless you leave `sparse` to its default  
value.
```

```
warnings.warn()
```

```
[CV 4/5] END randomforestclassifier__criterion=gini,  
randomforestclassifier__max_features=0.33,  
randomforestclassifier__min_samples_leaf=10,  
randomforestclassifier__min_samples_split=3,  
randomforestclassifier__n_estimators=150;; score=0.819 total time=  
6.7s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\  
preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to  
`sparse_output` in version 1.2 and will be removed in 1.4.  
`sparse_output` is ignored unless you leave `sparse` to its default  
value.
```

```
warnings.warn()
```

```
[CV 5/5] END randomforestclassifier__criterion=gini,  
randomforestclassifier__max_features=0.33,  
randomforestclassifier__min_samples_leaf=10,  
randomforestclassifier__min_samples_split=3,
```

```
randomforestclassifier__n_estimators=150;; score=0.831 total time=6.7s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to `sparse_output` in version 1.2 and will be removed in 1.4. `sparse_output` is ignored unless you leave `sparse` to its default value.
```

```
warnings.warn(
```

```
[CV 1/5] END randomforestclassifier__criterion=gini,  
randomforestclassifier__max_features=0.33,  
randomforestclassifier__min_samples_leaf=10,  
randomforestclassifier__min_samples_split=4,  
randomforestclassifier__n_estimators=50;; score=0.827 total time=2.2s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to `sparse_output` in version 1.2 and will be removed in 1.4. `sparse_output` is ignored unless you leave `sparse` to its default value.
```

```
warnings.warn(
```

```
[CV 2/5] END randomforestclassifier__criterion=gini,  
randomforestclassifier__max_features=0.33,  
randomforestclassifier__min_samples_leaf=10,  
randomforestclassifier__min_samples_split=4,  
randomforestclassifier__n_estimators=50;; score=0.819 total time=2.2s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to `sparse_output` in version 1.2 and will be removed in 1.4. `sparse_output` is ignored unless you leave `sparse` to its default value.
```

```
warnings.warn(
```

```
[CV 3/5] END randomforestclassifier__criterion=gini,  
randomforestclassifier__max_features=0.33,  
randomforestclassifier__min_samples_leaf=10,  
randomforestclassifier__min_samples_split=4,  
randomforestclassifier__n_estimators=50;; score=0.808 total time=2.3s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to `sparse_output` in version 1.2 and will be removed in 1.4. `sparse_output` is ignored unless you leave `sparse` to its default value.
```

```
warnings.warn(
```

```
[CV 4/5] END randomforestclassifier__criterion=gini,  
randomforestclassifier__max_features=0.33,  
randomforestclassifier__min_samples_leaf=10,  
randomforestclassifier__min_samples_split=4,  
randomforestclassifier__n_estimators=50;; score=0.824 total time=  
2.4s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\  
preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to  
`sparse_output` in version 1.2 and will be removed in 1.4.  
`sparse_output` is ignored unless you leave `sparse` to its default  
value.
```

```
warnings.warn(
```

```
[CV 5/5] END randomforestclassifier__criterion=gini,  
randomforestclassifier__max_features=0.33,  
randomforestclassifier__min_samples_leaf=10,  
randomforestclassifier__min_samples_split=4,  
randomforestclassifier__n_estimators=50;; score=0.831 total time=  
2.3s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\  
preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to  
`sparse_output` in version 1.2 and will be removed in 1.4.  
`sparse_output` is ignored unless you leave `sparse` to its default  
value.
```

```
warnings.warn(
```

```
[CV 1/5] END randomforestclassifier__criterion=gini,  
randomforestclassifier__max_features=0.33,  
randomforestclassifier__min_samples_leaf=10,  
randomforestclassifier__min_samples_split=4,  
randomforestclassifier__n_estimators=100;; score=0.834 total time=  
4.5s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\  
preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to  
`sparse_output` in version 1.2 and will be removed in 1.4.  
`sparse_output` is ignored unless you leave `sparse` to its default  
value.
```

```
warnings.warn(
```

```
[CV 2/5] END randomforestclassifier__criterion=gini,  
randomforestclassifier__max_features=0.33,  
randomforestclassifier__min_samples_leaf=10,  
randomforestclassifier__min_samples_split=4,  
randomforestclassifier__n_estimators=100;; score=0.820 total time=  
4.5s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\  
preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to
```

```
`sparse_output` in version 1.2 and will be removed in 1.4.  
`sparse_output` is ignored unless you leave `sparse` to its default  
value.
```

```
warnings.warn()
```

```
[CV 3/5] END randomforestclassifier__criterion=gini,  
randomforestclassifier__max_features=0.33,  
randomforestclassifier__min_samples_leaf=10,  
randomforestclassifier__min_samples_split=4,  
randomforestclassifier__n_estimators=100;; score=0.807 total time=  
4.6s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\  
preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to  
`sparse_output` in version 1.2 and will be removed in 1.4.  
`sparse_output` is ignored unless you leave `sparse` to its default  
value.
```

```
warnings.warn()
```

```
[CV 4/5] END randomforestclassifier__criterion=gini,  
randomforestclassifier__max_features=0.33,  
randomforestclassifier__min_samples_leaf=10,  
randomforestclassifier__min_samples_split=4,  
randomforestclassifier__n_estimators=100;; score=0.822 total time=  
4.5s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\  
preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to  
`sparse_output` in version 1.2 and will be removed in 1.4.  
`sparse_output` is ignored unless you leave `sparse` to its default  
value.
```

```
warnings.warn()
```

```
[CV 5/5] END randomforestclassifier__criterion=gini,  
randomforestclassifier__max_features=0.33,  
randomforestclassifier__min_samples_leaf=10,  
randomforestclassifier__min_samples_split=4,  
randomforestclassifier__n_estimators=100;; score=0.832 total time=  
4.4s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\  
preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to  
`sparse_output` in version 1.2 and will be removed in 1.4.  
`sparse_output` is ignored unless you leave `sparse` to its default  
value.
```

```
warnings.warn()
```

```
[CV 1/5] END randomforestclassifier__criterion=gini,  
randomforestclassifier__max_features=0.33,  
randomforestclassifier__min_samples_leaf=10,  
randomforestclassifier__min_samples_split=4,
```

```
randomforestclassifier__n_estimators=150;; score=0.834 total time=6.9s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to `sparse_output` in version 1.2 and will be removed in 1.4.
`sparse_output` is ignored unless you leave `sparse` to its default value.
```

```
warnings.warn(
```

```
[CV 2/5] END randomforestclassifier__criterion=gini,
randomforestclassifier__max_features=0.33,
randomforestclassifier__min_samples_leaf=10,
randomforestclassifier__min_samples_split=4,
randomforestclassifier__n_estimators=150;; score=0.826 total time=6.9s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to `sparse_output` in version 1.2 and will be removed in 1.4.
`sparse_output` is ignored unless you leave `sparse` to its default value.
```

```
warnings.warn(
```

```
[CV 3/5] END randomforestclassifier__criterion=gini,
randomforestclassifier__max_features=0.33,
randomforestclassifier__min_samples_leaf=10,
randomforestclassifier__min_samples_split=4,
randomforestclassifier__n_estimators=150;; score=0.810 total time=6.7s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to `sparse_output` in version 1.2 and will be removed in 1.4.
`sparse_output` is ignored unless you leave `sparse` to its default value.
```

```
warnings.warn(
```

```
[CV 4/5] END randomforestclassifier__criterion=gini,
randomforestclassifier__max_features=0.33,
randomforestclassifier__min_samples_leaf=10,
randomforestclassifier__min_samples_split=4,
randomforestclassifier__n_estimators=150;; score=0.825 total time=6.7s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to `sparse_output` in version 1.2 and will be removed in 1.4.
`sparse_output` is ignored unless you leave `sparse` to its default value.
```

```
warnings.warn(
```

```
[CV 5/5] END randomforestclassifier__criterion=gini,  
randomforestclassifier__max_features=0.33,  
randomforestclassifier__min_samples_leaf=10,  
randomforestclassifier__min_samples_split=4,  
randomforestclassifier__n_estimators=150;; score=0.834 total time=  
6.7s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\  
preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to  
`sparse_output` in version 1.2 and will be removed in 1.4.  
`sparse_output` is ignored unless you leave `sparse` to its default  
value.
```

```
warnings.warn(
```

```
[CV 1/5] END randomforestclassifier__criterion=gini,  
randomforestclassifier__max_features=0.33,  
randomforestclassifier__min_samples_leaf=15,  
randomforestclassifier__min_samples_split=2,  
randomforestclassifier__n_estimators=50;; score=0.825 total time=  
2.2s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\  
preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to  
`sparse_output` in version 1.2 and will be removed in 1.4.  
`sparse_output` is ignored unless you leave `sparse` to its default  
value.
```

```
warnings.warn(
```

```
[CV 2/5] END randomforestclassifier__criterion=gini,  
randomforestclassifier__max_features=0.33,  
randomforestclassifier__min_samples_leaf=15,  
randomforestclassifier__min_samples_split=2,  
randomforestclassifier__n_estimators=50;; score=0.816 total time=  
2.2s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\  
preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to  
`sparse_output` in version 1.2 and will be removed in 1.4.  
`sparse_output` is ignored unless you leave `sparse` to its default  
value.
```

```
warnings.warn(
```

```
[CV 3/5] END randomforestclassifier__criterion=gini,  
randomforestclassifier__max_features=0.33,  
randomforestclassifier__min_samples_leaf=15,  
randomforestclassifier__min_samples_split=2,  
randomforestclassifier__n_estimators=50;; score=0.800 total time=  
2.1s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\  
preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to
```

```
`sparse_output` in version 1.2 and will be removed in 1.4.  
`sparse_output` is ignored unless you leave `sparse` to its default  
value.
```

```
warnings.warn()
```

```
[CV 4/5] END randomforestclassifier__criterion=gini,  
randomforestclassifier__max_features=0.33,  
randomforestclassifier__min_samples_leaf=15,  
randomforestclassifier__min_samples_split=2,  
randomforestclassifier__n_estimators=50;; score=0.821 total time=  
2.0s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\  
preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to  
`sparse_output` in version 1.2 and will be removed in 1.4.  
`sparse_output` is ignored unless you leave `sparse` to its default  
value.
```

```
warnings.warn()
```

```
[CV 5/5] END randomforestclassifier__criterion=gini,  
randomforestclassifier__max_features=0.33,  
randomforestclassifier__min_samples_leaf=15,  
randomforestclassifier__min_samples_split=2,  
randomforestclassifier__n_estimators=50;; score=0.826 total time=  
2.0s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\  
preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to  
`sparse_output` in version 1.2 and will be removed in 1.4.  
`sparse_output` is ignored unless you leave `sparse` to its default  
value.
```

```
warnings.warn()
```

```
[CV 1/5] END randomforestclassifier__criterion=gini,  
randomforestclassifier__max_features=0.33,  
randomforestclassifier__min_samples_leaf=15,  
randomforestclassifier__min_samples_split=2,  
randomforestclassifier__n_estimators=100;; score=0.826 total time=  
4.1s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\  
preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to  
`sparse_output` in version 1.2 and will be removed in 1.4.  
`sparse_output` is ignored unless you leave `sparse` to its default  
value.
```

```
warnings.warn()
```

```
[CV 2/5] END randomforestclassifier__criterion=gini,  
randomforestclassifier__max_features=0.33,  
randomforestclassifier__min_samples_leaf=15,  
randomforestclassifier__min_samples_split=2,
```



```
randomforestclassifier__n_estimators=100;; score=0.818 total time=4.3s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to `sparse_output` in version 1.2 and will be removed in 1.4. `sparse_output` is ignored unless you leave `sparse` to its default value.
```

```
warnings.warn(
```

```
[CV 3/5] END randomforestclassifier__criterion=gini, randomforestclassifier__max_features=0.33, randomforestclassifier__min_samples_leaf=15, randomforestclassifier__min_samples_split=2, randomforestclassifier__n_estimators=100;; score=0.804 total time=4.2s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to `sparse_output` in version 1.2 and will be removed in 1.4. `sparse_output` is ignored unless you leave `sparse` to its default value.
```

```
warnings.warn(
```

```
[CV 4/5] END randomforestclassifier__criterion=gini, randomforestclassifier__max_features=0.33, randomforestclassifier__min_samples_leaf=15, randomforestclassifier__min_samples_split=2, randomforestclassifier__n_estimators=100;; score=0.814 total time=4.1s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to `sparse_output` in version 1.2 and will be removed in 1.4. `sparse_output` is ignored unless you leave `sparse` to its default value.
```

```
warnings.warn(
```

```
[CV 5/5] END randomforestclassifier__criterion=gini, randomforestclassifier__max_features=0.33, randomforestclassifier__min_samples_leaf=15, randomforestclassifier__min_samples_split=2, randomforestclassifier__n_estimators=100;; score=0.829 total time=4.0s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to `sparse_output` in version 1.2 and will be removed in 1.4. `sparse_output` is ignored unless you leave `sparse` to its default value.
```

```
warnings.warn(
```

```
[CV 1/5] END randomforestclassifier__criterion=gini,  
randomforestclassifier__max_features=0.33,  
randomforestclassifier__min_samples_leaf=15,  
randomforestclassifier__min_samples_split=2,  
randomforestclassifier__n_estimators=150;; score=0.826 total time=  
6.8s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\  
preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to  
`sparse_output` in version 1.2 and will be removed in 1.4.  
`sparse_output` is ignored unless you leave `sparse` to its default  
value.
```

```
warnings.warn(
```

```
[CV 2/5] END randomforestclassifier__criterion=gini,  
randomforestclassifier__max_features=0.33,  
randomforestclassifier__min_samples_leaf=15,  
randomforestclassifier__min_samples_split=2,  
randomforestclassifier__n_estimators=150;; score=0.824 total time=  
6.2s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\  
preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to  
`sparse_output` in version 1.2 and will be removed in 1.4.  
`sparse_output` is ignored unless you leave `sparse` to its default  
value.
```

```
warnings.warn(
```

```
[CV 3/5] END randomforestclassifier__criterion=gini,  
randomforestclassifier__max_features=0.33,  
randomforestclassifier__min_samples_leaf=15,  
randomforestclassifier__min_samples_split=2,  
randomforestclassifier__n_estimators=150;; score=0.806 total time=  
6.2s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\  
preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to  
`sparse_output` in version 1.2 and will be removed in 1.4.  
`sparse_output` is ignored unless you leave `sparse` to its default  
value.
```

```
warnings.warn(
```

```
[CV 4/5] END randomforestclassifier__criterion=gini,  
randomforestclassifier__max_features=0.33,  
randomforestclassifier__min_samples_leaf=15,  
randomforestclassifier__min_samples_split=2,  
randomforestclassifier__n_estimators=150;; score=0.819 total time=  
6.2s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\  
preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to
```

```
`sparse_output` in version 1.2 and will be removed in 1.4.  
`sparse_output` is ignored unless you leave `sparse` to its default  
value.
```

```
warnings.warn()
```

```
[CV 5/5] END randomforestclassifier__criterion=gini,  
randomforestclassifier__max_features=0.33,  
randomforestclassifier__min_samples_leaf=15,  
randomforestclassifier__min_samples_split=2,  
randomforestclassifier__n_estimators=150;; score=0.823 total time=  
6.1s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\  
preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to  
`sparse_output` in version 1.2 and will be removed in 1.4.  
`sparse_output` is ignored unless you leave `sparse` to its default  
value.
```

```
warnings.warn()
```

```
[CV 1/5] END randomforestclassifier__criterion=gini,  
randomforestclassifier__max_features=0.33,  
randomforestclassifier__min_samples_leaf=15,  
randomforestclassifier__min_samples_split=3,  
randomforestclassifier__n_estimators=50;; score=0.827 total time=  
2.2s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\  
preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to  
`sparse_output` in version 1.2 and will be removed in 1.4.  
`sparse_output` is ignored unless you leave `sparse` to its default  
value.
```

```
warnings.warn()
```

```
[CV 2/5] END randomforestclassifier__criterion=gini,  
randomforestclassifier__max_features=0.33,  
randomforestclassifier__min_samples_leaf=15,  
randomforestclassifier__min_samples_split=3,  
randomforestclassifier__n_estimators=50;; score=0.816 total time=  
2.1s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\  
preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to  
`sparse_output` in version 1.2 and will be removed in 1.4.  
`sparse_output` is ignored unless you leave `sparse` to its default  
value.
```

```
warnings.warn()
```

```
[CV 3/5] END randomforestclassifier__criterion=gini,  
randomforestclassifier__max_features=0.33,  
randomforestclassifier__min_samples_leaf=15,  
randomforestclassifier__min_samples_split=3,
```

```
randomforestclassifier__n_estimators=50;; score=0.808 total time=2.1s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to `sparse_output` in version 1.2 and will be removed in 1.4.
`sparse_output` is ignored unless you leave `sparse` to its default value.
```

```
warnings.warn(
```

```
[CV 4/5] END randomforestclassifier__criterion=gini,
randomforestclassifier__max_features=0.33,
randomforestclassifier__min_samples_leaf=15,
randomforestclassifier__min_samples_split=3,
randomforestclassifier__n_estimators=50;; score=0.814 total time=2.0s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to `sparse_output` in version 1.2 and will be removed in 1.4.
`sparse_output` is ignored unless you leave `sparse` to its default value.
```

```
warnings.warn(
```

```
[CV 5/5] END randomforestclassifier__criterion=gini,
randomforestclassifier__max_features=0.33,
randomforestclassifier__min_samples_leaf=15,
randomforestclassifier__min_samples_split=3,
randomforestclassifier__n_estimators=50;; score=0.829 total time=2.0s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to `sparse_output` in version 1.2 and will be removed in 1.4.
`sparse_output` is ignored unless you leave `sparse` to its default value.
```

```
warnings.warn(
```

```
[CV 1/5] END randomforestclassifier__criterion=gini,
randomforestclassifier__max_features=0.33,
randomforestclassifier__min_samples_leaf=15,
randomforestclassifier__min_samples_split=3,
randomforestclassifier__n_estimators=100;; score=0.831 total time=4.1s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to `sparse_output` in version 1.2 and will be removed in 1.4.
`sparse_output` is ignored unless you leave `sparse` to its default value.
```

```
warnings.warn(
```

```
[CV 2/5] END randomforestclassifier__criterion=gini,  
randomforestclassifier__max_features=0.33,  
randomforestclassifier__min_samples_leaf=15,  
randomforestclassifier__min_samples_split=3,  
randomforestclassifier__n_estimators=100;; score=0.814 total time=  
4.3s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\  
preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to  
`sparse_output` in version 1.2 and will be removed in 1.4.  
`sparse_output` is ignored unless you leave `sparse` to its default  
value.
```

```
warnings.warn(
```

```
[CV 3/5] END randomforestclassifier__criterion=gini,  
randomforestclassifier__max_features=0.33,  
randomforestclassifier__min_samples_leaf=15,  
randomforestclassifier__min_samples_split=3,  
randomforestclassifier__n_estimators=100;; score=0.806 total time=  
4.2s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\  
preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to  
`sparse_output` in version 1.2 and will be removed in 1.4.  
`sparse_output` is ignored unless you leave `sparse` to its default  
value.
```

```
warnings.warn(
```

```
[CV 4/5] END randomforestclassifier__criterion=gini,  
randomforestclassifier__max_features=0.33,  
randomforestclassifier__min_samples_leaf=15,  
randomforestclassifier__min_samples_split=3,  
randomforestclassifier__n_estimators=100;; score=0.812 total time=  
4.1s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\  
preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to  
`sparse_output` in version 1.2 and will be removed in 1.4.  
`sparse_output` is ignored unless you leave `sparse` to its default  
value.
```

```
warnings.warn(
```

```
[CV 5/5] END randomforestclassifier__criterion=gini,  
randomforestclassifier__max_features=0.33,  
randomforestclassifier__min_samples_leaf=15,  
randomforestclassifier__min_samples_split=3,  
randomforestclassifier__n_estimators=100;; score=0.826 total time=  
4.0s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\  
preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to
```

```
`sparse_output` in version 1.2 and will be removed in 1.4.  
`sparse_output` is ignored unless you leave `sparse` to its default  
value.
```

```
warnings.warn()
```

```
[CV 1/5] END randomforestclassifier__criterion=gini,  
randomforestclassifier__max_features=0.33,  
randomforestclassifier__min_samples_leaf=15,  
randomforestclassifier__min_samples_split=3,  
randomforestclassifier__n_estimators=150;; score=0.827 total time=  
6.5s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\  
preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to  
`sparse_output` in version 1.2 and will be removed in 1.4.  
`sparse_output` is ignored unless you leave `sparse` to its default  
value.
```

```
warnings.warn()
```

```
[CV 2/5] END randomforestclassifier__criterion=gini,  
randomforestclassifier__max_features=0.33,  
randomforestclassifier__min_samples_leaf=15,  
randomforestclassifier__min_samples_split=3,  
randomforestclassifier__n_estimators=150;; score=0.819 total time=  
6.2s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\  
preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to  
`sparse_output` in version 1.2 and will be removed in 1.4.  
`sparse_output` is ignored unless you leave `sparse` to its default  
value.
```

```
warnings.warn()
```

```
[CV 3/5] END randomforestclassifier__criterion=gini,  
randomforestclassifier__max_features=0.33,  
randomforestclassifier__min_samples_leaf=15,  
randomforestclassifier__min_samples_split=3,  
randomforestclassifier__n_estimators=150;; score=0.809 total time=  
6.3s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\  
preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to  
`sparse_output` in version 1.2 and will be removed in 1.4.  
`sparse_output` is ignored unless you leave `sparse` to its default  
value.
```

```
warnings.warn()
```

```
[CV 4/5] END randomforestclassifier__criterion=gini,  
randomforestclassifier__max_features=0.33,  
randomforestclassifier__min_samples_leaf=15,  
randomforestclassifier__min_samples_split=3,
```

```
randomforestclassifier__n_estimators=150;; score=0.819 total time=6.2s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to `sparse_output` in version 1.2 and will be removed in 1.4.
`sparse_output` is ignored unless you leave `sparse` to its default value.
  warnings.warn(
```

```
[CV 5/5] END randomforestclassifier__criterion=gini,
randomforestclassifier__max_features=0.33,
randomforestclassifier__min_samples_leaf=15,
randomforestclassifier__min_samples_split=3,
randomforestclassifier__n_estimators=150;; score=0.824 total time=6.1s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to `sparse_output` in version 1.2 and will be removed in 1.4.
`sparse_output` is ignored unless you leave `sparse` to its default value.
  warnings.warn(
```

```
[CV 1/5] END randomforestclassifier__criterion=gini,
randomforestclassifier__max_features=0.33,
randomforestclassifier__min_samples_leaf=15,
randomforestclassifier__min_samples_split=4,
randomforestclassifier__n_estimators=50;; score=0.833 total time=2.2s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to `sparse_output` in version 1.2 and will be removed in 1.4.
`sparse_output` is ignored unless you leave `sparse` to its default value.
  warnings.warn(
```

```
[CV 2/5] END randomforestclassifier__criterion=gini,
randomforestclassifier__max_features=0.33,
randomforestclassifier__min_samples_leaf=15,
randomforestclassifier__min_samples_split=4,
randomforestclassifier__n_estimators=50;; score=0.819 total time=2.1s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to `sparse_output` in version 1.2 and will be removed in 1.4.
`sparse_output` is ignored unless you leave `sparse` to its default value.
  warnings.warn(
```

```
[CV 3/5] END randomforestclassifier__criterion=gini,  
randomforestclassifier__max_features=0.33,  
randomforestclassifier__min_samples_leaf=15,  
randomforestclassifier__min_samples_split=4,  
randomforestclassifier__n_estimators=50;; score=0.799 total time=  
2.1s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\  
preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to  
`sparse_output` in version 1.2 and will be removed in 1.4.  
`sparse_output` is ignored unless you leave `sparse` to its default  
value.  
warnings.warn(
```

```
[CV 4/5] END randomforestclassifier__criterion=gini,  
randomforestclassifier__max_features=0.33,  
randomforestclassifier__min_samples_leaf=15,  
randomforestclassifier__min_samples_split=4,  
randomforestclassifier__n_estimators=50;; score=0.819 total time=  
2.0s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\  
preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to  
`sparse_output` in version 1.2 and will be removed in 1.4.  
`sparse_output` is ignored unless you leave `sparse` to its default  
value.  
warnings.warn(
```

```
[CV 5/5] END randomforestclassifier__criterion=gini,  
randomforestclassifier__max_features=0.33,  
randomforestclassifier__min_samples_leaf=15,  
randomforestclassifier__min_samples_split=4,  
randomforestclassifier__n_estimators=50;; score=0.831 total time=  
2.0s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\  
preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to  
`sparse_output` in version 1.2 and will be removed in 1.4.  
`sparse_output` is ignored unless you leave `sparse` to its default  
value.  
warnings.warn(
```

```
[CV 1/5] END randomforestclassifier__criterion=gini,  
randomforestclassifier__max_features=0.33,  
randomforestclassifier__min_samples_leaf=15,  
randomforestclassifier__min_samples_split=4,  
randomforestclassifier__n_estimators=100;; score=0.821 total time=  
4.2s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\  
preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to
```



```
`sparse_output` in version 1.2 and will be removed in 1.4.  
`sparse_output` is ignored unless you leave `sparse` to its default  
value.
```

```
warnings.warn()
```

```
[CV 2/5] END randomforestclassifier__criterion=gini,  
randomforestclassifier__max_features=0.33,  
randomforestclassifier__min_samples_leaf=15,  
randomforestclassifier__min_samples_split=4,  
randomforestclassifier__n_estimators=100;; score=0.817 total time=  
4.3s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\  
preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to  
`sparse_output` in version 1.2 and will be removed in 1.4.  
`sparse_output` is ignored unless you leave `sparse` to its default  
value.
```

```
warnings.warn()
```

```
[CV 3/5] END randomforestclassifier__criterion=gini,  
randomforestclassifier__max_features=0.33,  
randomforestclassifier__min_samples_leaf=15,  
randomforestclassifier__min_samples_split=4,  
randomforestclassifier__n_estimators=100;; score=0.806 total time=  
4.1s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\  
preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to  
`sparse_output` in version 1.2 and will be removed in 1.4.  
`sparse_output` is ignored unless you leave `sparse` to its default  
value.
```

```
warnings.warn()
```

```
[CV 4/5] END randomforestclassifier__criterion=gini,  
randomforestclassifier__max_features=0.33,  
randomforestclassifier__min_samples_leaf=15,  
randomforestclassifier__min_samples_split=4,  
randomforestclassifier__n_estimators=100;; score=0.816 total time=  
4.1s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\  
preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to  
`sparse_output` in version 1.2 and will be removed in 1.4.  
`sparse_output` is ignored unless you leave `sparse` to its default  
value.
```

```
warnings.warn()
```

```
[CV 5/5] END randomforestclassifier__criterion=gini,  
randomforestclassifier__max_features=0.33,  
randomforestclassifier__min_samples_leaf=15,  
randomforestclassifier__min_samples_split=4,
```

```
randomforestclassifier__n_estimators=100;; score=0.819 total time=
4.1s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\
preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to
`sparse_output` in version 1.2 and will be removed in 1.4.
`sparse_output` is ignored unless you leave `sparse` to its default
value.
```

```
warnings.warn(
```

```
[CV 1/5] END randomforestclassifier__criterion=gini,
randomforestclassifier__max_features=0.33,
randomforestclassifier__min_samples_leaf=15,
randomforestclassifier__min_samples_split=4,
randomforestclassifier__n_estimators=150;; score=0.824 total time=
6.6s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\
preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to
`sparse_output` in version 1.2 and will be removed in 1.4.
`sparse_output` is ignored unless you leave `sparse` to its default
value.
```

```
warnings.warn(
```

```
[CV 2/5] END randomforestclassifier__criterion=gini,
randomforestclassifier__max_features=0.33,
randomforestclassifier__min_samples_leaf=15,
randomforestclassifier__min_samples_split=4,
randomforestclassifier__n_estimators=150;; score=0.821 total time=
6.1s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\
preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to
`sparse_output` in version 1.2 and will be removed in 1.4.
`sparse_output` is ignored unless you leave `sparse` to its default
value.
```

```
warnings.warn(
```

```
[CV 3/5] END randomforestclassifier__criterion=gini,
randomforestclassifier__max_features=0.33,
randomforestclassifier__min_samples_leaf=15,
randomforestclassifier__min_samples_split=4,
randomforestclassifier__n_estimators=150;; score=0.804 total time=
6.3s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\
preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to
`sparse_output` in version 1.2 and will be removed in 1.4.
`sparse_output` is ignored unless you leave `sparse` to its default
value.
```

```
warnings.warn(
```

```
[CV 4/5] END randomforestclassifier__criterion=gini,  
randomforestclassifier__max_features=0.33,  
randomforestclassifier__min_samples_leaf=15,  
randomforestclassifier__min_samples_split=4,  
randomforestclassifier__n_estimators=150;; score=0.823 total time=  
6.1s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\  
preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to  
`sparse_output` in version 1.2 and will be removed in 1.4.  
`sparse_output` is ignored unless you leave `sparse` to its default  
value.
```

```
warnings.warn(
```

```
[CV 5/5] END randomforestclassifier__criterion=gini,  
randomforestclassifier__max_features=0.33,  
randomforestclassifier__min_samples_leaf=15,  
randomforestclassifier__min_samples_split=4,  
randomforestclassifier__n_estimators=150;; score=0.823 total time=  
6.2s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\  
preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to  
`sparse_output` in version 1.2 and will be removed in 1.4.  
`sparse_output` is ignored unless you leave `sparse` to its default  
value.
```

```
warnings.warn(
```

```
[CV 1/5] END randomforestclassifier__criterion=entropy,  
randomforestclassifier__max_features=sqrt,  
randomforestclassifier__min_samples_leaf=1,  
randomforestclassifier__min_samples_split=2,  
randomforestclassifier__n_estimators=50;; score=0.837 total time=  
2.9s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\  
preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to  
`sparse_output` in version 1.2 and will be removed in 1.4.  
`sparse_output` is ignored unless you leave `sparse` to its default  
value.
```

```
warnings.warn(
```

```
[CV 2/5] END randomforestclassifier__criterion=entropy,  
randomforestclassifier__max_features=sqrt,  
randomforestclassifier__min_samples_leaf=1,  
randomforestclassifier__min_samples_split=2,  
randomforestclassifier__n_estimators=50;; score=0.833 total time=  
3.0s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\  
preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to
```

```
`sparse_output` in version 1.2 and will be removed in 1.4.  
`sparse_output` is ignored unless you leave `sparse` to its default  
value.
```

```
warnings.warn()
```

```
[CV 3/5] END randomforestclassifier__criterion=entropy,  
randomforestclassifier__max_features=sqrt,  
randomforestclassifier__min_samples_leaf=1,  
randomforestclassifier__min_samples_split=2,  
randomforestclassifier__n_estimators=50;; score=0.821 total time=  
2.7s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\  
preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to  
`sparse_output` in version 1.2 and will be removed in 1.4.  
`sparse_output` is ignored unless you leave `sparse` to its default  
value.
```

```
warnings.warn()
```

```
[CV 4/5] END randomforestclassifier__criterion=entropy,  
randomforestclassifier__max_features=sqrt,  
randomforestclassifier__min_samples_leaf=1,  
randomforestclassifier__min_samples_split=2,  
randomforestclassifier__n_estimators=50;; score=0.832 total time=  
2.7s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\  
preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to  
`sparse_output` in version 1.2 and will be removed in 1.4.  
`sparse_output` is ignored unless you leave `sparse` to its default  
value.
```

```
warnings.warn()
```

```
[CV 5/5] END randomforestclassifier__criterion=entropy,  
randomforestclassifier__max_features=sqrt,  
randomforestclassifier__min_samples_leaf=1,  
randomforestclassifier__min_samples_split=2,  
randomforestclassifier__n_estimators=50;; score=0.844 total time=  
2.7s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\  
preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to  
`sparse_output` in version 1.2 and will be removed in 1.4.  
`sparse_output` is ignored unless you leave `sparse` to its default  
value.
```

```
warnings.warn()
```

```
[CV 1/5] END randomforestclassifier__criterion=entropy,  
randomforestclassifier__max_features=sqrt,  
randomforestclassifier__min_samples_leaf=1,  
randomforestclassifier__min_samples_split=2,
```

```
randomforestclassifier__n_estimators=100;; score=0.843 total time=5.8s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to `sparse_output` in version 1.2 and will be removed in 1.4.
`sparse_output` is ignored unless you leave `sparse` to its default value.
```

```
warnings.warn(
```

```
[CV 2/5] END randomforestclassifier__criterion=entropy,
randomforestclassifier__max_features=sqrt,
randomforestclassifier__min_samples_leaf=1,
randomforestclassifier__min_samples_split=2,
randomforestclassifier__n_estimators=100;; score=0.839 total time=5.7s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to `sparse_output` in version 1.2 and will be removed in 1.4.
`sparse_output` is ignored unless you leave `sparse` to its default value.
```

```
warnings.warn(
```

```
[CV 3/5] END randomforestclassifier__criterion=entropy,
randomforestclassifier__max_features=sqrt,
randomforestclassifier__min_samples_leaf=1,
randomforestclassifier__min_samples_split=2,
randomforestclassifier__n_estimators=100;; score=0.822 total time=5.4s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to `sparse_output` in version 1.2 and will be removed in 1.4.
`sparse_output` is ignored unless you leave `sparse` to its default value.
```

```
warnings.warn(
```

```
[CV 4/5] END randomforestclassifier__criterion=entropy,
randomforestclassifier__max_features=sqrt,
randomforestclassifier__min_samples_leaf=1,
randomforestclassifier__min_samples_split=2,
randomforestclassifier__n_estimators=100;; score=0.829 total time=5.8s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to `sparse_output` in version 1.2 and will be removed in 1.4.
`sparse_output` is ignored unless you leave `sparse` to its default value.
```

```
warnings.warn(
```

```
[CV 5/5] END randomforestclassifier__criterion=entropy,  
randomforestclassifier__max_features=sqrt,  
randomforestclassifier__min_samples_leaf=1,  
randomforestclassifier__min_samples_split=2,  
randomforestclassifier__n_estimators=100;; score=0.841 total time=  
5.4s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\  
preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to  
`sparse_output` in version 1.2 and will be removed in 1.4.  
`sparse_output` is ignored unless you leave `sparse` to its default  
value.
```

```
warnings.warn(
```

```
[CV 1/5] END randomforestclassifier__criterion=entropy,  
randomforestclassifier__max_features=sqrt,  
randomforestclassifier__min_samples_leaf=1,  
randomforestclassifier__min_samples_split=2,  
randomforestclassifier__n_estimators=150;; score=0.834 total time=  
8.5s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\  
preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to  
`sparse_output` in version 1.2 and will be removed in 1.4.  
`sparse_output` is ignored unless you leave `sparse` to its default  
value.
```

```
warnings.warn(
```

```
[CV 2/5] END randomforestclassifier__criterion=entropy,  
randomforestclassifier__max_features=sqrt,  
randomforestclassifier__min_samples_leaf=1,  
randomforestclassifier__min_samples_split=2,  
randomforestclassifier__n_estimators=150;; score=0.841 total time=  
8.3s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\  
preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to  
`sparse_output` in version 1.2 and will be removed in 1.4.  
`sparse_output` is ignored unless you leave `sparse` to its default  
value.
```

```
warnings.warn(
```

```
[CV 3/5] END randomforestclassifier__criterion=entropy,  
randomforestclassifier__max_features=sqrt,  
randomforestclassifier__min_samples_leaf=1,  
randomforestclassifier__min_samples_split=2,  
randomforestclassifier__n_estimators=150;; score=0.825 total time=  
8.3s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\  
preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to
```

```
`sparse_output` in version 1.2 and will be removed in 1.4.  
`sparse_output` is ignored unless you leave `sparse` to its default  
value.
```

```
warnings.warn()
```

```
[CV 4/5] END randomforestclassifier__criterion=entropy,  
randomforestclassifier__max_features=sqrt,  
randomforestclassifier__min_samples_leaf=1,  
randomforestclassifier__min_samples_split=2,  
randomforestclassifier__n_estimators=150;; score=0.829 total time=  
8.2s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\  
preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to  
`sparse_output` in version 1.2 and will be removed in 1.4.  
`sparse_output` is ignored unless you leave `sparse` to its default  
value.
```

```
warnings.warn()
```

```
[CV 5/5] END randomforestclassifier__criterion=entropy,  
randomforestclassifier__max_features=sqrt,  
randomforestclassifier__min_samples_leaf=1,  
randomforestclassifier__min_samples_split=2,  
randomforestclassifier__n_estimators=150;; score=0.851 total time=  
8.5s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\  
preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to  
`sparse_output` in version 1.2 and will be removed in 1.4.  
`sparse_output` is ignored unless you leave `sparse` to its default  
value.
```

```
warnings.warn()
```

```
[CV 1/5] END randomforestclassifier__criterion=entropy,  
randomforestclassifier__max_features=sqrt,  
randomforestclassifier__min_samples_leaf=1,  
randomforestclassifier__min_samples_split=3,  
randomforestclassifier__n_estimators=50;; score=0.831 total time=  
2.8s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\  
preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to  
`sparse_output` in version 1.2 and will be removed in 1.4.  
`sparse_output` is ignored unless you leave `sparse` to its default  
value.
```

```
warnings.warn()
```

```
[CV 2/5] END randomforestclassifier__criterion=entropy,  
randomforestclassifier__max_features=sqrt,  
randomforestclassifier__min_samples_leaf=1,  
randomforestclassifier__min_samples_split=3,
```

```
randomforestclassifier__n_estimators=50;; score=0.845 total time=2.7s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to `sparse_output` in version 1.2 and will be removed in 1.4.
`sparse_output` is ignored unless you leave `sparse` to its default value.
  warnings.warn(
```

```
[CV 3/5] END randomforestclassifier__criterion=entropy,
randomforestclassifier__max_features=sqrt,
randomforestclassifier__min_samples_leaf=1,
randomforestclassifier__min_samples_split=3,
randomforestclassifier__n_estimators=50;; score=0.829 total time=2.7s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to `sparse_output` in version 1.2 and will be removed in 1.4.
`sparse_output` is ignored unless you leave `sparse` to its default value.
  warnings.warn(
```

```
[CV 4/5] END randomforestclassifier__criterion=entropy,
randomforestclassifier__max_features=sqrt,
randomforestclassifier__min_samples_leaf=1,
randomforestclassifier__min_samples_split=3,
randomforestclassifier__n_estimators=50;; score=0.824 total time=2.7s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to `sparse_output` in version 1.2 and will be removed in 1.4.
`sparse_output` is ignored unless you leave `sparse` to its default value.
  warnings.warn(
```

```
[CV 5/5] END randomforestclassifier__criterion=entropy,
randomforestclassifier__max_features=sqrt,
randomforestclassifier__min_samples_leaf=1,
randomforestclassifier__min_samples_split=3,
randomforestclassifier__n_estimators=50;; score=0.843 total time=2.8s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to `sparse_output` in version 1.2 and will be removed in 1.4.
`sparse_output` is ignored unless you leave `sparse` to its default value.
  warnings.warn(
```



```
[CV 1/5] END randomforestclassifier__criterion=entropy,  
randomforestclassifier__max_features=sqrt,  
randomforestclassifier__min_samples_leaf=1,  
randomforestclassifier__min_samples_split=3,  
randomforestclassifier__n_estimators=100;; score=0.839 total time=  
5.6s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\  
preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to  
`sparse_output` in version 1.2 and will be removed in 1.4.  
`sparse_output` is ignored unless you leave `sparse` to its default  
value.
```

```
warnings.warn(
```

```
[CV 2/5] END randomforestclassifier__criterion=entropy,  
randomforestclassifier__max_features=sqrt,  
randomforestclassifier__min_samples_leaf=1,  
randomforestclassifier__min_samples_split=3,  
randomforestclassifier__n_estimators=100;; score=0.839 total time=  
5.5s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\  
preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to  
`sparse_output` in version 1.2 and will be removed in 1.4.  
`sparse_output` is ignored unless you leave `sparse` to its default  
value.
```

```
warnings.warn(
```

```
[CV 3/5] END randomforestclassifier__criterion=entropy,  
randomforestclassifier__max_features=sqrt,  
randomforestclassifier__min_samples_leaf=1,  
randomforestclassifier__min_samples_split=3,  
randomforestclassifier__n_estimators=100;; score=0.826 total time=  
5.7s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\  
preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to  
`sparse_output` in version 1.2 and will be removed in 1.4.  
`sparse_output` is ignored unless you leave `sparse` to its default  
value.
```

```
warnings.warn(
```

```
[CV 4/5] END randomforestclassifier__criterion=entropy,  
randomforestclassifier__max_features=sqrt,  
randomforestclassifier__min_samples_leaf=1,  
randomforestclassifier__min_samples_split=3,  
randomforestclassifier__n_estimators=100;; score=0.831 total time=  
5.4s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\  
preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to
```

```
`sparse_output` in version 1.2 and will be removed in 1.4.  
`sparse_output` is ignored unless you leave `sparse` to its default  
value.
```

```
warnings.warn()
```

```
[CV 5/5] END randomforestclassifier__criterion=entropy,  
randomforestclassifier__max_features=sqrt,  
randomforestclassifier__min_samples_leaf=1,  
randomforestclassifier__min_samples_split=3,  
randomforestclassifier__n_estimators=100;; score=0.846 total time=  
5.4s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\  
preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to  
`sparse_output` in version 1.2 and will be removed in 1.4.  
`sparse_output` is ignored unless you leave `sparse` to its default  
value.
```

```
warnings.warn()
```

```
[CV 1/5] END randomforestclassifier__criterion=entropy,  
randomforestclassifier__max_features=sqrt,  
randomforestclassifier__min_samples_leaf=1,  
randomforestclassifier__min_samples_split=3,  
randomforestclassifier__n_estimators=150;; score=0.839 total time=  
8.6s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\  
preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to  
`sparse_output` in version 1.2 and will be removed in 1.4.  
`sparse_output` is ignored unless you leave `sparse` to its default  
value.
```

```
warnings.warn()
```

```
[CV 2/5] END randomforestclassifier__criterion=entropy,  
randomforestclassifier__max_features=sqrt,  
randomforestclassifier__min_samples_leaf=1,  
randomforestclassifier__min_samples_split=3,  
randomforestclassifier__n_estimators=150;; score=0.836 total time=  
8.3s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\  
preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to  
`sparse_output` in version 1.2 and will be removed in 1.4.  
`sparse_output` is ignored unless you leave `sparse` to its default  
value.
```

```
warnings.warn()
```

```
[CV 3/5] END randomforestclassifier__criterion=entropy,  
randomforestclassifier__max_features=sqrt,  
randomforestclassifier__min_samples_leaf=1,  
randomforestclassifier__min_samples_split=3,
```

```
randomforestclassifier__n_estimators=150;; score=0.824 total time=8.4s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to `sparse_output` in version 1.2 and will be removed in 1.4.
`sparse_output` is ignored unless you leave `sparse` to its default value.
```

```
warnings.warn(
```

```
[CV 4/5] END randomforestclassifier__criterion=entropy,
randomforestclassifier__max_features=sqrt,
randomforestclassifier__min_samples_leaf=1,
randomforestclassifier__min_samples_split=3,
randomforestclassifier__n_estimators=150;; score=0.829 total time=8.2s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to `sparse_output` in version 1.2 and will be removed in 1.4.
`sparse_output` is ignored unless you leave `sparse` to its default value.
```

```
warnings.warn(
```

```
[CV 5/5] END randomforestclassifier__criterion=entropy,
randomforestclassifier__max_features=sqrt,
randomforestclassifier__min_samples_leaf=1,
randomforestclassifier__min_samples_split=3,
randomforestclassifier__n_estimators=150;; score=0.845 total time=8.3s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to `sparse_output` in version 1.2 and will be removed in 1.4.
`sparse_output` is ignored unless you leave `sparse` to its default value.
```

```
warnings.warn(
```

```
[CV 1/5] END randomforestclassifier__criterion=entropy,
randomforestclassifier__max_features=sqrt,
randomforestclassifier__min_samples_leaf=1,
randomforestclassifier__min_samples_split=4,
randomforestclassifier__n_estimators=50;; score=0.840 total time=2.7s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to `sparse_output` in version 1.2 and will be removed in 1.4.
`sparse_output` is ignored unless you leave `sparse` to its default value.
```

```
warnings.warn(
```

```
[CV 2/5] END randomforestclassifier__criterion=entropy,  
randomforestclassifier__max_features=sqrt,  
randomforestclassifier__min_samples_leaf=1,  
randomforestclassifier__min_samples_split=4,  
randomforestclassifier__n_estimators=50;; score=0.834 total time=  
2.7s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\  
preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to  
`sparse_output` in version 1.2 and will be removed in 1.4.  
`sparse_output` is ignored unless you leave `sparse` to its default  
value.  
warnings.warn(
```

```
[CV 3/5] END randomforestclassifier__criterion=entropy,  
randomforestclassifier__max_features=sqrt,  
randomforestclassifier__min_samples_leaf=1,  
randomforestclassifier__min_samples_split=4,  
randomforestclassifier__n_estimators=50;; score=0.826 total time=  
2.8s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\  
preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to  
`sparse_output` in version 1.2 and will be removed in 1.4.  
`sparse_output` is ignored unless you leave `sparse` to its default  
value.  
warnings.warn(
```

```
[CV 4/5] END randomforestclassifier__criterion=entropy,  
randomforestclassifier__max_features=sqrt,  
randomforestclassifier__min_samples_leaf=1,  
randomforestclassifier__min_samples_split=4,  
randomforestclassifier__n_estimators=50;; score=0.831 total time=  
2.8s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\  
preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to  
`sparse_output` in version 1.2 and will be removed in 1.4.  
`sparse_output` is ignored unless you leave `sparse` to its default  
value.  
warnings.warn(
```

```
[CV 5/5] END randomforestclassifier__criterion=entropy,  
randomforestclassifier__max_features=sqrt,  
randomforestclassifier__min_samples_leaf=1,  
randomforestclassifier__min_samples_split=4,  
randomforestclassifier__n_estimators=50;; score=0.843 total time=  
2.7s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\  
preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to
```

```
`sparse_output` in version 1.2 and will be removed in 1.4.  
`sparse_output` is ignored unless you leave `sparse` to its default  
value.
```

```
warnings.warn()
```

```
[CV 1/5] END randomforestclassifier__criterion=entropy,  
randomforestclassifier__max_features=sqrt,  
randomforestclassifier__min_samples_leaf=1,  
randomforestclassifier__min_samples_split=4,  
randomforestclassifier__n_estimators=100;; score=0.832 total time=  
5.4s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\  
preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to  
`sparse_output` in version 1.2 and will be removed in 1.4.  
`sparse_output` is ignored unless you leave `sparse` to its default  
value.
```

```
warnings.warn()
```

```
[CV 2/5] END randomforestclassifier__criterion=entropy,  
randomforestclassifier__max_features=sqrt,  
randomforestclassifier__min_samples_leaf=1,  
randomforestclassifier__min_samples_split=4,  
randomforestclassifier__n_estimators=100;; score=0.836 total time=  
5.5s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\  
preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to  
`sparse_output` in version 1.2 and will be removed in 1.4.  
`sparse_output` is ignored unless you leave `sparse` to its default  
value.
```

```
warnings.warn()
```

```
[CV 3/5] END randomforestclassifier__criterion=entropy,  
randomforestclassifier__max_features=sqrt,  
randomforestclassifier__min_samples_leaf=1,  
randomforestclassifier__min_samples_split=4,  
randomforestclassifier__n_estimators=100;; score=0.818 total time=  
5.4s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\  
preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to  
`sparse_output` in version 1.2 and will be removed in 1.4.  
`sparse_output` is ignored unless you leave `sparse` to its default  
value.
```

```
warnings.warn()
```

```
[CV 4/5] END randomforestclassifier__criterion=entropy,  
randomforestclassifier__max_features=sqrt,  
randomforestclassifier__min_samples_leaf=1,  
randomforestclassifier__min_samples_split=4,
```

```
randomforestclassifier__n_estimators=100;; score=0.829 total time=5.2s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to `sparse_output` in version 1.2 and will be removed in 1.4. `sparse_output` is ignored unless you leave `sparse` to its default value.
```

```
warnings.warn(
```

```
[CV 5/5] END randomforestclassifier__criterion=entropy, randomforestclassifier__max_features=sqrt, randomforestclassifier__min_samples_leaf=1, randomforestclassifier__min_samples_split=4, randomforestclassifier__n_estimators=100;; score=0.836 total time=5.7s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to `sparse_output` in version 1.2 and will be removed in 1.4. `sparse_output` is ignored unless you leave `sparse` to its default value.
```

```
warnings.warn(
```

```
[CV 1/5] END randomforestclassifier__criterion=entropy, randomforestclassifier__max_features=sqrt, randomforestclassifier__min_samples_leaf=1, randomforestclassifier__min_samples_split=4, randomforestclassifier__n_estimators=150;; score=0.838 total time=8.3s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to `sparse_output` in version 1.2 and will be removed in 1.4. `sparse_output` is ignored unless you leave `sparse` to its default value.
```

```
warnings.warn(
```

```
[CV 2/5] END randomforestclassifier__criterion=entropy, randomforestclassifier__max_features=sqrt, randomforestclassifier__min_samples_leaf=1, randomforestclassifier__min_samples_split=4, randomforestclassifier__n_estimators=150;; score=0.837 total time=8.5s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to `sparse_output` in version 1.2 and will be removed in 1.4. `sparse_output` is ignored unless you leave `sparse` to its default value.
```

```
warnings.warn(
```

```
[CV 3/5] END randomforestclassifier__criterion=entropy,  
randomforestclassifier__max_features=sqrt,  
randomforestclassifier__min_samples_leaf=1,  
randomforestclassifier__min_samples_split=4,  
randomforestclassifier__n_estimators=150;; score=0.824 total time=  
8.1s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\  
preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to  
`sparse_output` in version 1.2 and will be removed in 1.4.  
`sparse_output` is ignored unless you leave `sparse` to its default  
value.
```

```
warnings.warn(
```

```
[CV 4/5] END randomforestclassifier__criterion=entropy,  
randomforestclassifier__max_features=sqrt,  
randomforestclassifier__min_samples_leaf=1,  
randomforestclassifier__min_samples_split=4,  
randomforestclassifier__n_estimators=150;; score=0.828 total time=  
8.4s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\  
preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to  
`sparse_output` in version 1.2 and will be removed in 1.4.  
`sparse_output` is ignored unless you leave `sparse` to its default  
value.
```

```
warnings.warn(
```

```
[CV 5/5] END randomforestclassifier__criterion=entropy,  
randomforestclassifier__max_features=sqrt,  
randomforestclassifier__min_samples_leaf=1,  
randomforestclassifier__min_samples_split=4,  
randomforestclassifier__n_estimators=150;; score=0.844 total time=  
8.0s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\  
preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to  
`sparse_output` in version 1.2 and will be removed in 1.4.  
`sparse_output` is ignored unless you leave `sparse` to its default  
value.
```

```
warnings.warn(
```

```
[CV 1/5] END randomforestclassifier__criterion=entropy,  
randomforestclassifier__max_features=sqrt,  
randomforestclassifier__min_samples_leaf=5,  
randomforestclassifier__min_samples_split=2,  
randomforestclassifier__n_estimators=50;; score=0.834 total time=  
2.3s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\  
preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to
```

```
`sparse_output` in version 1.2 and will be removed in 1.4.  
`sparse_output` is ignored unless you leave `sparse` to its default  
value.
```

```
warnings.warn()
```

```
[CV 2/5] END randomforestclassifier__criterion=entropy,  
randomforestclassifier__max_features=sqrt,  
randomforestclassifier__min_samples_leaf=5,  
randomforestclassifier__min_samples_split=2,  
randomforestclassifier__n_estimators=50;; score=0.825 total time=  
2.5s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\  
preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to  
`sparse_output` in version 1.2 and will be removed in 1.4.  
`sparse_output` is ignored unless you leave `sparse` to its default  
value.
```

```
warnings.warn()
```

```
[CV 3/5] END randomforestclassifier__criterion=entropy,  
randomforestclassifier__max_features=sqrt,  
randomforestclassifier__min_samples_leaf=5,  
randomforestclassifier__min_samples_split=2,  
randomforestclassifier__n_estimators=50;; score=0.808 total time=  
2.5s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\  
preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to  
`sparse_output` in version 1.2 and will be removed in 1.4.  
`sparse_output` is ignored unless you leave `sparse` to its default  
value.
```

```
warnings.warn()
```

```
[CV 4/5] END randomforestclassifier__criterion=entropy,  
randomforestclassifier__max_features=sqrt,  
randomforestclassifier__min_samples_leaf=5,  
randomforestclassifier__min_samples_split=2,  
randomforestclassifier__n_estimators=50;; score=0.819 total time=  
2.4s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\  
preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to  
`sparse_output` in version 1.2 and will be removed in 1.4.  
`sparse_output` is ignored unless you leave `sparse` to its default  
value.
```

```
warnings.warn()
```

```
[CV 5/5] END randomforestclassifier__criterion=entropy,  
randomforestclassifier__max_features=sqrt,  
randomforestclassifier__min_samples_leaf=5,  
randomforestclassifier__min_samples_split=2,
```



```
randomforestclassifier__n_estimators=50;; score=0.831 total time=2.5s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to `sparse_output` in version 1.2 and will be removed in 1.4. `sparse_output` is ignored unless you leave `sparse` to its default value.
```

```
warnings.warn(
```

```
[CV 1/5] END randomforestclassifier__criterion=entropy, randomforestclassifier__max_features=sqrt, randomforestclassifier__min_samples_leaf=5, randomforestclassifier__min_samples_split=2, randomforestclassifier__n_estimators=100;; score=0.825 total time=4.7s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to `sparse_output` in version 1.2 and will be removed in 1.4. `sparse_output` is ignored unless you leave `sparse` to its default value.
```

```
warnings.warn(
```

```
[CV 2/5] END randomforestclassifier__criterion=entropy, randomforestclassifier__max_features=sqrt, randomforestclassifier__min_samples_leaf=5, randomforestclassifier__min_samples_split=2, randomforestclassifier__n_estimators=100;; score=0.830 total time=5.0s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to `sparse_output` in version 1.2 and will be removed in 1.4. `sparse_output` is ignored unless you leave `sparse` to its default value.
```

```
warnings.warn(
```

```
[CV 3/5] END randomforestclassifier__criterion=entropy, randomforestclassifier__max_features=sqrt, randomforestclassifier__min_samples_leaf=5, randomforestclassifier__min_samples_split=2, randomforestclassifier__n_estimators=100;; score=0.813 total time=4.7s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to `sparse_output` in version 1.2 and will be removed in 1.4. `sparse_output` is ignored unless you leave `sparse` to its default value.
```

```
warnings.warn(
```

```
[CV 4/5] END randomforestclassifier__criterion=entropy,  
randomforestclassifier__max_features=sqrt,  
randomforestclassifier__min_samples_leaf=5,  
randomforestclassifier__min_samples_split=2,  
randomforestclassifier__n_estimators=100;; score=0.830 total time=  
4.6s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\  
preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to  
`sparse_output` in version 1.2 and will be removed in 1.4.  
`sparse_output` is ignored unless you leave `sparse` to its default  
value.
```

```
warnings.warn(
```

```
[CV 5/5] END randomforestclassifier__criterion=entropy,  
randomforestclassifier__max_features=sqrt,  
randomforestclassifier__min_samples_leaf=5,  
randomforestclassifier__min_samples_split=2,  
randomforestclassifier__n_estimators=100;; score=0.835 total time=  
4.8s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\  
preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to  
`sparse_output` in version 1.2 and will be removed in 1.4.  
`sparse_output` is ignored unless you leave `sparse` to its default  
value.
```

```
warnings.warn(
```

```
[CV 1/5] END randomforestclassifier__criterion=entropy,  
randomforestclassifier__max_features=sqrt,  
randomforestclassifier__min_samples_leaf=5,  
randomforestclassifier__min_samples_split=2,  
randomforestclassifier__n_estimators=150;; score=0.832 total time=  
7.4s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\  
preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to  
`sparse_output` in version 1.2 and will be removed in 1.4.  
`sparse_output` is ignored unless you leave `sparse` to its default  
value.
```

```
warnings.warn(
```

```
[CV 2/5] END randomforestclassifier__criterion=entropy,  
randomforestclassifier__max_features=sqrt,  
randomforestclassifier__min_samples_leaf=5,  
randomforestclassifier__min_samples_split=2,  
randomforestclassifier__n_estimators=150;; score=0.833 total time=  
7.1s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\  
preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to
```

```
`sparse_output` in version 1.2 and will be removed in 1.4.  
`sparse_output` is ignored unless you leave `sparse` to its default  
value.
```

```
warnings.warn()
```

```
[CV 3/5] END randomforestclassifier__criterion=entropy,  
randomforestclassifier__max_features=sqrt,  
randomforestclassifier__min_samples_leaf=5,  
randomforestclassifier__min_samples_split=2,  
randomforestclassifier__n_estimators=150;; score=0.812 total time=  
7.2s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\  
preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to  
`sparse_output` in version 1.2 and will be removed in 1.4.  
`sparse_output` is ignored unless you leave `sparse` to its default  
value.
```

```
warnings.warn()
```

```
[CV 4/5] END randomforestclassifier__criterion=entropy,  
randomforestclassifier__max_features=sqrt,  
randomforestclassifier__min_samples_leaf=5,  
randomforestclassifier__min_samples_split=2,  
randomforestclassifier__n_estimators=150;; score=0.824 total time=  
7.0s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\  
preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to  
`sparse_output` in version 1.2 and will be removed in 1.4.  
`sparse_output` is ignored unless you leave `sparse` to its default  
value.
```

```
warnings.warn()
```

```
[CV 5/5] END randomforestclassifier__criterion=entropy,  
randomforestclassifier__max_features=sqrt,  
randomforestclassifier__min_samples_leaf=5,  
randomforestclassifier__min_samples_split=2,  
randomforestclassifier__n_estimators=150;; score=0.841 total time=  
7.4s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\  
preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to  
`sparse_output` in version 1.2 and will be removed in 1.4.  
`sparse_output` is ignored unless you leave `sparse` to its default  
value.
```

```
warnings.warn()
```

```
[CV 1/5] END randomforestclassifier__criterion=entropy,  
randomforestclassifier__max_features=sqrt,  
randomforestclassifier__min_samples_leaf=5,  
randomforestclassifier__min_samples_split=3,
```

```
randomforestclassifier__n_estimators=50;; score=0.832 total time=2.4s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to `sparse_output` in version 1.2 and will be removed in 1.4. `sparse_output` is ignored unless you leave `sparse` to its default value.
```

```
warnings.warn(
```

```
[CV 2/5] END randomforestclassifier__criterion=entropy, randomforestclassifier__max_features=sqrt, randomforestclassifier__min_samples_leaf=5, randomforestclassifier__min_samples_split=3, randomforestclassifier__n_estimators=50;; score=0.829 total time=2.3s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to `sparse_output` in version 1.2 and will be removed in 1.4. `sparse_output` is ignored unless you leave `sparse` to its default value.
```

```
warnings.warn(
```

```
[CV 3/5] END randomforestclassifier__criterion=entropy, randomforestclassifier__max_features=sqrt, randomforestclassifier__min_samples_leaf=5, randomforestclassifier__min_samples_split=3, randomforestclassifier__n_estimators=50;; score=0.814 total time=2.3s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to `sparse_output` in version 1.2 and will be removed in 1.4. `sparse_output` is ignored unless you leave `sparse` to its default value.
```

```
warnings.warn(
```

```
[CV 4/5] END randomforestclassifier__criterion=entropy, randomforestclassifier__max_features=sqrt, randomforestclassifier__min_samples_leaf=5, randomforestclassifier__min_samples_split=3, randomforestclassifier__n_estimators=50;; score=0.822 total time=2.4s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to `sparse_output` in version 1.2 and will be removed in 1.4. `sparse_output` is ignored unless you leave `sparse` to its default value.
```

```
warnings.warn(
```

```
[CV 5/5] END randomforestclassifier__criterion=entropy,  
randomforestclassifier__max_features=sqrt,  
randomforestclassifier__min_samples_leaf=5,  
randomforestclassifier__min_samples_split=3,  
randomforestclassifier__n_estimators=50;; score=0.841 total time=  
2.4s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\  
preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to  
`sparse_output` in version 1.2 and will be removed in 1.4.  
`sparse_output` is ignored unless you leave `sparse` to its default  
value.
```

```
warnings.warn(
```

```
[CV 1/5] END randomforestclassifier__criterion=entropy,  
randomforestclassifier__max_features=sqrt,  
randomforestclassifier__min_samples_leaf=5,  
randomforestclassifier__min_samples_split=3,  
randomforestclassifier__n_estimators=100;; score=0.840 total time=  
4.8s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\  
preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to  
`sparse_output` in version 1.2 and will be removed in 1.4.  
`sparse_output` is ignored unless you leave `sparse` to its default  
value.
```

```
warnings.warn(
```

```
[CV 2/5] END randomforestclassifier__criterion=entropy,  
randomforestclassifier__max_features=sqrt,  
randomforestclassifier__min_samples_leaf=5,  
randomforestclassifier__min_samples_split=3,  
randomforestclassifier__n_estimators=100;; score=0.832 total time=  
4.7s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\  
preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to  
`sparse_output` in version 1.2 and will be removed in 1.4.  
`sparse_output` is ignored unless you leave `sparse` to its default  
value.
```

```
warnings.warn(
```

```
[CV 3/5] END randomforestclassifier__criterion=entropy,  
randomforestclassifier__max_features=sqrt,  
randomforestclassifier__min_samples_leaf=5,  
randomforestclassifier__min_samples_split=3,  
randomforestclassifier__n_estimators=100;; score=0.812 total time=  
4.8s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\  
preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to
```

```
`sparse_output` in version 1.2 and will be removed in 1.4.  
`sparse_output` is ignored unless you leave `sparse` to its default  
value.
```

```
warnings.warn()
```

```
[CV 4/5] END randomforestclassifier__criterion=entropy,  
randomforestclassifier__max_features=sqrt,  
randomforestclassifier__min_samples_leaf=5,  
randomforestclassifier__min_samples_split=3,  
randomforestclassifier__n_estimators=100;; score=0.819 total time=  
5.0s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\  
preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to  
`sparse_output` in version 1.2 and will be removed in 1.4.  
`sparse_output` is ignored unless you leave `sparse` to its default  
value.
```

```
warnings.warn()
```

```
[CV 5/5] END randomforestclassifier__criterion=entropy,  
randomforestclassifier__max_features=sqrt,  
randomforestclassifier__min_samples_leaf=5,  
randomforestclassifier__min_samples_split=3,  
randomforestclassifier__n_estimators=100;; score=0.839 total time=  
4.6s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\  
preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to  
`sparse_output` in version 1.2 and will be removed in 1.4.  
`sparse_output` is ignored unless you leave `sparse` to its default  
value.
```

```
warnings.warn()
```

```
[CV 1/5] END randomforestclassifier__criterion=entropy,  
randomforestclassifier__max_features=sqrt,  
randomforestclassifier__min_samples_leaf=5,  
randomforestclassifier__min_samples_split=3,  
randomforestclassifier__n_estimators=150;; score=0.839 total time=  
7.4s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\  
preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to  
`sparse_output` in version 1.2 and will be removed in 1.4.  
`sparse_output` is ignored unless you leave `sparse` to its default  
value.
```

```
warnings.warn()
```

```
[CV 2/5] END randomforestclassifier__criterion=entropy,  
randomforestclassifier__max_features=sqrt,  
randomforestclassifier__min_samples_leaf=5,  
randomforestclassifier__min_samples_split=3,
```

```
randomforestclassifier__n_estimators=150;; score=0.829 total time=7.5s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to `sparse_output` in version 1.2 and will be removed in 1.4. `sparse_output` is ignored unless you leave `sparse` to its default value.
```

```
warnings.warn(
```

```
[CV 3/5] END randomforestclassifier__criterion=entropy, randomforestclassifier__max_features=sqrt, randomforestclassifier__min_samples_leaf=5, randomforestclassifier__min_samples_split=3, randomforestclassifier__n_estimators=150;; score=0.812 total time=7.4s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to `sparse_output` in version 1.2 and will be removed in 1.4. `sparse_output` is ignored unless you leave `sparse` to its default value.
```

```
warnings.warn(
```

```
[CV 4/5] END randomforestclassifier__criterion=entropy, randomforestclassifier__max_features=sqrt, randomforestclassifier__min_samples_leaf=5, randomforestclassifier__min_samples_split=3, randomforestclassifier__n_estimators=150;; score=0.827 total time=7.4s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to `sparse_output` in version 1.2 and will be removed in 1.4. `sparse_output` is ignored unless you leave `sparse` to its default value.
```

```
warnings.warn(
```

```
[CV 5/5] END randomforestclassifier__criterion=entropy, randomforestclassifier__max_features=sqrt, randomforestclassifier__min_samples_leaf=5, randomforestclassifier__min_samples_split=3, randomforestclassifier__n_estimators=150;; score=0.839 total time=7.3s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to `sparse_output` in version 1.2 and will be removed in 1.4. `sparse_output` is ignored unless you leave `sparse` to its default value.
```

```
warnings.warn(
```

```
[CV 1/5] END randomforestclassifier__criterion=entropy,  
randomforestclassifier__max_features=sqrt,  
randomforestclassifier__min_samples_leaf=5,  
randomforestclassifier__min_samples_split=4,  
randomforestclassifier__n_estimators=50;; score=0.834 total time=  
2.4s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\  
preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to  
`sparse_output` in version 1.2 and will be removed in 1.4.  
`sparse_output` is ignored unless you leave `sparse` to its default  
value.  
  warnings.warn(
```

```
[CV 2/5] END randomforestclassifier__criterion=entropy,  
randomforestclassifier__max_features=sqrt,  
randomforestclassifier__min_samples_leaf=5,  
randomforestclassifier__min_samples_split=4,  
randomforestclassifier__n_estimators=50;; score=0.823 total time=  
2.4s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\  
preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to  
`sparse_output` in version 1.2 and will be removed in 1.4.  
`sparse_output` is ignored unless you leave `sparse` to its default  
value.  
  warnings.warn(
```

```
[CV 3/5] END randomforestclassifier__criterion=entropy,  
randomforestclassifier__max_features=sqrt,  
randomforestclassifier__min_samples_leaf=5,  
randomforestclassifier__min_samples_split=4,  
randomforestclassifier__n_estimators=50;; score=0.804 total time=  
2.4s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\  
preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to  
`sparse_output` in version 1.2 and will be removed in 1.4.  
`sparse_output` is ignored unless you leave `sparse` to its default  
value.  
  warnings.warn(
```

```
[CV 4/5] END randomforestclassifier__criterion=entropy,  
randomforestclassifier__max_features=sqrt,  
randomforestclassifier__min_samples_leaf=5,  
randomforestclassifier__min_samples_split=4,  
randomforestclassifier__n_estimators=50;; score=0.814 total time=  
2.4s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\  
preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to
```



```
`sparse_output` in version 1.2 and will be removed in 1.4.  
`sparse_output` is ignored unless you leave `sparse` to its default  
value.
```

```
warnings.warn()
```

```
[CV 5/5] END randomforestclassifier__criterion=entropy,  
randomforestclassifier__max_features=sqrt,  
randomforestclassifier__min_samples_leaf=5,  
randomforestclassifier__min_samples_split=4,  
randomforestclassifier__n_estimators=50;; score=0.830 total time=  
2.4s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\  
preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to  
`sparse_output` in version 1.2 and will be removed in 1.4.  
`sparse_output` is ignored unless you leave `sparse` to its default  
value.
```

```
warnings.warn()
```

```
[CV 1/5] END randomforestclassifier__criterion=entropy,  
randomforestclassifier__max_features=sqrt,  
randomforestclassifier__min_samples_leaf=5,  
randomforestclassifier__min_samples_split=4,  
randomforestclassifier__n_estimators=100;; score=0.837 total time=  
4.9s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\  
preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to  
`sparse_output` in version 1.2 and will be removed in 1.4.  
`sparse_output` is ignored unless you leave `sparse` to its default  
value.
```

```
warnings.warn()
```

```
[CV 2/5] END randomforestclassifier__criterion=entropy,  
randomforestclassifier__max_features=sqrt,  
randomforestclassifier__min_samples_leaf=5,  
randomforestclassifier__min_samples_split=4,  
randomforestclassifier__n_estimators=100;; score=0.827 total time=  
4.8s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\  
preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to  
`sparse_output` in version 1.2 and will be removed in 1.4.  
`sparse_output` is ignored unless you leave `sparse` to its default  
value.
```

```
warnings.warn()
```

```
[CV 3/5] END randomforestclassifier__criterion=entropy,  
randomforestclassifier__max_features=sqrt,  
randomforestclassifier__min_samples_leaf=5,  
randomforestclassifier__min_samples_split=4,
```

```
randomforestclassifier__n_estimators=100;; score=0.811 total time=4.6s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to `sparse_output` in version 1.2 and will be removed in 1.4.  
`sparse_output` is ignored unless you leave `sparse` to its default value.
```

```
warnings.warn(
```

```
[CV 4/5] END randomforestclassifier__criterion=entropy,  
randomforestclassifier__max_features=sqrt,  
randomforestclassifier__min_samples_leaf=5,  
randomforestclassifier__min_samples_split=4,  
randomforestclassifier__n_estimators=100;; score=0.823 total time=4.8s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to `sparse_output` in version 1.2 and will be removed in 1.4.  
`sparse_output` is ignored unless you leave `sparse` to its default value.
```

```
warnings.warn(
```

```
[CV 5/5] END randomforestclassifier__criterion=entropy,  
randomforestclassifier__max_features=sqrt,  
randomforestclassifier__min_samples_leaf=5,  
randomforestclassifier__min_samples_split=4,  
randomforestclassifier__n_estimators=100;; score=0.836 total time=4.9s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to `sparse_output` in version 1.2 and will be removed in 1.4.  
`sparse_output` is ignored unless you leave `sparse` to its default value.
```

```
warnings.warn(
```

```
[CV 1/5] END randomforestclassifier__criterion=entropy,  
randomforestclassifier__max_features=sqrt,  
randomforestclassifier__min_samples_leaf=5,  
randomforestclassifier__min_samples_split=4,  
randomforestclassifier__n_estimators=150;; score=0.831 total time=7.3s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to `sparse_output` in version 1.2 and will be removed in 1.4.  
`sparse_output` is ignored unless you leave `sparse` to its default value.
```

```
warnings.warn(
```

```
[CV 2/5] END randomforestclassifier__criterion=entropy,  
randomforestclassifier__max_features=sqrt,  
randomforestclassifier__min_samples_leaf=5,  
randomforestclassifier__min_samples_split=4,  
randomforestclassifier__n_estimators=150;; score=0.829 total time=  
7.2s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\  
preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to  
`sparse_output` in version 1.2 and will be removed in 1.4.  
`sparse_output` is ignored unless you leave `sparse` to its default  
value.
```

```
warnings.warn(
```

```
[CV 3/5] END randomforestclassifier__criterion=entropy,  
randomforestclassifier__max_features=sqrt,  
randomforestclassifier__min_samples_leaf=5,  
randomforestclassifier__min_samples_split=4,  
randomforestclassifier__n_estimators=150;; score=0.806 total time=  
7.2s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\  
preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to  
`sparse_output` in version 1.2 and will be removed in 1.4.  
`sparse_output` is ignored unless you leave `sparse` to its default  
value.
```

```
warnings.warn(
```

```
[CV 4/5] END randomforestclassifier__criterion=entropy,  
randomforestclassifier__max_features=sqrt,  
randomforestclassifier__min_samples_leaf=5,  
randomforestclassifier__min_samples_split=4,  
randomforestclassifier__n_estimators=150;; score=0.821 total time=  
7.4s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\  
preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to  
`sparse_output` in version 1.2 and will be removed in 1.4.  
`sparse_output` is ignored unless you leave `sparse` to its default  
value.
```

```
warnings.warn(
```

```
[CV 5/5] END randomforestclassifier__criterion=entropy,  
randomforestclassifier__max_features=sqrt,  
randomforestclassifier__min_samples_leaf=5,  
randomforestclassifier__min_samples_split=4,  
randomforestclassifier__n_estimators=150;; score=0.840 total time=  
7.9s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\  
preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to
```

```
`sparse_output` in version 1.2 and will be removed in 1.4.  
`sparse_output` is ignored unless you leave `sparse` to its default  
value.
```

```
warnings.warn()
```

```
[CV 1/5] END randomforestclassifier__criterion=entropy,  
randomforestclassifier__max_features=sqrt,  
randomforestclassifier__min_samples_leaf=10,  
randomforestclassifier__min_samples_split=2,  
randomforestclassifier__n_estimators=50;; score=0.824 total time=  
2.2s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\  
preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to  
`sparse_output` in version 1.2 and will be removed in 1.4.  
`sparse_output` is ignored unless you leave `sparse` to its default  
value.
```

```
warnings.warn()
```

```
[CV 2/5] END randomforestclassifier__criterion=entropy,  
randomforestclassifier__max_features=sqrt,  
randomforestclassifier__min_samples_leaf=10,  
randomforestclassifier__min_samples_split=2,  
randomforestclassifier__n_estimators=50;; score=0.824 total time=  
2.2s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\  
preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to  
`sparse_output` in version 1.2 and will be removed in 1.4.  
`sparse_output` is ignored unless you leave `sparse` to its default  
value.
```

```
warnings.warn()
```

```
[CV 3/5] END randomforestclassifier__criterion=entropy,  
randomforestclassifier__max_features=sqrt,  
randomforestclassifier__min_samples_leaf=10,  
randomforestclassifier__min_samples_split=2,  
randomforestclassifier__n_estimators=50;; score=0.812 total time=  
2.2s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\  
preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to  
`sparse_output` in version 1.2 and will be removed in 1.4.  
`sparse_output` is ignored unless you leave `sparse` to its default  
value.
```

```
warnings.warn()
```

```
[CV 4/5] END randomforestclassifier__criterion=entropy,  
randomforestclassifier__max_features=sqrt,  
randomforestclassifier__min_samples_leaf=10,  
randomforestclassifier__min_samples_split=2,
```

```
randomforestclassifier__n_estimators=50;; score=0.818 total time=2.2s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to `sparse_output` in version 1.2 and will be removed in 1.4. `sparse_output` is ignored unless you leave `sparse` to its default value.
```

```
warnings.warn(
```

```
[CV 5/5] END randomforestclassifier__criterion=entropy, randomforestclassifier__max_features=sqrt, randomforestclassifier__min_samples_leaf=10, randomforestclassifier__min_samples_split=2, randomforestclassifier__n_estimators=50;; score=0.835 total time=2.3s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to `sparse_output` in version 1.2 and will be removed in 1.4. `sparse_output` is ignored unless you leave `sparse` to its default value.
```

```
warnings.warn(
```

```
[CV 1/5] END randomforestclassifier__criterion=entropy, randomforestclassifier__max_features=sqrt, randomforestclassifier__min_samples_leaf=10, randomforestclassifier__min_samples_split=2, randomforestclassifier__n_estimators=100;; score=0.832 total time=4.7s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to `sparse_output` in version 1.2 and will be removed in 1.4. `sparse_output` is ignored unless you leave `sparse` to its default value.
```

```
warnings.warn(
```

```
[CV 2/5] END randomforestclassifier__criterion=entropy, randomforestclassifier__max_features=sqrt, randomforestclassifier__min_samples_leaf=10, randomforestclassifier__min_samples_split=2, randomforestclassifier__n_estimators=100;; score=0.823 total time=5.0s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to `sparse_output` in version 1.2 and will be removed in 1.4. `sparse_output` is ignored unless you leave `sparse` to its default value.
```

```
warnings.warn(
```

```
[CV 3/5] END randomforestclassifier__criterion=entropy,  
randomforestclassifier__max_features=sqrt,  
randomforestclassifier__min_samples_leaf=10,  
randomforestclassifier__min_samples_split=2,  
randomforestclassifier__n_estimators=100;; score=0.806 total time=  
4.7s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\  
preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to  
`sparse_output` in version 1.2 and will be removed in 1.4.  
`sparse_output` is ignored unless you leave `sparse` to its default  
value.
```

```
warnings.warn(
```

```
[CV 4/5] END randomforestclassifier__criterion=entropy,  
randomforestclassifier__max_features=sqrt,  
randomforestclassifier__min_samples_leaf=10,  
randomforestclassifier__min_samples_split=2,  
randomforestclassifier__n_estimators=100;; score=0.821 total time=  
4.6s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\  
preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to  
`sparse_output` in version 1.2 and will be removed in 1.4.  
`sparse_output` is ignored unless you leave `sparse` to its default  
value.
```

```
warnings.warn(
```

```
[CV 5/5] END randomforestclassifier__criterion=entropy,  
randomforestclassifier__max_features=sqrt,  
randomforestclassifier__min_samples_leaf=10,  
randomforestclassifier__min_samples_split=2,  
randomforestclassifier__n_estimators=100;; score=0.828 total time=  
4.6s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\  
preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to  
`sparse_output` in version 1.2 and will be removed in 1.4.  
`sparse_output` is ignored unless you leave `sparse` to its default  
value.
```

```
warnings.warn(
```

```
[CV 1/5] END randomforestclassifier__criterion=entropy,  
randomforestclassifier__max_features=sqrt,  
randomforestclassifier__min_samples_leaf=10,  
randomforestclassifier__min_samples_split=2,  
randomforestclassifier__n_estimators=150;; score=0.825 total time=  
6.8s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\  
preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to
```

```
`sparse_output` in version 1.2 and will be removed in 1.4.  
`sparse_output` is ignored unless you leave `sparse` to its default  
value.
```

```
warnings.warn()
```

```
[CV 2/5] END randomforestclassifier__criterion=entropy,  
randomforestclassifier__max_features=sqrt,  
randomforestclassifier__min_samples_leaf=10,  
randomforestclassifier__min_samples_split=2,  
randomforestclassifier__n_estimators=150;; score=0.824 total time=  
6.5s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\  
preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to  
`sparse_output` in version 1.2 and will be removed in 1.4.  
`sparse_output` is ignored unless you leave `sparse` to its default  
value.
```

```
warnings.warn()
```

```
[CV 3/5] END randomforestclassifier__criterion=entropy,  
randomforestclassifier__max_features=sqrt,  
randomforestclassifier__min_samples_leaf=10,  
randomforestclassifier__min_samples_split=2,  
randomforestclassifier__n_estimators=150;; score=0.812 total time=  
6.6s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\  
preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to  
`sparse_output` in version 1.2 and will be removed in 1.4.  
`sparse_output` is ignored unless you leave `sparse` to its default  
value.
```

```
warnings.warn()
```

```
[CV 4/5] END randomforestclassifier__criterion=entropy,  
randomforestclassifier__max_features=sqrt,  
randomforestclassifier__min_samples_leaf=10,  
randomforestclassifier__min_samples_split=2,  
randomforestclassifier__n_estimators=150;; score=0.824 total time=  
6.4s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\  
preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to  
`sparse_output` in version 1.2 and will be removed in 1.4.  
`sparse_output` is ignored unless you leave `sparse` to its default  
value.
```

```
warnings.warn()
```

```
[CV 5/5] END randomforestclassifier__criterion=entropy,  
randomforestclassifier__max_features=sqrt,  
randomforestclassifier__min_samples_leaf=10,  
randomforestclassifier__min_samples_split=2,
```

```
randomforestclassifier__n_estimators=150;; score=0.831 total time=6.5s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to `sparse_output` in version 1.2 and will be removed in 1.4. `sparse_output` is ignored unless you leave `sparse` to its default value.
```

```
warnings.warn(
```

```
[CV 1/5] END randomforestclassifier__criterion=entropy,  
randomforestclassifier__max_features=sqrt,  
randomforestclassifier__min_samples_leaf=10,  
randomforestclassifier__min_samples_split=3,  
randomforestclassifier__n_estimators=50;; score=0.836 total time=2.4s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to `sparse_output` in version 1.2 and will be removed in 1.4. `sparse_output` is ignored unless you leave `sparse` to its default value.
```

```
warnings.warn(
```

```
[CV 2/5] END randomforestclassifier__criterion=entropy,  
randomforestclassifier__max_features=sqrt,  
randomforestclassifier__min_samples_leaf=10,  
randomforestclassifier__min_samples_split=3,  
randomforestclassifier__n_estimators=50;; score=0.824 total time=2.3s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to `sparse_output` in version 1.2 and will be removed in 1.4. `sparse_output` is ignored unless you leave `sparse` to its default value.
```

```
warnings.warn(
```

```
[CV 3/5] END randomforestclassifier__criterion=entropy,  
randomforestclassifier__max_features=sqrt,  
randomforestclassifier__min_samples_leaf=10,  
randomforestclassifier__min_samples_split=3,  
randomforestclassifier__n_estimators=50;; score=0.804 total time=2.1s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to `sparse_output` in version 1.2 and will be removed in 1.4. `sparse_output` is ignored unless you leave `sparse` to its default value.
```

```
warnings.warn(
```



```
[CV 4/5] END randomforestclassifier__criterion=entropy,  
randomforestclassifier__max_features=sqrt,  
randomforestclassifier__min_samples_leaf=10,  
randomforestclassifier__min_samples_split=3,  
randomforestclassifier__n_estimators=50;; score=0.818 total time=  
2.1s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\  
preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to  
`sparse_output` in version 1.2 and will be removed in 1.4.  
`sparse_output` is ignored unless you leave `sparse` to its default  
value.
```

```
warnings.warn(
```

```
[CV 5/5] END randomforestclassifier__criterion=entropy,  
randomforestclassifier__max_features=sqrt,  
randomforestclassifier__min_samples_leaf=10,  
randomforestclassifier__min_samples_split=3,  
randomforestclassifier__n_estimators=50;; score=0.825 total time=  
2.2s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\  
preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to  
`sparse_output` in version 1.2 and will be removed in 1.4.  
`sparse_output` is ignored unless you leave `sparse` to its default  
value.
```

```
warnings.warn(
```

```
[CV 1/5] END randomforestclassifier__criterion=entropy,  
randomforestclassifier__max_features=sqrt,  
randomforestclassifier__min_samples_leaf=10,  
randomforestclassifier__min_samples_split=3,  
randomforestclassifier__n_estimators=100;; score=0.830 total time=  
4.5s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\  
preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to  
`sparse_output` in version 1.2 and will be removed in 1.4.  
`sparse_output` is ignored unless you leave `sparse` to its default  
value.
```

```
warnings.warn(
```

```
[CV 2/5] END randomforestclassifier__criterion=entropy,  
randomforestclassifier__max_features=sqrt,  
randomforestclassifier__min_samples_leaf=10,  
randomforestclassifier__min_samples_split=3,  
randomforestclassifier__n_estimators=100;; score=0.816 total time=  
4.4s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\  
preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to
```

```
`sparse_output` in version 1.2 and will be removed in 1.4.  
`sparse_output` is ignored unless you leave `sparse` to its default  
value.
```

```
warnings.warn()
```

```
[CV 3/5] END randomforestclassifier__criterion=entropy,  
randomforestclassifier__max_features=sqrt,  
randomforestclassifier__min_samples_leaf=10,  
randomforestclassifier__min_samples_split=3,  
randomforestclassifier__n_estimators=100;; score=0.805 total time=  
4.2s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\  
preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to  
`sparse_output` in version 1.2 and will be removed in 1.4.  
`sparse_output` is ignored unless you leave `sparse` to its default  
value.
```

```
warnings.warn()
```

```
[CV 4/5] END randomforestclassifier__criterion=entropy,  
randomforestclassifier__max_features=sqrt,  
randomforestclassifier__min_samples_leaf=10,  
randomforestclassifier__min_samples_split=3,  
randomforestclassifier__n_estimators=100;; score=0.824 total time=  
4.2s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\  
preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to  
`sparse_output` in version 1.2 and will be removed in 1.4.  
`sparse_output` is ignored unless you leave `sparse` to its default  
value.
```

```
warnings.warn()
```

```
[CV 5/5] END randomforestclassifier__criterion=entropy,  
randomforestclassifier__max_features=sqrt,  
randomforestclassifier__min_samples_leaf=10,  
randomforestclassifier__min_samples_split=3,  
randomforestclassifier__n_estimators=100;; score=0.828 total time=  
4.4s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\  
preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to  
`sparse_output` in version 1.2 and will be removed in 1.4.  
`sparse_output` is ignored unless you leave `sparse` to its default  
value.
```

```
warnings.warn()
```

```
[CV 1/5] END randomforestclassifier__criterion=entropy,  
randomforestclassifier__max_features=sqrt,  
randomforestclassifier__min_samples_leaf=10,  
randomforestclassifier__min_samples_split=3,
```

```
randomforestclassifier__n_estimators=150;; score=0.829 total time=6.5s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to `sparse_output` in version 1.2 and will be removed in 1.4.  
`sparse_output` is ignored unless you leave `sparse` to its default value.
```

```
warnings.warn(
```

```
[CV 2/5] END randomforestclassifier__criterion=entropy,  
randomforestclassifier__max_features=sqrt,  
randomforestclassifier__min_samples_leaf=10,  
randomforestclassifier__min_samples_split=3,  
randomforestclassifier__n_estimators=150;; score=0.826 total time=6.3s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to `sparse_output` in version 1.2 and will be removed in 1.4.  
`sparse_output` is ignored unless you leave `sparse` to its default value.
```

```
warnings.warn(
```

```
[CV 3/5] END randomforestclassifier__criterion=entropy,  
randomforestclassifier__max_features=sqrt,  
randomforestclassifier__min_samples_leaf=10,  
randomforestclassifier__min_samples_split=3,  
randomforestclassifier__n_estimators=150;; score=0.806 total time=6.8s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to `sparse_output` in version 1.2 and will be removed in 1.4.  
`sparse_output` is ignored unless you leave `sparse` to its default value.
```

```
warnings.warn(
```

```
[CV 4/5] END randomforestclassifier__criterion=entropy,  
randomforestclassifier__max_features=sqrt,  
randomforestclassifier__min_samples_leaf=10,  
randomforestclassifier__min_samples_split=3,  
randomforestclassifier__n_estimators=150;; score=0.825 total time=6.8s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to `sparse_output` in version 1.2 and will be removed in 1.4.  
`sparse_output` is ignored unless you leave `sparse` to its default value.
```

```
warnings.warn(
```

```
[CV 5/5] END randomforestclassifier__criterion=entropy,  
randomforestclassifier__max_features=sqrt,  
randomforestclassifier__min_samples_leaf=10,  
randomforestclassifier__min_samples_split=3,  
randomforestclassifier__n_estimators=150;; score=0.826 total time=  
6.4s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\  
preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to  
`sparse_output` in version 1.2 and will be removed in 1.4.  
`sparse_output` is ignored unless you leave `sparse` to its default  
value.
```

```
warnings.warn(
```

```
[CV 1/5] END randomforestclassifier__criterion=entropy,  
randomforestclassifier__max_features=sqrt,  
randomforestclassifier__min_samples_leaf=10,  
randomforestclassifier__min_samples_split=4,  
randomforestclassifier__n_estimators=50;; score=0.827 total time=  
2.3s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\  
preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to  
`sparse_output` in version 1.2 and will be removed in 1.4.  
`sparse_output` is ignored unless you leave `sparse` to its default  
value.
```

```
warnings.warn(
```

```
[CV 2/5] END randomforestclassifier__criterion=entropy,  
randomforestclassifier__max_features=sqrt,  
randomforestclassifier__min_samples_leaf=10,  
randomforestclassifier__min_samples_split=4,  
randomforestclassifier__n_estimators=50;; score=0.811 total time=  
2.1s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\  
preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to  
`sparse_output` in version 1.2 and will be removed in 1.4.  
`sparse_output` is ignored unless you leave `sparse` to its default  
value.
```

```
warnings.warn(
```

```
[CV 3/5] END randomforestclassifier__criterion=entropy,  
randomforestclassifier__max_features=sqrt,  
randomforestclassifier__min_samples_leaf=10,  
randomforestclassifier__min_samples_split=4,  
randomforestclassifier__n_estimators=50;; score=0.809 total time=  
2.1s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\  
preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to
```

```
`sparse_output` in version 1.2 and will be removed in 1.4.  
`sparse_output` is ignored unless you leave `sparse` to its default  
value.
```

```
warnings.warn()
```

```
[CV 4/5] END randomforestclassifier__criterion=entropy,  
randomforestclassifier__max_features=sqrt,  
randomforestclassifier__min_samples_leaf=10,  
randomforestclassifier__min_samples_split=4,  
randomforestclassifier__n_estimators=50;; score=0.817 total time=  
2.1s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\  
preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to  
`sparse_output` in version 1.2 and will be removed in 1.4.  
`sparse_output` is ignored unless you leave `sparse` to its default  
value.
```

```
warnings.warn()
```

```
[CV 5/5] END randomforestclassifier__criterion=entropy,  
randomforestclassifier__max_features=sqrt,  
randomforestclassifier__min_samples_leaf=10,  
randomforestclassifier__min_samples_split=4,  
randomforestclassifier__n_estimators=50;; score=0.829 total time=  
2.1s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\  
preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to  
`sparse_output` in version 1.2 and will be removed in 1.4.  
`sparse_output` is ignored unless you leave `sparse` to its default  
value.
```

```
warnings.warn()
```

```
[CV 1/5] END randomforestclassifier__criterion=entropy,  
randomforestclassifier__max_features=sqrt,  
randomforestclassifier__min_samples_leaf=10,  
randomforestclassifier__min_samples_split=4,  
randomforestclassifier__n_estimators=100;; score=0.833 total time=  
4.6s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\  
preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to  
`sparse_output` in version 1.2 and will be removed in 1.4.  
`sparse_output` is ignored unless you leave `sparse` to its default  
value.
```

```
warnings.warn()
```

```
[CV 2/5] END randomforestclassifier__criterion=entropy,  
randomforestclassifier__max_features=sqrt,  
randomforestclassifier__min_samples_leaf=10,  
randomforestclassifier__min_samples_split=4,
```

```
randomforestclassifier__n_estimators=100;; score=0.825 total time=4.3s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to `sparse_output` in version 1.2 and will be removed in 1.4.
`sparse_output` is ignored unless you leave `sparse` to its default value.
```

```
warnings.warn(
```

```
[CV 3/5] END randomforestclassifier__criterion=entropy,
randomforestclassifier__max_features=sqrt,
randomforestclassifier__min_samples_leaf=10,
randomforestclassifier__min_samples_split=4,
randomforestclassifier__n_estimators=100;; score=0.804 total time=4.3s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to `sparse_output` in version 1.2 and will be removed in 1.4.
`sparse_output` is ignored unless you leave `sparse` to its default value.
```

```
warnings.warn(
```

```
[CV 4/5] END randomforestclassifier__criterion=entropy,
randomforestclassifier__max_features=sqrt,
randomforestclassifier__min_samples_leaf=10,
randomforestclassifier__min_samples_split=4,
randomforestclassifier__n_estimators=100;; score=0.823 total time=4.2s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to `sparse_output` in version 1.2 and will be removed in 1.4.
`sparse_output` is ignored unless you leave `sparse` to its default value.
```

```
warnings.warn(
```

```
[CV 5/5] END randomforestclassifier__criterion=entropy,
randomforestclassifier__max_features=sqrt,
randomforestclassifier__min_samples_leaf=10,
randomforestclassifier__min_samples_split=4,
randomforestclassifier__n_estimators=100;; score=0.829 total time=4.4s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to `sparse_output` in version 1.2 and will be removed in 1.4.
`sparse_output` is ignored unless you leave `sparse` to its default value.
```

```
warnings.warn(
```

```
[CV 1/5] END randomforestclassifier__criterion=entropy,  
randomforestclassifier__max_features=sqrt,  
randomforestclassifier__min_samples_leaf=10,  
randomforestclassifier__min_samples_split=4,  
randomforestclassifier__n_estimators=150;; score=0.829 total time=  
6.4s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\  
preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to  
`sparse_output` in version 1.2 and will be removed in 1.4.  
`sparse_output` is ignored unless you leave `sparse` to its default  
value.
```

```
warnings.warn(
```

```
[CV 2/5] END randomforestclassifier__criterion=entropy,  
randomforestclassifier__max_features=sqrt,  
randomforestclassifier__min_samples_leaf=10,  
randomforestclassifier__min_samples_split=4,  
randomforestclassifier__n_estimators=150;; score=0.825 total time=  
6.4s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\  
preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to  
`sparse_output` in version 1.2 and will be removed in 1.4.  
`sparse_output` is ignored unless you leave `sparse` to its default  
value.
```

```
warnings.warn(
```

```
[CV 3/5] END randomforestclassifier__criterion=entropy,  
randomforestclassifier__max_features=sqrt,  
randomforestclassifier__min_samples_leaf=10,  
randomforestclassifier__min_samples_split=4,  
randomforestclassifier__n_estimators=150;; score=0.809 total time=  
6.4s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\  
preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to  
`sparse_output` in version 1.2 and will be removed in 1.4.  
`sparse_output` is ignored unless you leave `sparse` to its default  
value.
```

```
warnings.warn(
```

```
[CV 4/5] END randomforestclassifier__criterion=entropy,  
randomforestclassifier__max_features=sqrt,  
randomforestclassifier__min_samples_leaf=10,  
randomforestclassifier__min_samples_split=4,  
randomforestclassifier__n_estimators=150;; score=0.821 total time=  
6.2s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\  
preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to
```

```
`sparse_output` in version 1.2 and will be removed in 1.4.  
`sparse_output` is ignored unless you leave `sparse` to its default  
value.
```

```
warnings.warn()
```

```
[CV 5/5] END randomforestclassifier__criterion=entropy,  
randomforestclassifier__max_features=sqrt,  
randomforestclassifier__min_samples_leaf=10,  
randomforestclassifier__min_samples_split=4,  
randomforestclassifier__n_estimators=150;; score=0.831 total time=  
6.6s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\  
preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to  
`sparse_output` in version 1.2 and will be removed in 1.4.  
`sparse_output` is ignored unless you leave `sparse` to its default  
value.
```

```
warnings.warn()
```

```
[CV 1/5] END randomforestclassifier__criterion=entropy,  
randomforestclassifier__max_features=sqrt,  
randomforestclassifier__min_samples_leaf=15,  
randomforestclassifier__min_samples_split=2,  
randomforestclassifier__n_estimators=50;; score=0.824 total time=  
2.0s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\  
preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to  
`sparse_output` in version 1.2 and will be removed in 1.4.  
`sparse_output` is ignored unless you leave `sparse` to its default  
value.
```

```
warnings.warn()
```

```
[CV 2/5] END randomforestclassifier__criterion=entropy,  
randomforestclassifier__max_features=sqrt,  
randomforestclassifier__min_samples_leaf=15,  
randomforestclassifier__min_samples_split=2,  
randomforestclassifier__n_estimators=50;; score=0.820 total time=  
2.0s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\  
preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to  
`sparse_output` in version 1.2 and will be removed in 1.4.  
`sparse_output` is ignored unless you leave `sparse` to its default  
value.
```

```
warnings.warn()
```

```
[CV 3/5] END randomforestclassifier__criterion=entropy,  
randomforestclassifier__max_features=sqrt,  
randomforestclassifier__min_samples_leaf=15,  
randomforestclassifier__min_samples_split=2,
```



```
randomforestclassifier__n_estimators=50;; score=0.805 total time=1.9s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to `sparse_output` in version 1.2 and will be removed in 1.4. `sparse_output` is ignored unless you leave `sparse` to its default value.
```

```
warnings.warn(
```

```
[CV 4/5] END randomforestclassifier__criterion=entropy, randomforestclassifier__max_features=sqrt, randomforestclassifier__min_samples_leaf=15, randomforestclassifier__min_samples_split=2, randomforestclassifier__n_estimators=50;; score=0.813 total time=1.9s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to `sparse_output` in version 1.2 and will be removed in 1.4. `sparse_output` is ignored unless you leave `sparse` to its default value.
```

```
warnings.warn(
```

```
[CV 5/5] END randomforestclassifier__criterion=entropy, randomforestclassifier__max_features=sqrt, randomforestclassifier__min_samples_leaf=15, randomforestclassifier__min_samples_split=2, randomforestclassifier__n_estimators=50;; score=0.831 total time=2.0s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to `sparse_output` in version 1.2 and will be removed in 1.4. `sparse_output` is ignored unless you leave `sparse` to its default value.
```

```
warnings.warn(
```

```
[CV 1/5] END randomforestclassifier__criterion=entropy, randomforestclassifier__max_features=sqrt, randomforestclassifier__min_samples_leaf=15, randomforestclassifier__min_samples_split=2, randomforestclassifier__n_estimators=100;; score=0.821 total time=4.2s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to `sparse_output` in version 1.2 and will be removed in 1.4. `sparse_output` is ignored unless you leave `sparse` to its default value.
```

```
warnings.warn(
```

```
[CV 2/5] END randomforestclassifier__criterion=entropy,  
randomforestclassifier__max_features=sqrt,  
randomforestclassifier__min_samples_leaf=15,  
randomforestclassifier__min_samples_split=2,  
randomforestclassifier__n_estimators=100;; score=0.817 total time=  
4.0s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\  
preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to  
`sparse_output` in version 1.2 and will be removed in 1.4.  
`sparse_output` is ignored unless you leave `sparse` to its default  
value.
```

```
warnings.warn(
```

```
[CV 3/5] END randomforestclassifier__criterion=entropy,  
randomforestclassifier__max_features=sqrt,  
randomforestclassifier__min_samples_leaf=15,  
randomforestclassifier__min_samples_split=2,  
randomforestclassifier__n_estimators=100;; score=0.806 total time=  
3.8s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\  
preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to  
`sparse_output` in version 1.2 and will be removed in 1.4.  
`sparse_output` is ignored unless you leave `sparse` to its default  
value.
```

```
warnings.warn(
```

```
[CV 4/5] END randomforestclassifier__criterion=entropy,  
randomforestclassifier__max_features=sqrt,  
randomforestclassifier__min_samples_leaf=15,  
randomforestclassifier__min_samples_split=2,  
randomforestclassifier__n_estimators=100;; score=0.814 total time=  
3.9s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\  
preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to  
`sparse_output` in version 1.2 and will be removed in 1.4.  
`sparse_output` is ignored unless you leave `sparse` to its default  
value.
```

```
warnings.warn(
```

```
[CV 5/5] END randomforestclassifier__criterion=entropy,  
randomforestclassifier__max_features=sqrt,  
randomforestclassifier__min_samples_leaf=15,  
randomforestclassifier__min_samples_split=2,  
randomforestclassifier__n_estimators=100;; score=0.821 total time=  
4.1s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\  
preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to
```

```
`sparse_output` in version 1.2 and will be removed in 1.4.  
`sparse_output` is ignored unless you leave `sparse` to its default  
value.
```

```
warnings.warn()
```

```
[CV 1/5] END randomforestclassifier__criterion=entropy,  
randomforestclassifier__max_features=sqrt,  
randomforestclassifier__min_samples_leaf=15,  
randomforestclassifier__min_samples_split=2,  
randomforestclassifier__n_estimators=150;; score=0.828 total time=  
6.1s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\  
preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to  
`sparse_output` in version 1.2 and will be removed in 1.4.  
`sparse_output` is ignored unless you leave `sparse` to its default  
value.
```

```
warnings.warn()
```

```
[CV 2/5] END randomforestclassifier__criterion=entropy,  
randomforestclassifier__max_features=sqrt,  
randomforestclassifier__min_samples_leaf=15,  
randomforestclassifier__min_samples_split=2,  
randomforestclassifier__n_estimators=150;; score=0.818 total time=  
5.9s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\  
preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to  
`sparse_output` in version 1.2 and will be removed in 1.4.  
`sparse_output` is ignored unless you leave `sparse` to its default  
value.
```

```
warnings.warn()
```

```
[CV 3/5] END randomforestclassifier__criterion=entropy,  
randomforestclassifier__max_features=sqrt,  
randomforestclassifier__min_samples_leaf=15,  
randomforestclassifier__min_samples_split=2,  
randomforestclassifier__n_estimators=150;; score=0.801 total time=  
6.1s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\  
preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to  
`sparse_output` in version 1.2 and will be removed in 1.4.  
`sparse_output` is ignored unless you leave `sparse` to its default  
value.
```

```
warnings.warn()
```

```
[CV 4/5] END randomforestclassifier__criterion=entropy,  
randomforestclassifier__max_features=sqrt,  
randomforestclassifier__min_samples_leaf=15,  
randomforestclassifier__min_samples_split=2,
```

```
randomforestclassifier__n_estimators=150;; score=0.811 total time=5.8s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to `sparse_output` in version 1.2 and will be removed in 1.4. `sparse_output` is ignored unless you leave `sparse` to its default value.
```

```
warnings.warn(
```

```
[CV 5/5] END randomforestclassifier__criterion=entropy, randomforestclassifier__max_features=sqrt, randomforestclassifier__min_samples_leaf=15, randomforestclassifier__min_samples_split=2, randomforestclassifier__n_estimators=150;; score=0.821 total time=6.1s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to `sparse_output` in version 1.2 and will be removed in 1.4. `sparse_output` is ignored unless you leave `sparse` to its default value.
```

```
warnings.warn(
```

```
[CV 1/5] END randomforestclassifier__criterion=entropy, randomforestclassifier__max_features=sqrt, randomforestclassifier__min_samples_leaf=15, randomforestclassifier__min_samples_split=3, randomforestclassifier__n_estimators=50;; score=0.821 total time=2.1s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to `sparse_output` in version 1.2 and will be removed in 1.4. `sparse_output` is ignored unless you leave `sparse` to its default value.
```

```
warnings.warn(
```

```
[CV 2/5] END randomforestclassifier__criterion=entropy, randomforestclassifier__max_features=sqrt, randomforestclassifier__min_samples_leaf=15, randomforestclassifier__min_samples_split=3, randomforestclassifier__n_estimators=50;; score=0.814 total time=1.9s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to `sparse_output` in version 1.2 and will be removed in 1.4. `sparse_output` is ignored unless you leave `sparse` to its default value.
```

```
warnings.warn(
```



```
`sparse_output` in version 1.2 and will be removed in 1.4.  
`sparse_output` is ignored unless you leave `sparse` to its default  
value.
```

```
warnings.warn()
```

```
[CV 2/5] END randomforestclassifier__criterion=entropy,  
randomforestclassifier__max_features=sqrt,  
randomforestclassifier__min_samples_leaf=15,  
randomforestclassifier__min_samples_split=3,  
randomforestclassifier__n_estimators=100;; score=0.816 total time=  
4.0s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\  
preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to  
`sparse_output` in version 1.2 and will be removed in 1.4.  
`sparse_output` is ignored unless you leave `sparse` to its default  
value.
```

```
warnings.warn()
```

```
[CV 3/5] END randomforestclassifier__criterion=entropy,  
randomforestclassifier__max_features=sqrt,  
randomforestclassifier__min_samples_leaf=15,  
randomforestclassifier__min_samples_split=3,  
randomforestclassifier__n_estimators=100;; score=0.805 total time=  
3.9s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\  
preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to  
`sparse_output` in version 1.2 and will be removed in 1.4.  
`sparse_output` is ignored unless you leave `sparse` to its default  
value.
```

```
warnings.warn()
```

```
[CV 4/5] END randomforestclassifier__criterion=entropy,  
randomforestclassifier__max_features=sqrt,  
randomforestclassifier__min_samples_leaf=15,  
randomforestclassifier__min_samples_split=3,  
randomforestclassifier__n_estimators=100;; score=0.810 total time=  
3.8s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\  
preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to  
`sparse_output` in version 1.2 and will be removed in 1.4.  
`sparse_output` is ignored unless you leave `sparse` to its default  
value.
```

```
warnings.warn()
```

```
[CV 5/5] END randomforestclassifier__criterion=entropy,  
randomforestclassifier__max_features=sqrt,  
randomforestclassifier__min_samples_leaf=15,  
randomforestclassifier__min_samples_split=3,
```

```
randomforestclassifier__n_estimators=100;; score=0.829 total time=4.0s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to `sparse_output` in version 1.2 and will be removed in 1.4.
`sparse_output` is ignored unless you leave `sparse` to its default value.
```

```
warnings.warn(
```

```
[CV 1/5] END randomforestclassifier__criterion=entropy,
randomforestclassifier__max_features=sqrt,
randomforestclassifier__min_samples_leaf=15,
randomforestclassifier__min_samples_split=3,
randomforestclassifier__n_estimators=150;; score=0.826 total time=6.0s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to `sparse_output` in version 1.2 and will be removed in 1.4.
`sparse_output` is ignored unless you leave `sparse` to its default value.
```

```
warnings.warn(
```

```
[CV 2/5] END randomforestclassifier__criterion=entropy,
randomforestclassifier__max_features=sqrt,
randomforestclassifier__min_samples_leaf=15,
randomforestclassifier__min_samples_split=3,
randomforestclassifier__n_estimators=150;; score=0.819 total time=5.7s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to `sparse_output` in version 1.2 and will be removed in 1.4.
`sparse_output` is ignored unless you leave `sparse` to its default value.
```

```
warnings.warn(
```

```
[CV 3/5] END randomforestclassifier__criterion=entropy,
randomforestclassifier__max_features=sqrt,
randomforestclassifier__min_samples_leaf=15,
randomforestclassifier__min_samples_split=3,
randomforestclassifier__n_estimators=150;; score=0.802 total time=6.1s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to `sparse_output` in version 1.2 and will be removed in 1.4.
`sparse_output` is ignored unless you leave `sparse` to its default value.
```

```
warnings.warn(
```

```
[CV 4/5] END randomforestclassifier__criterion=entropy,  
randomforestclassifier__max_features=sqrt,  
randomforestclassifier__min_samples_leaf=15,  
randomforestclassifier__min_samples_split=3,  
randomforestclassifier__n_estimators=150;; score=0.810 total time=  
5.8s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\  
preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to  
`sparse_output` in version 1.2 and will be removed in 1.4.  
`sparse_output` is ignored unless you leave `sparse` to its default  
value.
```

```
warnings.warn(
```

```
[CV 5/5] END randomforestclassifier__criterion=entropy,  
randomforestclassifier__max_features=sqrt,  
randomforestclassifier__min_samples_leaf=15,  
randomforestclassifier__min_samples_split=3,  
randomforestclassifier__n_estimators=150;; score=0.826 total time=  
5.8s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\  
preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to  
`sparse_output` in version 1.2 and will be removed in 1.4.  
`sparse_output` is ignored unless you leave `sparse` to its default  
value.
```

```
warnings.warn(
```

```
[CV 1/5] END randomforestclassifier__criterion=entropy,  
randomforestclassifier__max_features=sqrt,  
randomforestclassifier__min_samples_leaf=15,  
randomforestclassifier__min_samples_split=4,  
randomforestclassifier__n_estimators=50;; score=0.824 total time=  
2.0s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\  
preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to  
`sparse_output` in version 1.2 and will be removed in 1.4.  
`sparse_output` is ignored unless you leave `sparse` to its default  
value.
```

```
warnings.warn(
```

```
[CV 2/5] END randomforestclassifier__criterion=entropy,  
randomforestclassifier__max_features=sqrt,  
randomforestclassifier__min_samples_leaf=15,  
randomforestclassifier__min_samples_split=4,  
randomforestclassifier__n_estimators=50;; score=0.819 total time=  
2.1s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\  
preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to
```



```
`sparse_output` in version 1.2 and will be removed in 1.4.  
`sparse_output` is ignored unless you leave `sparse` to its default  
value.
```

```
warnings.warn()
```

```
[CV 3/5] END randomforestclassifier__criterion=entropy,  
randomforestclassifier__max_features=sqrt,  
randomforestclassifier__min_samples_leaf=15,  
randomforestclassifier__min_samples_split=4,  
randomforestclassifier__n_estimators=50;; score=0.803 total time=  
2.0s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\  
preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to  
`sparse_output` in version 1.2 and will be removed in 1.4.  
`sparse_output` is ignored unless you leave `sparse` to its default  
value.
```

```
warnings.warn()
```

```
[CV 4/5] END randomforestclassifier__criterion=entropy,  
randomforestclassifier__max_features=sqrt,  
randomforestclassifier__min_samples_leaf=15,  
randomforestclassifier__min_samples_split=4,  
randomforestclassifier__n_estimators=50;; score=0.810 total time=  
2.0s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\  
preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to  
`sparse_output` in version 1.2 and will be removed in 1.4.  
`sparse_output` is ignored unless you leave `sparse` to its default  
value.
```

```
warnings.warn()
```

```
[CV 5/5] END randomforestclassifier__criterion=entropy,  
randomforestclassifier__max_features=sqrt,  
randomforestclassifier__min_samples_leaf=15,  
randomforestclassifier__min_samples_split=4,  
randomforestclassifier__n_estimators=50;; score=0.819 total time=  
1.9s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\  
preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to  
`sparse_output` in version 1.2 and will be removed in 1.4.  
`sparse_output` is ignored unless you leave `sparse` to its default  
value.
```

```
warnings.warn()
```

```
[CV 1/5] END randomforestclassifier__criterion=entropy,  
randomforestclassifier__max_features=sqrt,  
randomforestclassifier__min_samples_leaf=15,  
randomforestclassifier__min_samples_split=4,
```

```
randomforestclassifier__n_estimators=100;; score=0.819 total time=3.9s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to `sparse_output` in version 1.2 and will be removed in 1.4. `sparse_output` is ignored unless you leave `sparse` to its default value.
```

```
warnings.warn(
```

```
[CV 2/5] END randomforestclassifier__criterion=entropy, randomforestclassifier__max_features=sqrt, randomforestclassifier__min_samples_leaf=15, randomforestclassifier__min_samples_split=4, randomforestclassifier__n_estimators=100;; score=0.819 total time=4.0s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to `sparse_output` in version 1.2 and will be removed in 1.4. `sparse_output` is ignored unless you leave `sparse` to its default value.
```

```
warnings.warn(
```

```
[CV 3/5] END randomforestclassifier__criterion=entropy, randomforestclassifier__max_features=sqrt, randomforestclassifier__min_samples_leaf=15, randomforestclassifier__min_samples_split=4, randomforestclassifier__n_estimators=100;; score=0.802 total time=4.0s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to `sparse_output` in version 1.2 and will be removed in 1.4. `sparse_output` is ignored unless you leave `sparse` to its default value.
```

```
warnings.warn(
```

```
[CV 4/5] END randomforestclassifier__criterion=entropy, randomforestclassifier__max_features=sqrt, randomforestclassifier__min_samples_leaf=15, randomforestclassifier__min_samples_split=4, randomforestclassifier__n_estimators=100;; score=0.819 total time=3.8s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to `sparse_output` in version 1.2 and will be removed in 1.4. `sparse_output` is ignored unless you leave `sparse` to its default value.
```

```
warnings.warn(
```

```
[CV 5/5] END randomforestclassifier__criterion=entropy,  
randomforestclassifier__max_features=sqrt,  
randomforestclassifier__min_samples_leaf=15,  
randomforestclassifier__min_samples_split=4,  
randomforestclassifier__n_estimators=100;; score=0.821 total time=  
3.9s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\  
preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to  
`sparse_output` in version 1.2 and will be removed in 1.4.  
`sparse_output` is ignored unless you leave `sparse` to its default  
value.
```

```
warnings.warn(
```

```
[CV 1/5] END randomforestclassifier__criterion=entropy,  
randomforestclassifier__max_features=sqrt,  
randomforestclassifier__min_samples_leaf=15,  
randomforestclassifier__min_samples_split=4,  
randomforestclassifier__n_estimators=150;; score=0.820 total time=  
6.1s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\  
preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to  
`sparse_output` in version 1.2 and will be removed in 1.4.  
`sparse_output` is ignored unless you leave `sparse` to its default  
value.
```

```
warnings.warn(
```

```
[CV 2/5] END randomforestclassifier__criterion=entropy,  
randomforestclassifier__max_features=sqrt,  
randomforestclassifier__min_samples_leaf=15,  
randomforestclassifier__min_samples_split=4,  
randomforestclassifier__n_estimators=150;; score=0.820 total time=  
6.0s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\  
preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to  
`sparse_output` in version 1.2 and will be removed in 1.4.  
`sparse_output` is ignored unless you leave `sparse` to its default  
value.
```

```
warnings.warn(
```

```
[CV 3/5] END randomforestclassifier__criterion=entropy,  
randomforestclassifier__max_features=sqrt,  
randomforestclassifier__min_samples_leaf=15,  
randomforestclassifier__min_samples_split=4,  
randomforestclassifier__n_estimators=150;; score=0.806 total time=  
5.8s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\  
preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to
```

```
`sparse_output` in version 1.2 and will be removed in 1.4.  
`sparse_output` is ignored unless you leave `sparse` to its default  
value.
```

```
warnings.warn()
```

```
[CV 4/5] END randomforestclassifier__criterion=entropy,  
randomforestclassifier__max_features=sqrt,  
randomforestclassifier__min_samples_leaf=15,  
randomforestclassifier__min_samples_split=4,  
randomforestclassifier__n_estimators=150;; score=0.809 total time=  
6.0s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\  
preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to  
`sparse_output` in version 1.2 and will be removed in 1.4.  
`sparse_output` is ignored unless you leave `sparse` to its default  
value.
```

```
warnings.warn()
```

```
[CV 5/5] END randomforestclassifier__criterion=entropy,  
randomforestclassifier__max_features=sqrt,  
randomforestclassifier__min_samples_leaf=15,  
randomforestclassifier__min_samples_split=4,  
randomforestclassifier__n_estimators=150;; score=0.824 total time=  
5.8s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\  
preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to  
`sparse_output` in version 1.2 and will be removed in 1.4.  
`sparse_output` is ignored unless you leave `sparse` to its default  
value.
```

```
warnings.warn()
```

```
[CV 1/5] END randomforestclassifier__criterion=entropy,  
randomforestclassifier__max_features=0.33,  
randomforestclassifier__min_samples_leaf=1,  
randomforestclassifier__min_samples_split=2,  
randomforestclassifier__n_estimators=50;; score=0.842 total time=  
3.5s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\  
preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to  
`sparse_output` in version 1.2 and will be removed in 1.4.  
`sparse_output` is ignored unless you leave `sparse` to its default  
value.
```

```
warnings.warn()
```

```
[CV 2/5] END randomforestclassifier__criterion=entropy,  
randomforestclassifier__max_features=0.33,  
randomforestclassifier__min_samples_leaf=1,  
randomforestclassifier__min_samples_split=2,
```

```
randomforestclassifier__n_estimators=50;; score=0.834 total time=3.5s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to `sparse_output` in version 1.2 and will be removed in 1.4.
`sparse_output` is ignored unless you leave `sparse` to its default value.
```

```
warnings.warn(
```

```
[CV 3/5] END randomforestclassifier__criterion=entropy,
randomforestclassifier__max_features=0.33,
randomforestclassifier__min_samples_leaf=1,
randomforestclassifier__min_samples_split=2,
randomforestclassifier__n_estimators=50;; score=0.831 total time=3.4s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to `sparse_output` in version 1.2 and will be removed in 1.4.
`sparse_output` is ignored unless you leave `sparse` to its default value.
```

```
warnings.warn(
```

```
[CV 4/5] END randomforestclassifier__criterion=entropy,
randomforestclassifier__max_features=0.33,
randomforestclassifier__min_samples_leaf=1,
randomforestclassifier__min_samples_split=2,
randomforestclassifier__n_estimators=50;; score=0.838 total time=3.4s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to `sparse_output` in version 1.2 and will be removed in 1.4.
`sparse_output` is ignored unless you leave `sparse` to its default value.
```

```
warnings.warn(
```

```
[CV 5/5] END randomforestclassifier__criterion=entropy,
randomforestclassifier__max_features=0.33,
randomforestclassifier__min_samples_leaf=1,
randomforestclassifier__min_samples_split=2,
randomforestclassifier__n_estimators=50;; score=0.849 total time=3.3s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to `sparse_output` in version 1.2 and will be removed in 1.4.
`sparse_output` is ignored unless you leave `sparse` to its default value.
```

```
warnings.warn(
```

```
[CV 1/5] END randomforestclassifier__criterion=entropy,  
randomforestclassifier__max_features=0.33,  
randomforestclassifier__min_samples_leaf=1,  
randomforestclassifier__min_samples_split=2,  
randomforestclassifier__n_estimators=100;; score=0.840 total time=  
7.1s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\  
preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to  
`sparse_output` in version 1.2 and will be removed in 1.4.  
`sparse_output` is ignored unless you leave `sparse` to its default  
value.
```

```
warnings.warn(
```

```
[CV 2/5] END randomforestclassifier__criterion=entropy,  
randomforestclassifier__max_features=0.33,  
randomforestclassifier__min_samples_leaf=1,  
randomforestclassifier__min_samples_split=2,  
randomforestclassifier__n_estimators=100;; score=0.839 total time=  
6.7s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\  
preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to  
`sparse_output` in version 1.2 and will be removed in 1.4.  
`sparse_output` is ignored unless you leave `sparse` to its default  
value.
```

```
warnings.warn(
```

```
[CV 3/5] END randomforestclassifier__criterion=entropy,  
randomforestclassifier__max_features=0.33,  
randomforestclassifier__min_samples_leaf=1,  
randomforestclassifier__min_samples_split=2,  
randomforestclassifier__n_estimators=100;; score=0.825 total time=  
6.8s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\  
preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to  
`sparse_output` in version 1.2 and will be removed in 1.4.  
`sparse_output` is ignored unless you leave `sparse` to its default  
value.
```

```
warnings.warn(
```

```
[CV 4/5] END randomforestclassifier__criterion=entropy,  
randomforestclassifier__max_features=0.33,  
randomforestclassifier__min_samples_leaf=1,  
randomforestclassifier__min_samples_split=2,  
randomforestclassifier__n_estimators=100;; score=0.834 total time=  
6.8s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\  
preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to
```

```
`sparse_output` in version 1.2 and will be removed in 1.4.  
`sparse_output` is ignored unless you leave `sparse` to its default  
value.
```

```
warnings.warn()
```

```
[CV 5/5] END randomforestclassifier__criterion=entropy,  
randomforestclassifier__max_features=0.33,  
randomforestclassifier__min_samples_leaf=1,  
randomforestclassifier__min_samples_split=2,  
randomforestclassifier__n_estimators=100;; score=0.836 total time=  
7.0s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\  
preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to  
`sparse_output` in version 1.2 and will be removed in 1.4.  
`sparse_output` is ignored unless you leave `sparse` to its default  
value.
```

```
warnings.warn()
```

```
[CV 1/5] END randomforestclassifier__criterion=entropy,  
randomforestclassifier__max_features=0.33,  
randomforestclassifier__min_samples_leaf=1,  
randomforestclassifier__min_samples_split=2,  
randomforestclassifier__n_estimators=150;; score=0.842 total time=  
10.4s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\  
preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to  
`sparse_output` in version 1.2 and will be removed in 1.4.  
`sparse_output` is ignored unless you leave `sparse` to its default  
value.
```

```
warnings.warn()
```

```
[CV 2/5] END randomforestclassifier__criterion=entropy,  
randomforestclassifier__max_features=0.33,  
randomforestclassifier__min_samples_leaf=1,  
randomforestclassifier__min_samples_split=2,  
randomforestclassifier__n_estimators=150;; score=0.838 total time=  
10.7s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\  
preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to  
`sparse_output` in version 1.2 and will be removed in 1.4.  
`sparse_output` is ignored unless you leave `sparse` to its default  
value.
```

```
warnings.warn()
```

```
[CV 3/5] END randomforestclassifier__criterion=entropy,  
randomforestclassifier__max_features=0.33,  
randomforestclassifier__min_samples_leaf=1,  
randomforestclassifier__min_samples_split=2,
```

```
randomforestclassifier__n_estimators=150;; score=0.824 total time=10.2s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to `sparse_output` in version 1.2 and will be removed in 1.4. `sparse_output` is ignored unless you leave `sparse` to its default value.
```

```
warnings.warn(
```

```
[CV 4/5] END randomforestclassifier__criterion=entropy, randomforestclassifier__max_features=0.33, randomforestclassifier__min_samples_leaf=1, randomforestclassifier__min_samples_split=2, randomforestclassifier__n_estimators=150;; score=0.832 total time=10.1s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to `sparse_output` in version 1.2 and will be removed in 1.4. `sparse_output` is ignored unless you leave `sparse` to its default value.
```

```
warnings.warn(
```

```
[CV 5/5] END randomforestclassifier__criterion=entropy, randomforestclassifier__max_features=0.33, randomforestclassifier__min_samples_leaf=1, randomforestclassifier__min_samples_split=2, randomforestclassifier__n_estimators=150;; score=0.847 total time=10.4s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to `sparse_output` in version 1.2 and will be removed in 1.4. `sparse_output` is ignored unless you leave `sparse` to its default value.
```

```
warnings.warn(
```

```
[CV 1/5] END randomforestclassifier__criterion=entropy, randomforestclassifier__max_features=0.33, randomforestclassifier__min_samples_leaf=1, randomforestclassifier__min_samples_split=3, randomforestclassifier__n_estimators=50;; score=0.844 total time=3.4s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to `sparse_output` in version 1.2 and will be removed in 1.4. `sparse_output` is ignored unless you leave `sparse` to its default value.
```

```
warnings.warn(
```



```
[CV 2/5] END randomforestclassifier__criterion=entropy,  
randomforestclassifier__max_features=0.33,  
randomforestclassifier__min_samples_leaf=1,  
randomforestclassifier__min_samples_split=3,  
randomforestclassifier__n_estimators=50;; score=0.837 total time=  
3.4s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\  
preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to  
`sparse_output` in version 1.2 and will be removed in 1.4.  
`sparse_output` is ignored unless you leave `sparse` to its default  
value.
```

```
warnings.warn(
```

```
[CV 3/5] END randomforestclassifier__criterion=entropy,  
randomforestclassifier__max_features=0.33,  
randomforestclassifier__min_samples_leaf=1,  
randomforestclassifier__min_samples_split=3,  
randomforestclassifier__n_estimators=50;; score=0.826 total time=  
3.3s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\  
preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to  
`sparse_output` in version 1.2 and will be removed in 1.4.  
`sparse_output` is ignored unless you leave `sparse` to its default  
value.
```

```
warnings.warn(
```

```
[CV 4/5] END randomforestclassifier__criterion=entropy,  
randomforestclassifier__max_features=0.33,  
randomforestclassifier__min_samples_leaf=1,  
randomforestclassifier__min_samples_split=3,  
randomforestclassifier__n_estimators=50;; score=0.831 total time=  
3.5s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\  
preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to  
`sparse_output` in version 1.2 and will be removed in 1.4.  
`sparse_output` is ignored unless you leave `sparse` to its default  
value.
```

```
warnings.warn(
```

```
[CV 5/5] END randomforestclassifier__criterion=entropy,  
randomforestclassifier__max_features=0.33,  
randomforestclassifier__min_samples_leaf=1,  
randomforestclassifier__min_samples_split=3,  
randomforestclassifier__n_estimators=50;; score=0.843 total time=  
3.4s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\  
preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to
```

```
`sparse_output` in version 1.2 and will be removed in 1.4.  
`sparse_output` is ignored unless you leave `sparse` to its default  
value.
```

```
warnings.warn()
```

```
[CV 1/5] END randomforestclassifier__criterion=entropy,  
randomforestclassifier__max_features=0.33,  
randomforestclassifier__min_samples_leaf=1,  
randomforestclassifier__min_samples_split=3,  
randomforestclassifier__n_estimators=100;; score=0.845 total time=  
7.0s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\  
preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to  
`sparse_output` in version 1.2 and will be removed in 1.4.  
`sparse_output` is ignored unless you leave `sparse` to its default  
value.
```

```
warnings.warn()
```

```
[CV 2/5] END randomforestclassifier__criterion=entropy,  
randomforestclassifier__max_features=0.33,  
randomforestclassifier__min_samples_leaf=1,  
randomforestclassifier__min_samples_split=3,  
randomforestclassifier__n_estimators=100;; score=0.839 total time=  
7.0s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\  
preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to  
`sparse_output` in version 1.2 and will be removed in 1.4.  
`sparse_output` is ignored unless you leave `sparse` to its default  
value.
```

```
warnings.warn()
```

```
[CV 3/5] END randomforestclassifier__criterion=entropy,  
randomforestclassifier__max_features=0.33,  
randomforestclassifier__min_samples_leaf=1,  
randomforestclassifier__min_samples_split=3,  
randomforestclassifier__n_estimators=100;; score=0.819 total time=  
6.7s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\  
preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to  
`sparse_output` in version 1.2 and will be removed in 1.4.  
`sparse_output` is ignored unless you leave `sparse` to its default  
value.
```

```
warnings.warn()
```

```
[CV 4/5] END randomforestclassifier__criterion=entropy,  
randomforestclassifier__max_features=0.33,  
randomforestclassifier__min_samples_leaf=1,  
randomforestclassifier__min_samples_split=3,
```

```
randomforestclassifier__n_estimators=100;; score=0.831 total time=6.8s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to `sparse_output` in version 1.2 and will be removed in 1.4. `sparse_output` is ignored unless you leave `sparse` to its default value.
```

```
warnings.warn(
```

```
[CV 5/5] END randomforestclassifier__criterion=entropy, randomforestclassifier__max_features=0.33, randomforestclassifier__min_samples_leaf=1, randomforestclassifier__min_samples_split=3, randomforestclassifier__n_estimators=100;; score=0.854 total time=6.7s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to `sparse_output` in version 1.2 and will be removed in 1.4. `sparse_output` is ignored unless you leave `sparse` to its default value.
```

```
warnings.warn(
```

```
[CV 1/5] END randomforestclassifier__criterion=entropy, randomforestclassifier__max_features=0.33, randomforestclassifier__min_samples_leaf=1, randomforestclassifier__min_samples_split=3, randomforestclassifier__n_estimators=150;; score=0.841 total time=10.5s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to `sparse_output` in version 1.2 and will be removed in 1.4. `sparse_output` is ignored unless you leave `sparse` to its default value.
```

```
warnings.warn(
```

```
[CV 2/5] END randomforestclassifier__criterion=entropy, randomforestclassifier__max_features=0.33, randomforestclassifier__min_samples_leaf=1, randomforestclassifier__min_samples_split=3, randomforestclassifier__n_estimators=150;; score=0.840 total time=10.3s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to `sparse_output` in version 1.2 and will be removed in 1.4. `sparse_output` is ignored unless you leave `sparse` to its default value.
```

```
warnings.warn(
```

```
[CV 3/5] END randomforestclassifier__criterion=entropy,  
randomforestclassifier__max_features=0.33,  
randomforestclassifier__min_samples_leaf=1,  
randomforestclassifier__min_samples_split=3,  
randomforestclassifier__n_estimators=150;; score=0.828 total time=  
10.4s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\  
preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to  
`sparse_output` in version 1.2 and will be removed in 1.4.  
`sparse_output` is ignored unless you leave `sparse` to its default  
value.  
  warnings.warn(
```

```
[CV 4/5] END randomforestclassifier__criterion=entropy,  
randomforestclassifier__max_features=0.33,  
randomforestclassifier__min_samples_leaf=1,  
randomforestclassifier__min_samples_split=3,  
randomforestclassifier__n_estimators=150;; score=0.834 total time=  
10.2s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\  
preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to  
`sparse_output` in version 1.2 and will be removed in 1.4.  
`sparse_output` is ignored unless you leave `sparse` to its default  
value.  
  warnings.warn(
```

```
[CV 5/5] END randomforestclassifier__criterion=entropy,  
randomforestclassifier__max_features=0.33,  
randomforestclassifier__min_samples_leaf=1,  
randomforestclassifier__min_samples_split=3,  
randomforestclassifier__n_estimators=150;; score=0.839 total time=  
10.3s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\  
preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to  
`sparse_output` in version 1.2 and will be removed in 1.4.  
`sparse_output` is ignored unless you leave `sparse` to its default  
value.  
  warnings.warn(
```

```
[CV 1/5] END randomforestclassifier__criterion=entropy,  
randomforestclassifier__max_features=0.33,  
randomforestclassifier__min_samples_leaf=1,  
randomforestclassifier__min_samples_split=4,  
randomforestclassifier__n_estimators=50;; score=0.834 total time=  
3.5s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\  
preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to
```

```
`sparse_output` in version 1.2 and will be removed in 1.4.  
`sparse_output` is ignored unless you leave `sparse` to its default  
value.
```

```
warnings.warn()
```

```
[CV 2/5] END randomforestclassifier__criterion=entropy,  
randomforestclassifier__max_features=0.33,  
randomforestclassifier__min_samples_leaf=1,  
randomforestclassifier__min_samples_split=4,  
randomforestclassifier__n_estimators=50;; score=0.839 total time=  
3.6s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\  
preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to  
`sparse_output` in version 1.2 and will be removed in 1.4.  
`sparse_output` is ignored unless you leave `sparse` to its default  
value.
```

```
warnings.warn()
```

```
[CV 3/5] END randomforestclassifier__criterion=entropy,  
randomforestclassifier__max_features=0.33,  
randomforestclassifier__min_samples_leaf=1,  
randomforestclassifier__min_samples_split=4,  
randomforestclassifier__n_estimators=50;; score=0.824 total time=  
3.4s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\  
preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to  
`sparse_output` in version 1.2 and will be removed in 1.4.  
`sparse_output` is ignored unless you leave `sparse` to its default  
value.
```

```
warnings.warn()
```

```
[CV 4/5] END randomforestclassifier__criterion=entropy,  
randomforestclassifier__max_features=0.33,  
randomforestclassifier__min_samples_leaf=1,  
randomforestclassifier__min_samples_split=4,  
randomforestclassifier__n_estimators=50;; score=0.829 total time=  
3.4s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\  
preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to  
`sparse_output` in version 1.2 and will be removed in 1.4.  
`sparse_output` is ignored unless you leave `sparse` to its default  
value.
```

```
warnings.warn()
```

```
[CV 5/5] END randomforestclassifier__criterion=entropy,  
randomforestclassifier__max_features=0.33,  
randomforestclassifier__min_samples_leaf=1,  
randomforestclassifier__min_samples_split=4,
```

```
randomforestclassifier__n_estimators=50;; score=0.840 total time=3.3s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to `sparse_output` in version 1.2 and will be removed in 1.4.
`sparse_output` is ignored unless you leave `sparse` to its default value.
```

```
warnings.warn(
```

```
[CV 1/5] END randomforestclassifier__criterion=entropy,
randomforestclassifier__max_features=0.33,
randomforestclassifier__min_samples_leaf=1,
randomforestclassifier__min_samples_split=4,
randomforestclassifier__n_estimators=100;; score=0.831 total time=7.2s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to `sparse_output` in version 1.2 and will be removed in 1.4.
`sparse_output` is ignored unless you leave `sparse` to its default value.
```

```
warnings.warn(
```

```
[CV 2/5] END randomforestclassifier__criterion=entropy,
randomforestclassifier__max_features=0.33,
randomforestclassifier__min_samples_leaf=1,
randomforestclassifier__min_samples_split=4,
randomforestclassifier__n_estimators=100;; score=0.836 total time=6.6s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to `sparse_output` in version 1.2 and will be removed in 1.4.
`sparse_output` is ignored unless you leave `sparse` to its default value.
```

```
warnings.warn(
```

```
[CV 3/5] END randomforestclassifier__criterion=entropy,
randomforestclassifier__max_features=0.33,
randomforestclassifier__min_samples_leaf=1,
randomforestclassifier__min_samples_split=4,
randomforestclassifier__n_estimators=100;; score=0.831 total time=6.9s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to `sparse_output` in version 1.2 and will be removed in 1.4.
`sparse_output` is ignored unless you leave `sparse` to its default value.
```

```
warnings.warn(
```

```
[CV 4/5] END randomforestclassifier__criterion=entropy,  
randomforestclassifier__max_features=0.33,  
randomforestclassifier__min_samples_leaf=1,  
randomforestclassifier__min_samples_split=4,  
randomforestclassifier__n_estimators=100;; score=0.825 total time=  
6.6s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\  
preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to  
`sparse_output` in version 1.2 and will be removed in 1.4.  
`sparse_output` is ignored unless you leave `sparse` to its default  
value.
```

```
warnings.warn(
```

```
[CV 5/5] END randomforestclassifier__criterion=entropy,  
randomforestclassifier__max_features=0.33,  
randomforestclassifier__min_samples_leaf=1,  
randomforestclassifier__min_samples_split=4,  
randomforestclassifier__n_estimators=100;; score=0.844 total time=  
6.7s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\  
preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to  
`sparse_output` in version 1.2 and will be removed in 1.4.  
`sparse_output` is ignored unless you leave `sparse` to its default  
value.
```

```
warnings.warn(
```

```
[CV 1/5] END randomforestclassifier__criterion=entropy,  
randomforestclassifier__max_features=0.33,  
randomforestclassifier__min_samples_leaf=1,  
randomforestclassifier__min_samples_split=4,  
randomforestclassifier__n_estimators=150;; score=0.836 total time=  
10.4s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\  
preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to  
`sparse_output` in version 1.2 and will be removed in 1.4.  
`sparse_output` is ignored unless you leave `sparse` to its default  
value.
```

```
warnings.warn(
```

```
[CV 2/5] END randomforestclassifier__criterion=entropy,  
randomforestclassifier__max_features=0.33,  
randomforestclassifier__min_samples_leaf=1,  
randomforestclassifier__min_samples_split=4,  
randomforestclassifier__n_estimators=150;; score=0.840 total time=  
10.2s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\  
preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to
```

```
`sparse_output` in version 1.2 and will be removed in 1.4.  
`sparse_output` is ignored unless you leave `sparse` to its default  
value.
```

```
warnings.warn()
```

```
[CV 3/5] END randomforestclassifier__criterion=entropy,  
randomforestclassifier__max_features=0.33,  
randomforestclassifier__min_samples_leaf=1,  
randomforestclassifier__min_samples_split=4,  
randomforestclassifier__n_estimators=150;; score=0.829 total time=  
10.1s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\  
preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to  
`sparse_output` in version 1.2 and will be removed in 1.4.  
`sparse_output` is ignored unless you leave `sparse` to its default  
value.
```

```
warnings.warn()
```

```
[CV 4/5] END randomforestclassifier__criterion=entropy,  
randomforestclassifier__max_features=0.33,  
randomforestclassifier__min_samples_leaf=1,  
randomforestclassifier__min_samples_split=4,  
randomforestclassifier__n_estimators=150;; score=0.831 total time=  
10.1s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\  
preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to  
`sparse_output` in version 1.2 and will be removed in 1.4.  
`sparse_output` is ignored unless you leave `sparse` to its default  
value.
```

```
warnings.warn()
```

```
[CV 5/5] END randomforestclassifier__criterion=entropy,  
randomforestclassifier__max_features=0.33,  
randomforestclassifier__min_samples_leaf=1,  
randomforestclassifier__min_samples_split=4,  
randomforestclassifier__n_estimators=150;; score=0.852 total time=  
10.2s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\  
preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to  
`sparse_output` in version 1.2 and will be removed in 1.4.  
`sparse_output` is ignored unless you leave `sparse` to its default  
value.
```

```
warnings.warn()
```

```
[CV 1/5] END randomforestclassifier__criterion=entropy,  
randomforestclassifier__max_features=0.33,  
randomforestclassifier__min_samples_leaf=5,  
randomforestclassifier__min_samples_split=2,
```



```
randomforestclassifier__n_estimators=50;; score=0.831 total time=2.9s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to `sparse_output` in version 1.2 and will be removed in 1.4.
`sparse_output` is ignored unless you leave `sparse` to its default value.
```

```
warnings.warn(
```

```
[CV 2/5] END randomforestclassifier__criterion=entropy,
randomforestclassifier__max_features=0.33,
randomforestclassifier__min_samples_leaf=5,
randomforestclassifier__min_samples_split=2,
randomforestclassifier__n_estimators=50;; score=0.829 total time=3.0s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to `sparse_output` in version 1.2 and will be removed in 1.4.
`sparse_output` is ignored unless you leave `sparse` to its default value.
```

```
warnings.warn(
```

```
[CV 3/5] END randomforestclassifier__criterion=entropy,
randomforestclassifier__max_features=0.33,
randomforestclassifier__min_samples_leaf=5,
randomforestclassifier__min_samples_split=2,
randomforestclassifier__n_estimators=50;; score=0.816 total time=2.9s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to `sparse_output` in version 1.2 and will be removed in 1.4.
`sparse_output` is ignored unless you leave `sparse` to its default value.
```

```
warnings.warn(
```

```
[CV 4/5] END randomforestclassifier__criterion=entropy,
randomforestclassifier__max_features=0.33,
randomforestclassifier__min_samples_leaf=5,
randomforestclassifier__min_samples_split=2,
randomforestclassifier__n_estimators=50;; score=0.826 total time=3.1s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to `sparse_output` in version 1.2 and will be removed in 1.4.
`sparse_output` is ignored unless you leave `sparse` to its default value.
```

```
warnings.warn(
```

```
[CV 5/5] END randomforestclassifier__criterion=entropy,  
randomforestclassifier__max_features=0.33,  
randomforestclassifier__min_samples_leaf=5,  
randomforestclassifier__min_samples_split=2,  
randomforestclassifier__n_estimators=50;; score=0.843 total time=  
3.0s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\  
preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to  
`sparse_output` in version 1.2 and will be removed in 1.4.  
`sparse_output` is ignored unless you leave `sparse` to its default  
value.
```

```
warnings.warn(
```

```
[CV 1/5] END randomforestclassifier__criterion=entropy,  
randomforestclassifier__max_features=0.33,  
randomforestclassifier__min_samples_leaf=5,  
randomforestclassifier__min_samples_split=2,  
randomforestclassifier__n_estimators=100;; score=0.837 total time=  
6.0s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\  
preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to  
`sparse_output` in version 1.2 and will be removed in 1.4.  
`sparse_output` is ignored unless you leave `sparse` to its default  
value.
```

```
warnings.warn(
```

```
[CV 2/5] END randomforestclassifier__criterion=entropy,  
randomforestclassifier__max_features=0.33,  
randomforestclassifier__min_samples_leaf=5,  
randomforestclassifier__min_samples_split=2,  
randomforestclassifier__n_estimators=100;; score=0.830 total time=  
6.1s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\  
preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to  
`sparse_output` in version 1.2 and will be removed in 1.4.  
`sparse_output` is ignored unless you leave `sparse` to its default  
value.
```

```
warnings.warn(
```

```
[CV 3/5] END randomforestclassifier__criterion=entropy,  
randomforestclassifier__max_features=0.33,  
randomforestclassifier__min_samples_leaf=5,  
randomforestclassifier__min_samples_split=2,  
randomforestclassifier__n_estimators=100;; score=0.816 total time=  
6.0s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\  
preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to
```

```
`sparse_output` in version 1.2 and will be removed in 1.4.  
`sparse_output` is ignored unless you leave `sparse` to its default  
value.
```

```
warnings.warn()
```

```
[CV 4/5] END randomforestclassifier__criterion=entropy,  
randomforestclassifier__max_features=0.33,  
randomforestclassifier__min_samples_leaf=5,  
randomforestclassifier__min_samples_split=2,  
randomforestclassifier__n_estimators=100;; score=0.828 total time=  
5.9s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\  
preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to  
`sparse_output` in version 1.2 and will be removed in 1.4.  
`sparse_output` is ignored unless you leave `sparse` to its default  
value.
```

```
warnings.warn()
```

```
[CV 5/5] END randomforestclassifier__criterion=entropy,  
randomforestclassifier__max_features=0.33,  
randomforestclassifier__min_samples_leaf=5,  
randomforestclassifier__min_samples_split=2,  
randomforestclassifier__n_estimators=100;; score=0.836 total time=  
6.0s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\  
preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to  
`sparse_output` in version 1.2 and will be removed in 1.4.  
`sparse_output` is ignored unless you leave `sparse` to its default  
value.
```

```
warnings.warn()
```

```
[CV 1/5] END randomforestclassifier__criterion=entropy,  
randomforestclassifier__max_features=0.33,  
randomforestclassifier__min_samples_leaf=5,  
randomforestclassifier__min_samples_split=2,  
randomforestclassifier__n_estimators=150;; score=0.837 total time=  
9.2s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\  
preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to  
`sparse_output` in version 1.2 and will be removed in 1.4.  
`sparse_output` is ignored unless you leave `sparse` to its default  
value.
```

```
warnings.warn()
```

```
[CV 2/5] END randomforestclassifier__criterion=entropy,  
randomforestclassifier__max_features=0.33,  
randomforestclassifier__min_samples_leaf=5,  
randomforestclassifier__min_samples_split=2,
```

```
randomforestclassifier__n_estimators=150;; score=0.829 total time=9.2s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to `sparse_output` in version 1.2 and will be removed in 1.4. `sparse_output` is ignored unless you leave `sparse` to its default value.
```

```
warnings.warn(
```

```
[CV 3/5] END randomforestclassifier__criterion=entropy, randomforestclassifier__max_features=0.33, randomforestclassifier__min_samples_leaf=5, randomforestclassifier__min_samples_split=2, randomforestclassifier__n_estimators=150;; score=0.813 total time=8.7s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to `sparse_output` in version 1.2 and will be removed in 1.4. `sparse_output` is ignored unless you leave `sparse` to its default value.
```

```
warnings.warn(
```

```
[CV 4/5] END randomforestclassifier__criterion=entropy, randomforestclassifier__max_features=0.33, randomforestclassifier__min_samples_leaf=5, randomforestclassifier__min_samples_split=2, randomforestclassifier__n_estimators=150;; score=0.824 total time=9.0s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to `sparse_output` in version 1.2 and will be removed in 1.4. `sparse_output` is ignored unless you leave `sparse` to its default value.
```

```
warnings.warn(
```

```
[CV 5/5] END randomforestclassifier__criterion=entropy, randomforestclassifier__max_features=0.33, randomforestclassifier__min_samples_leaf=5, randomforestclassifier__min_samples_split=2, randomforestclassifier__n_estimators=150;; score=0.842 total time=8.9s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to `sparse_output` in version 1.2 and will be removed in 1.4. `sparse_output` is ignored unless you leave `sparse` to its default value.
```

```
warnings.warn(
```

```
[CV 1/5] END randomforestclassifier__criterion=entropy,  
randomforestclassifier__max_features=0.33,  
randomforestclassifier__min_samples_leaf=5,  
randomforestclassifier__min_samples_split=3,  
randomforestclassifier__n_estimators=50;; score=0.842 total time=  
3.1s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\  
preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to  
`sparse_output` in version 1.2 and will be removed in 1.4.  
`sparse_output` is ignored unless you leave `sparse` to its default  
value.
```

```
warnings.warn(
```

```
[CV 2/5] END randomforestclassifier__criterion=entropy,  
randomforestclassifier__max_features=0.33,  
randomforestclassifier__min_samples_leaf=5,  
randomforestclassifier__min_samples_split=3,  
randomforestclassifier__n_estimators=50;; score=0.826 total time=  
3.0s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\  
preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to  
`sparse_output` in version 1.2 and will be removed in 1.4.  
`sparse_output` is ignored unless you leave `sparse` to its default  
value.
```

```
warnings.warn(
```

```
[CV 3/5] END randomforestclassifier__criterion=entropy,  
randomforestclassifier__max_features=0.33,  
randomforestclassifier__min_samples_leaf=5,  
randomforestclassifier__min_samples_split=3,  
randomforestclassifier__n_estimators=50;; score=0.811 total time=  
2.9s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\  
preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to  
`sparse_output` in version 1.2 and will be removed in 1.4.  
`sparse_output` is ignored unless you leave `sparse` to its default  
value.
```

```
warnings.warn(
```

```
[CV 4/5] END randomforestclassifier__criterion=entropy,  
randomforestclassifier__max_features=0.33,  
randomforestclassifier__min_samples_leaf=5,  
randomforestclassifier__min_samples_split=3,  
randomforestclassifier__n_estimators=50;; score=0.825 total time=  
2.9s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\  
preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to
```

```
`sparse_output` in version 1.2 and will be removed in 1.4.  
`sparse_output` is ignored unless you leave `sparse` to its default  
value.
```

```
warnings.warn()
```

```
[CV 5/5] END randomforestclassifier__criterion=entropy,  
randomforestclassifier__max_features=0.33,  
randomforestclassifier__min_samples_leaf=5,  
randomforestclassifier__min_samples_split=3,  
randomforestclassifier__n_estimators=50;; score=0.834 total time=  
3.0s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\  
preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to  
`sparse_output` in version 1.2 and will be removed in 1.4.  
`sparse_output` is ignored unless you leave `sparse` to its default  
value.
```

```
warnings.warn()
```

```
[CV 1/5] END randomforestclassifier__criterion=entropy,  
randomforestclassifier__max_features=0.33,  
randomforestclassifier__min_samples_leaf=5,  
randomforestclassifier__min_samples_split=3,  
randomforestclassifier__n_estimators=100;; score=0.840 total time=  
6.3s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\  
preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to  
`sparse_output` in version 1.2 and will be removed in 1.4.  
`sparse_output` is ignored unless you leave `sparse` to its default  
value.
```

```
warnings.warn()
```

```
[CV 2/5] END randomforestclassifier__criterion=entropy,  
randomforestclassifier__max_features=0.33,  
randomforestclassifier__min_samples_leaf=5,  
randomforestclassifier__min_samples_split=3,  
randomforestclassifier__n_estimators=100;; score=0.836 total time=  
6.0s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\  
preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to  
`sparse_output` in version 1.2 and will be removed in 1.4.  
`sparse_output` is ignored unless you leave `sparse` to its default  
value.
```

```
warnings.warn()
```

```
[CV 3/5] END randomforestclassifier__criterion=entropy,  
randomforestclassifier__max_features=0.33,  
randomforestclassifier__min_samples_leaf=5,  
randomforestclassifier__min_samples_split=3,
```

```
randomforestclassifier__n_estimators=100;; score=0.814 total time=6.1s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to `sparse_output` in version 1.2 and will be removed in 1.4. `sparse_output` is ignored unless you leave `sparse` to its default value.
```

```
warnings.warn(
```

```
[CV 4/5] END randomforestclassifier__criterion=entropy, randomforestclassifier__max_features=0.33, randomforestclassifier__min_samples_leaf=5, randomforestclassifier__min_samples_split=3, randomforestclassifier__n_estimators=100;; score=0.824 total time=5.9s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to `sparse_output` in version 1.2 and will be removed in 1.4. `sparse_output` is ignored unless you leave `sparse` to its default value.
```

```
warnings.warn(
```

```
[CV 5/5] END randomforestclassifier__criterion=entropy, randomforestclassifier__max_features=0.33, randomforestclassifier__min_samples_leaf=5, randomforestclassifier__min_samples_split=3, randomforestclassifier__n_estimators=100;; score=0.844 total time=5.8s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to `sparse_output` in version 1.2 and will be removed in 1.4. `sparse_output` is ignored unless you leave `sparse` to its default value.
```

```
warnings.warn(
```

```
[CV 1/5] END randomforestclassifier__criterion=entropy, randomforestclassifier__max_features=0.33, randomforestclassifier__min_samples_leaf=5, randomforestclassifier__min_samples_split=3, randomforestclassifier__n_estimators=150;; score=0.841 total time=9.3s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to `sparse_output` in version 1.2 and will be removed in 1.4. `sparse_output` is ignored unless you leave `sparse` to its default value.
```

```
warnings.warn(
```

```
[CV 2/5] END randomforestclassifier__criterion=entropy,  
randomforestclassifier__max_features=0.33,  
randomforestclassifier__min_samples_leaf=5,  
randomforestclassifier__min_samples_split=3,  
randomforestclassifier__n_estimators=150;; score=0.830 total time=  
9.1s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\  
preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to  
`sparse_output` in version 1.2 and will be removed in 1.4.  
`sparse_output` is ignored unless you leave `sparse` to its default  
value.
```

```
warnings.warn(
```

```
[CV 3/5] END randomforestclassifier__criterion=entropy,  
randomforestclassifier__max_features=0.33,  
randomforestclassifier__min_samples_leaf=5,  
randomforestclassifier__min_samples_split=3,  
randomforestclassifier__n_estimators=150;; score=0.814 total time=  
9.1s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\  
preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to  
`sparse_output` in version 1.2 and will be removed in 1.4.  
`sparse_output` is ignored unless you leave `sparse` to its default  
value.
```

```
warnings.warn(
```

```
[CV 4/5] END randomforestclassifier__criterion=entropy,  
randomforestclassifier__max_features=0.33,  
randomforestclassifier__min_samples_leaf=5,  
randomforestclassifier__min_samples_split=3,  
randomforestclassifier__n_estimators=150;; score=0.833 total time=  
9.0s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\  
preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to  
`sparse_output` in version 1.2 and will be removed in 1.4.  
`sparse_output` is ignored unless you leave `sparse` to its default  
value.
```

```
warnings.warn(
```

```
[CV 5/5] END randomforestclassifier__criterion=entropy,  
randomforestclassifier__max_features=0.33,  
randomforestclassifier__min_samples_leaf=5,  
randomforestclassifier__min_samples_split=3,  
randomforestclassifier__n_estimators=150;; score=0.844 total time=  
9.0s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\  
preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to
```



```
`sparse_output` in version 1.2 and will be removed in 1.4.  
`sparse_output` is ignored unless you leave `sparse` to its default  
value.
```

```
warnings.warn()
```

```
[CV 1/5] END randomforestclassifier__criterion=entropy,  
randomforestclassifier__max_features=0.33,  
randomforestclassifier__min_samples_leaf=5,  
randomforestclassifier__min_samples_split=4,  
randomforestclassifier__n_estimators=50;; score=0.836 total time=  
3.0s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\  
preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to  
`sparse_output` in version 1.2 and will be removed in 1.4.  
`sparse_output` is ignored unless you leave `sparse` to its default  
value.
```

```
warnings.warn()
```

```
[CV 2/5] END randomforestclassifier__criterion=entropy,  
randomforestclassifier__max_features=0.33,  
randomforestclassifier__min_samples_leaf=5,  
randomforestclassifier__min_samples_split=4,  
randomforestclassifier__n_estimators=50;; score=0.826 total time=  
3.2s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\  
preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to  
`sparse_output` in version 1.2 and will be removed in 1.4.  
`sparse_output` is ignored unless you leave `sparse` to its default  
value.
```

```
warnings.warn()
```

```
[CV 3/5] END randomforestclassifier__criterion=entropy,  
randomforestclassifier__max_features=0.33,  
randomforestclassifier__min_samples_leaf=5,  
randomforestclassifier__min_samples_split=4,  
randomforestclassifier__n_estimators=50;; score=0.809 total time=  
3.0s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\  
preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to  
`sparse_output` in version 1.2 and will be removed in 1.4.  
`sparse_output` is ignored unless you leave `sparse` to its default  
value.
```

```
warnings.warn()
```

```
[CV 4/5] END randomforestclassifier__criterion=entropy,  
randomforestclassifier__max_features=0.33,  
randomforestclassifier__min_samples_leaf=5,  
randomforestclassifier__min_samples_split=4,
```

```
randomforestclassifier__n_estimators=50;; score=0.824 total time=2.9s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to `sparse_output` in version 1.2 and will be removed in 1.4.
`sparse_output` is ignored unless you leave `sparse` to its default value.
```

```
warnings.warn(
```

```
[CV 5/5] END randomforestclassifier__criterion=entropy,
randomforestclassifier__max_features=0.33,
randomforestclassifier__min_samples_leaf=5,
randomforestclassifier__min_samples_split=4,
randomforestclassifier__n_estimators=50;; score=0.834 total time=3.2s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to `sparse_output` in version 1.2 and will be removed in 1.4.
`sparse_output` is ignored unless you leave `sparse` to its default value.
```

```
warnings.warn(
```

```
[CV 1/5] END randomforestclassifier__criterion=entropy,
randomforestclassifier__max_features=0.33,
randomforestclassifier__min_samples_leaf=5,
randomforestclassifier__min_samples_split=4,
randomforestclassifier__n_estimators=100;; score=0.839 total time=6.2s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to `sparse_output` in version 1.2 and will be removed in 1.4.
`sparse_output` is ignored unless you leave `sparse` to its default value.
```

```
warnings.warn(
```

```
[CV 2/5] END randomforestclassifier__criterion=entropy,
randomforestclassifier__max_features=0.33,
randomforestclassifier__min_samples_leaf=5,
randomforestclassifier__min_samples_split=4,
randomforestclassifier__n_estimators=100;; score=0.827 total time=6.0s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to `sparse_output` in version 1.2 and will be removed in 1.4.
`sparse_output` is ignored unless you leave `sparse` to its default value.
```

```
warnings.warn(
```

```
[CV 3/5] END randomforestclassifier__criterion=entropy,  
randomforestclassifier__max_features=0.33,  
randomforestclassifier__min_samples_leaf=5,  
randomforestclassifier__min_samples_split=4,  
randomforestclassifier__n_estimators=100;; score=0.816 total time=  
5.8s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\  
preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to  
`sparse_output` in version 1.2 and will be removed in 1.4.  
`sparse_output` is ignored unless you leave `sparse` to its default  
value.
```

```
warnings.warn(
```

```
[CV 4/5] END randomforestclassifier__criterion=entropy,  
randomforestclassifier__max_features=0.33,  
randomforestclassifier__min_samples_leaf=5,  
randomforestclassifier__min_samples_split=4,  
randomforestclassifier__n_estimators=100;; score=0.835 total time=  
6.2s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\  
preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to  
`sparse_output` in version 1.2 and will be removed in 1.4.  
`sparse_output` is ignored unless you leave `sparse` to its default  
value.
```

```
warnings.warn(
```

```
[CV 5/5] END randomforestclassifier__criterion=entropy,  
randomforestclassifier__max_features=0.33,  
randomforestclassifier__min_samples_leaf=5,  
randomforestclassifier__min_samples_split=4,  
randomforestclassifier__n_estimators=100;; score=0.840 total time=  
5.8s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\  
preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to  
`sparse_output` in version 1.2 and will be removed in 1.4.  
`sparse_output` is ignored unless you leave `sparse` to its default  
value.
```

```
warnings.warn(
```

```
[CV 1/5] END randomforestclassifier__criterion=entropy,  
randomforestclassifier__max_features=0.33,  
randomforestclassifier__min_samples_leaf=5,  
randomforestclassifier__min_samples_split=4,  
randomforestclassifier__n_estimators=150;; score=0.841 total time=  
9.3s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\  
preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to
```

```
`sparse_output` in version 1.2 and will be removed in 1.4.  
`sparse_output` is ignored unless you leave `sparse` to its default  
value.
```

```
warnings.warn()
```

```
[CV 2/5] END randomforestclassifier__criterion=entropy,  
randomforestclassifier__max_features=0.33,  
randomforestclassifier__min_samples_leaf=5,  
randomforestclassifier__min_samples_split=4,  
randomforestclassifier__n_estimators=150;; score=0.830 total time=  
8.9s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\  
preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to  
`sparse_output` in version 1.2 and will be removed in 1.4.  
`sparse_output` is ignored unless you leave `sparse` to its default  
value.
```

```
warnings.warn()
```

```
[CV 3/5] END randomforestclassifier__criterion=entropy,  
randomforestclassifier__max_features=0.33,  
randomforestclassifier__min_samples_leaf=5,  
randomforestclassifier__min_samples_split=4,  
randomforestclassifier__n_estimators=150;; score=0.811 total time=  
9.0s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\  
preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to  
`sparse_output` in version 1.2 and will be removed in 1.4.  
`sparse_output` is ignored unless you leave `sparse` to its default  
value.
```

```
warnings.warn()
```

```
[CV 4/5] END randomforestclassifier__criterion=entropy,  
randomforestclassifier__max_features=0.33,  
randomforestclassifier__min_samples_leaf=5,  
randomforestclassifier__min_samples_split=4,  
randomforestclassifier__n_estimators=150;; score=0.832 total time=  
8.8s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\  
preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to  
`sparse_output` in version 1.2 and will be removed in 1.4.  
`sparse_output` is ignored unless you leave `sparse` to its default  
value.
```

```
warnings.warn()
```

```
[CV 5/5] END randomforestclassifier__criterion=entropy,  
randomforestclassifier__max_features=0.33,  
randomforestclassifier__min_samples_leaf=5,  
randomforestclassifier__min_samples_split=4,
```

```
randomforestclassifier__n_estimators=150;; score=0.839 total time=9.2s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to `sparse_output` in version 1.2 and will be removed in 1.4. `sparse_output` is ignored unless you leave `sparse` to its default value.
```

```
warnings.warn(
```

```
[CV 1/5] END randomforestclassifier__criterion=entropy,  
randomforestclassifier__max_features=0.33,  
randomforestclassifier__min_samples_leaf=10,  
randomforestclassifier__min_samples_split=2,  
randomforestclassifier__n_estimators=50;; score=0.831 total time=2.8s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to `sparse_output` in version 1.2 and will be removed in 1.4. `sparse_output` is ignored unless you leave `sparse` to its default value.
```

```
warnings.warn(
```

```
[CV 2/5] END randomforestclassifier__criterion=entropy,  
randomforestclassifier__max_features=0.33,  
randomforestclassifier__min_samples_leaf=10,  
randomforestclassifier__min_samples_split=2,  
randomforestclassifier__n_estimators=50;; score=0.823 total time=2.6s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to `sparse_output` in version 1.2 and will be removed in 1.4. `sparse_output` is ignored unless you leave `sparse` to its default value.
```

```
warnings.warn(
```

```
[CV 3/5] END randomforestclassifier__criterion=entropy,  
randomforestclassifier__max_features=0.33,  
randomforestclassifier__min_samples_leaf=10,  
randomforestclassifier__min_samples_split=2,  
randomforestclassifier__n_estimators=50;; score=0.807 total time=2.6s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to `sparse_output` in version 1.2 and will be removed in 1.4. `sparse_output` is ignored unless you leave `sparse` to its default value.
```

```
warnings.warn(
```

```
[CV 4/5] END randomforestclassifier__criterion=entropy,  
randomforestclassifier__max_features=0.33,  
randomforestclassifier__min_samples_leaf=10,  
randomforestclassifier__min_samples_split=2,  
randomforestclassifier__n_estimators=50;; score=0.821 total time=  
2.8s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\  
preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to  
`sparse_output` in version 1.2 and will be removed in 1.4.  
`sparse_output` is ignored unless you leave `sparse` to its default  
value.
```

```
warnings.warn(
```

```
[CV 5/5] END randomforestclassifier__criterion=entropy,  
randomforestclassifier__max_features=0.33,  
randomforestclassifier__min_samples_leaf=10,  
randomforestclassifier__min_samples_split=2,  
randomforestclassifier__n_estimators=50;; score=0.830 total time=  
2.6s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\  
preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to  
`sparse_output` in version 1.2 and will be removed in 1.4.  
`sparse_output` is ignored unless you leave `sparse` to its default  
value.
```

```
warnings.warn(
```

```
[CV 1/5] END randomforestclassifier__criterion=entropy,  
randomforestclassifier__max_features=0.33,  
randomforestclassifier__min_samples_leaf=10,  
randomforestclassifier__min_samples_split=2,  
randomforestclassifier__n_estimators=100;; score=0.835 total time=  
5.4s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\  
preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to  
`sparse_output` in version 1.2 and will be removed in 1.4.  
`sparse_output` is ignored unless you leave `sparse` to its default  
value.
```

```
warnings.warn(
```

```
[CV 2/5] END randomforestclassifier__criterion=entropy,  
randomforestclassifier__max_features=0.33,  
randomforestclassifier__min_samples_leaf=10,  
randomforestclassifier__min_samples_split=2,  
randomforestclassifier__n_estimators=100;; score=0.824 total time=  
5.5s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\  
preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to
```

```
`sparse_output` in version 1.2 and will be removed in 1.4.  
`sparse_output` is ignored unless you leave `sparse` to its default  
value.
```

```
warnings.warn()
```

```
[CV 3/5] END randomforestclassifier__criterion=entropy,  
randomforestclassifier__max_features=0.33,  
randomforestclassifier__min_samples_leaf=10,  
randomforestclassifier__min_samples_split=2,  
randomforestclassifier__n_estimators=100;; score=0.807 total time=  
5.4s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\  
preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to  
`sparse_output` in version 1.2 and will be removed in 1.4.  
`sparse_output` is ignored unless you leave `sparse` to its default  
value.
```

```
warnings.warn()
```

```
[CV 4/5] END randomforestclassifier__criterion=entropy,  
randomforestclassifier__max_features=0.33,  
randomforestclassifier__min_samples_leaf=10,  
randomforestclassifier__min_samples_split=2,  
randomforestclassifier__n_estimators=100;; score=0.820 total time=  
5.2s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\  
preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to  
`sparse_output` in version 1.2 and will be removed in 1.4.  
`sparse_output` is ignored unless you leave `sparse` to its default  
value.
```

```
warnings.warn()
```

```
[CV 5/5] END randomforestclassifier__criterion=entropy,  
randomforestclassifier__max_features=0.33,  
randomforestclassifier__min_samples_leaf=10,  
randomforestclassifier__min_samples_split=2,  
randomforestclassifier__n_estimators=100;; score=0.836 total time=  
5.5s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\  
preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to  
`sparse_output` in version 1.2 and will be removed in 1.4.  
`sparse_output` is ignored unless you leave `sparse` to its default  
value.
```

```
warnings.warn()
```

```
[CV 1/5] END randomforestclassifier__criterion=entropy,  
randomforestclassifier__max_features=0.33,  
randomforestclassifier__min_samples_leaf=10,  
randomforestclassifier__min_samples_split=2,
```

```
randomforestclassifier__n_estimators=150;; score=0.830 total time=8.4s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to `sparse_output` in version 1.2 and will be removed in 1.4. `sparse_output` is ignored unless you leave `sparse` to its default value.
```

```
warnings.warn(
```

```
[CV 2/5] END randomforestclassifier__criterion=entropy, randomforestclassifier__max_features=0.33, randomforestclassifier__min_samples_leaf=10, randomforestclassifier__min_samples_split=2, randomforestclassifier__n_estimators=150;; score=0.821 total time=8.1s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to `sparse_output` in version 1.2 and will be removed in 1.4. `sparse_output` is ignored unless you leave `sparse` to its default value.
```

```
warnings.warn(
```

```
[CV 3/5] END randomforestclassifier__criterion=entropy, randomforestclassifier__max_features=0.33, randomforestclassifier__min_samples_leaf=10, randomforestclassifier__min_samples_split=2, randomforestclassifier__n_estimators=150;; score=0.811 total time=7.9s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to `sparse_output` in version 1.2 and will be removed in 1.4. `sparse_output` is ignored unless you leave `sparse` to its default value.
```

```
warnings.warn(
```

```
[CV 4/5] END randomforestclassifier__criterion=entropy, randomforestclassifier__max_features=0.33, randomforestclassifier__min_samples_leaf=10, randomforestclassifier__min_samples_split=2, randomforestclassifier__n_estimators=150;; score=0.821 total time=8.1s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to `sparse_output` in version 1.2 and will be removed in 1.4. `sparse_output` is ignored unless you leave `sparse` to its default value.
```

```
warnings.warn(
```



```
[CV 5/5] END randomforestclassifier__criterion=entropy,  
randomforestclassifier__max_features=0.33,  
randomforestclassifier__min_samples_leaf=10,  
randomforestclassifier__min_samples_split=2,  
randomforestclassifier__n_estimators=150;; score=0.834 total time=  
7.9s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\  
preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to  
`sparse_output` in version 1.2 and will be removed in 1.4.  
`sparse_output` is ignored unless you leave `sparse` to its default  
value.
```

```
warnings.warn(
```

```
[CV 1/5] END randomforestclassifier__criterion=entropy,  
randomforestclassifier__max_features=0.33,  
randomforestclassifier__min_samples_leaf=10,  
randomforestclassifier__min_samples_split=3,  
randomforestclassifier__n_estimators=50;; score=0.832 total time=  
2.7s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\  
preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to  
`sparse_output` in version 1.2 and will be removed in 1.4.  
`sparse_output` is ignored unless you leave `sparse` to its default  
value.
```

```
warnings.warn(
```

```
[CV 2/5] END randomforestclassifier__criterion=entropy,  
randomforestclassifier__max_features=0.33,  
randomforestclassifier__min_samples_leaf=10,  
randomforestclassifier__min_samples_split=3,  
randomforestclassifier__n_estimators=50;; score=0.824 total time=  
2.7s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\  
preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to  
`sparse_output` in version 1.2 and will be removed in 1.4.  
`sparse_output` is ignored unless you leave `sparse` to its default  
value.
```

```
warnings.warn(
```

```
[CV 3/5] END randomforestclassifier__criterion=entropy,  
randomforestclassifier__max_features=0.33,  
randomforestclassifier__min_samples_leaf=10,  
randomforestclassifier__min_samples_split=3,  
randomforestclassifier__n_estimators=50;; score=0.801 total time=  
2.8s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\  
preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to
```

```
`sparse_output` in version 1.2 and will be removed in 1.4.  
`sparse_output` is ignored unless you leave `sparse` to its default  
value.
```

```
warnings.warn()
```

```
[CV 4/5] END randomforestclassifier__criterion=entropy,  
randomforestclassifier__max_features=0.33,  
randomforestclassifier__min_samples_leaf=10,  
randomforestclassifier__min_samples_split=3,  
randomforestclassifier__n_estimators=50;; score=0.816 total time=  
2.7s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\  
preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to  
`sparse_output` in version 1.2 and will be removed in 1.4.  
`sparse_output` is ignored unless you leave `sparse` to its default  
value.
```

```
warnings.warn()
```

```
[CV 5/5] END randomforestclassifier__criterion=entropy,  
randomforestclassifier__max_features=0.33,  
randomforestclassifier__min_samples_leaf=10,  
randomforestclassifier__min_samples_split=3,  
randomforestclassifier__n_estimators=50;; score=0.836 total time=  
2.7s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\  
preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to  
`sparse_output` in version 1.2 and will be removed in 1.4.  
`sparse_output` is ignored unless you leave `sparse` to its default  
value.
```

```
warnings.warn()
```

```
[CV 1/5] END randomforestclassifier__criterion=entropy,  
randomforestclassifier__max_features=0.33,  
randomforestclassifier__min_samples_leaf=10,  
randomforestclassifier__min_samples_split=3,  
randomforestclassifier__n_estimators=100;; score=0.834 total time=  
5.3s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\  
preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to  
`sparse_output` in version 1.2 and will be removed in 1.4.  
`sparse_output` is ignored unless you leave `sparse` to its default  
value.
```

```
warnings.warn()
```

```
[CV 2/5] END randomforestclassifier__criterion=entropy,  
randomforestclassifier__max_features=0.33,  
randomforestclassifier__min_samples_leaf=10,  
randomforestclassifier__min_samples_split=3,
```

```
randomforestclassifier__n_estimators=100;; score=0.826 total time=5.6s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to `sparse_output` in version 1.2 and will be removed in 1.4. `sparse_output` is ignored unless you leave `sparse` to its default value.
```

```
warnings.warn(
```

```
[CV 3/5] END randomforestclassifier__criterion=entropy, randomforestclassifier__max_features=0.33, randomforestclassifier__min_samples_leaf=10, randomforestclassifier__min_samples_split=3, randomforestclassifier__n_estimators=100;; score=0.808 total time=5.4s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to `sparse_output` in version 1.2 and will be removed in 1.4. `sparse_output` is ignored unless you leave `sparse` to its default value.
```

```
warnings.warn(
```

```
[CV 4/5] END randomforestclassifier__criterion=entropy, randomforestclassifier__max_features=0.33, randomforestclassifier__min_samples_leaf=10, randomforestclassifier__min_samples_split=3, randomforestclassifier__n_estimators=100;; score=0.828 total time=5.2s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to `sparse_output` in version 1.2 and will be removed in 1.4. `sparse_output` is ignored unless you leave `sparse` to its default value.
```

```
warnings.warn(
```

```
[CV 5/5] END randomforestclassifier__criterion=entropy, randomforestclassifier__max_features=0.33, randomforestclassifier__min_samples_leaf=10, randomforestclassifier__min_samples_split=3, randomforestclassifier__n_estimators=100;; score=0.838 total time=5.5s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to `sparse_output` in version 1.2 and will be removed in 1.4. `sparse_output` is ignored unless you leave `sparse` to its default value.
```

```
warnings.warn(
```

```
[CV 1/5] END randomforestclassifier__criterion=entropy,  
randomforestclassifier__max_features=0.33,  
randomforestclassifier__min_samples_leaf=10,  
randomforestclassifier__min_samples_split=3,  
randomforestclassifier__n_estimators=150;; score=0.835 total time=  
8.1s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\  
preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to  
`sparse_output` in version 1.2 and will be removed in 1.4.  
`sparse_output` is ignored unless you leave `sparse` to its default  
value.
```

```
warnings.warn(
```

```
[CV 2/5] END randomforestclassifier__criterion=entropy,  
randomforestclassifier__max_features=0.33,  
randomforestclassifier__min_samples_leaf=10,  
randomforestclassifier__min_samples_split=3,  
randomforestclassifier__n_estimators=150;; score=0.822 total time=  
8.4s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\  
preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to  
`sparse_output` in version 1.2 and will be removed in 1.4.  
`sparse_output` is ignored unless you leave `sparse` to its default  
value.
```

```
warnings.warn(
```

```
[CV 3/5] END randomforestclassifier__criterion=entropy,  
randomforestclassifier__max_features=0.33,  
randomforestclassifier__min_samples_leaf=10,  
randomforestclassifier__min_samples_split=3,  
randomforestclassifier__n_estimators=150;; score=0.811 total time=  
8.0s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\  
preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to  
`sparse_output` in version 1.2 and will be removed in 1.4.  
`sparse_output` is ignored unless you leave `sparse` to its default  
value.
```

```
warnings.warn(
```

```
[CV 4/5] END randomforestclassifier__criterion=entropy,  
randomforestclassifier__max_features=0.33,  
randomforestclassifier__min_samples_leaf=10,  
randomforestclassifier__min_samples_split=3,  
randomforestclassifier__n_estimators=150;; score=0.825 total time=  
8.8s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\  
preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to
```

```
`sparse_output` in version 1.2 and will be removed in 1.4.  
`sparse_output` is ignored unless you leave `sparse` to its default  
value.
```

```
warnings.warn()
```

```
[CV 5/5] END randomforestclassifier__criterion=entropy,  
randomforestclassifier__max_features=0.33,  
randomforestclassifier__min_samples_leaf=10,  
randomforestclassifier__min_samples_split=3,  
randomforestclassifier__n_estimators=150;; score=0.832 total time=  
8.6s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\  
preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to  
`sparse_output` in version 1.2 and will be removed in 1.4.  
`sparse_output` is ignored unless you leave `sparse` to its default  
value.
```

```
warnings.warn()
```

```
[CV 1/5] END randomforestclassifier__criterion=entropy,  
randomforestclassifier__max_features=0.33,  
randomforestclassifier__min_samples_leaf=10,  
randomforestclassifier__min_samples_split=4,  
randomforestclassifier__n_estimators=50;; score=0.837 total time=  
3.0s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\  
preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to  
`sparse_output` in version 1.2 and will be removed in 1.4.  
`sparse_output` is ignored unless you leave `sparse` to its default  
value.
```

```
warnings.warn()
```

```
[CV 2/5] END randomforestclassifier__criterion=entropy,  
randomforestclassifier__max_features=0.33,  
randomforestclassifier__min_samples_leaf=10,  
randomforestclassifier__min_samples_split=4,  
randomforestclassifier__n_estimators=50;; score=0.817 total time=  
2.8s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\  
preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to  
`sparse_output` in version 1.2 and will be removed in 1.4.  
`sparse_output` is ignored unless you leave `sparse` to its default  
value.
```

```
warnings.warn()
```

```
[CV 3/5] END randomforestclassifier__criterion=entropy,  
randomforestclassifier__max_features=0.33,  
randomforestclassifier__min_samples_leaf=10,  
randomforestclassifier__min_samples_split=4,
```

```
randomforestclassifier__n_estimators=50;; score=0.814 total time=3.1s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to `sparse_output` in version 1.2 and will be removed in 1.4.
`sparse_output` is ignored unless you leave `sparse` to its default value.
```

```
warnings.warn(
```

```
[CV 4/5] END randomforestclassifier__criterion=entropy,
randomforestclassifier__max_features=0.33,
randomforestclassifier__min_samples_leaf=10,
randomforestclassifier__min_samples_split=4,
randomforestclassifier__n_estimators=50;; score=0.816 total time=2.9s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to `sparse_output` in version 1.2 and will be removed in 1.4.
`sparse_output` is ignored unless you leave `sparse` to its default value.
```

```
warnings.warn(
```

```
[CV 5/5] END randomforestclassifier__criterion=entropy,
randomforestclassifier__max_features=0.33,
randomforestclassifier__min_samples_leaf=10,
randomforestclassifier__min_samples_split=4,
randomforestclassifier__n_estimators=50;; score=0.829 total time=2.8s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to `sparse_output` in version 1.2 and will be removed in 1.4.
`sparse_output` is ignored unless you leave `sparse` to its default value.
```

```
warnings.warn(
```

```
[CV 1/5] END randomforestclassifier__criterion=entropy,
randomforestclassifier__max_features=0.33,
randomforestclassifier__min_samples_leaf=10,
randomforestclassifier__min_samples_split=4,
randomforestclassifier__n_estimators=100;; score=0.831 total time=5.9s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to `sparse_output` in version 1.2 and will be removed in 1.4.
`sparse_output` is ignored unless you leave `sparse` to its default value.
```

```
warnings.warn(
```

```
[CV 2/5] END randomforestclassifier__criterion=entropy,  
randomforestclassifier__max_features=0.33,  
randomforestclassifier__min_samples_leaf=10,  
randomforestclassifier__min_samples_split=4,  
randomforestclassifier__n_estimators=100;; score=0.823 total time=  
5.8s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\  
preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to  
`sparse_output` in version 1.2 and will be removed in 1.4.  
`sparse_output` is ignored unless you leave `sparse` to its default  
value.
```

```
warnings.warn(
```

```
[CV 3/5] END randomforestclassifier__criterion=entropy,  
randomforestclassifier__max_features=0.33,  
randomforestclassifier__min_samples_leaf=10,  
randomforestclassifier__min_samples_split=4,  
randomforestclassifier__n_estimators=100;; score=0.807 total time=  
5.8s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\  
preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to  
`sparse_output` in version 1.2 and will be removed in 1.4.  
`sparse_output` is ignored unless you leave `sparse` to its default  
value.
```

```
warnings.warn(
```

```
[CV 4/5] END randomforestclassifier__criterion=entropy,  
randomforestclassifier__max_features=0.33,  
randomforestclassifier__min_samples_leaf=10,  
randomforestclassifier__min_samples_split=4,  
randomforestclassifier__n_estimators=100;; score=0.824 total time=  
6.0s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\  
preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to  
`sparse_output` in version 1.2 and will be removed in 1.4.  
`sparse_output` is ignored unless you leave `sparse` to its default  
value.
```

```
warnings.warn(
```

```
[CV 5/5] END randomforestclassifier__criterion=entropy,  
randomforestclassifier__max_features=0.33,  
randomforestclassifier__min_samples_leaf=10,  
randomforestclassifier__min_samples_split=4,  
randomforestclassifier__n_estimators=100;; score=0.836 total time=  
5.7s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\  
preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to
```

```
`sparse_output` in version 1.2 and will be removed in 1.4.  
`sparse_output` is ignored unless you leave `sparse` to its default  
value.
```

```
warnings.warn()
```

```
[CV 1/5] END randomforestclassifier__criterion=entropy,  
randomforestclassifier__max_features=0.33,  
randomforestclassifier__min_samples_leaf=10,  
randomforestclassifier__min_samples_split=4,  
randomforestclassifier__n_estimators=150;; score=0.834 total time=  
8.8s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\  
preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to  
`sparse_output` in version 1.2 and will be removed in 1.4.  
`sparse_output` is ignored unless you leave `sparse` to its default  
value.
```

```
warnings.warn()
```

```
[CV 2/5] END randomforestclassifier__criterion=entropy,  
randomforestclassifier__max_features=0.33,  
randomforestclassifier__min_samples_leaf=10,  
randomforestclassifier__min_samples_split=4,  
randomforestclassifier__n_estimators=150;; score=0.824 total time=  
8.8s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\  
preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to  
`sparse_output` in version 1.2 and will be removed in 1.4.  
`sparse_output` is ignored unless you leave `sparse` to its default  
value.
```

```
warnings.warn()
```

```
[CV 3/5] END randomforestclassifier__criterion=entropy,  
randomforestclassifier__max_features=0.33,  
randomforestclassifier__min_samples_leaf=10,  
randomforestclassifier__min_samples_split=4,  
randomforestclassifier__n_estimators=150;; score=0.809 total time=  
10.5s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\  
preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to  
`sparse_output` in version 1.2 and will be removed in 1.4.  
`sparse_output` is ignored unless you leave `sparse` to its default  
value.
```

```
warnings.warn()
```

```
[CV 4/5] END randomforestclassifier__criterion=entropy,  
randomforestclassifier__max_features=0.33,  
randomforestclassifier__min_samples_leaf=10,  
randomforestclassifier__min_samples_split=4,
```



```
randomforestclassifier__n_estimators=150;; score=0.820 total time=8.9s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to `sparse_output` in version 1.2 and will be removed in 1.4.
`sparse_output` is ignored unless you leave `sparse` to its default value.
  warnings.warn(
```

```
[CV 5/5] END randomforestclassifier__criterion=entropy,
randomforestclassifier__max_features=0.33,
randomforestclassifier__min_samples_leaf=10,
randomforestclassifier__min_samples_split=4,
randomforestclassifier__n_estimators=150;; score=0.832 total time=9.2s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to `sparse_output` in version 1.2 and will be removed in 1.4.
`sparse_output` is ignored unless you leave `sparse` to its default value.
  warnings.warn(
```

```
[CV 1/5] END randomforestclassifier__criterion=entropy,
randomforestclassifier__max_features=0.33,
randomforestclassifier__min_samples_leaf=15,
randomforestclassifier__min_samples_split=2,
randomforestclassifier__n_estimators=50;; score=0.831 total time=2.8s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to `sparse_output` in version 1.2 and will be removed in 1.4.
`sparse_output` is ignored unless you leave `sparse` to its default value.
  warnings.warn(
```

```
[CV 2/5] END randomforestclassifier__criterion=entropy,
randomforestclassifier__max_features=0.33,
randomforestclassifier__min_samples_leaf=15,
randomforestclassifier__min_samples_split=2,
randomforestclassifier__n_estimators=50;; score=0.814 total time=2.7s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to `sparse_output` in version 1.2 and will be removed in 1.4.
`sparse_output` is ignored unless you leave `sparse` to its default value.
  warnings.warn(
```

```
[CV 3/5] END randomforestclassifier__criterion=entropy,  
randomforestclassifier__max_features=0.33,  
randomforestclassifier__min_samples_leaf=15,  
randomforestclassifier__min_samples_split=2,  
randomforestclassifier__n_estimators=50;; score=0.810 total time=  
2.7s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\  
preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to  
`sparse_output` in version 1.2 and will be removed in 1.4.  
`sparse_output` is ignored unless you leave `sparse` to its default  
value.  
  warnings.warn(
```

```
[CV 4/5] END randomforestclassifier__criterion=entropy,  
randomforestclassifier__max_features=0.33,  
randomforestclassifier__min_samples_leaf=15,  
randomforestclassifier__min_samples_split=2,  
randomforestclassifier__n_estimators=50;; score=0.824 total time=  
2.8s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\  
preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to  
`sparse_output` in version 1.2 and will be removed in 1.4.  
`sparse_output` is ignored unless you leave `sparse` to its default  
value.  
  warnings.warn(
```

```
[CV 5/5] END randomforestclassifier__criterion=entropy,  
randomforestclassifier__max_features=0.33,  
randomforestclassifier__min_samples_leaf=15,  
randomforestclassifier__min_samples_split=2,  
randomforestclassifier__n_estimators=50;; score=0.825 total time=  
2.6s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\  
preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to  
`sparse_output` in version 1.2 and will be removed in 1.4.  
`sparse_output` is ignored unless you leave `sparse` to its default  
value.  
  warnings.warn(
```

```
[CV 1/5] END randomforestclassifier__criterion=entropy,  
randomforestclassifier__max_features=0.33,  
randomforestclassifier__min_samples_leaf=15,  
randomforestclassifier__min_samples_split=2,  
randomforestclassifier__n_estimators=100;; score=0.831 total time=  
5.5s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\  
preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to
```

```
`sparse_output` in version 1.2 and will be removed in 1.4.  
`sparse_output` is ignored unless you leave `sparse` to its default  
value.
```

```
warnings.warn()
```

```
[CV 2/5] END randomforestclassifier__criterion=entropy,  
randomforestclassifier__max_features=0.33,  
randomforestclassifier__min_samples_leaf=15,  
randomforestclassifier__min_samples_split=2,  
randomforestclassifier__n_estimators=100;; score=0.824 total time=  
5.8s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\  
preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to  
`sparse_output` in version 1.2 and will be removed in 1.4.  
`sparse_output` is ignored unless you leave `sparse` to its default  
value.
```

```
warnings.warn()
```

```
[CV 3/5] END randomforestclassifier__criterion=entropy,  
randomforestclassifier__max_features=0.33,  
randomforestclassifier__min_samples_leaf=15,  
randomforestclassifier__min_samples_split=2,  
randomforestclassifier__n_estimators=100;; score=0.801 total time=  
5.5s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\  
preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to  
`sparse_output` in version 1.2 and will be removed in 1.4.  
`sparse_output` is ignored unless you leave `sparse` to its default  
value.
```

```
warnings.warn()
```

```
[CV 4/5] END randomforestclassifier__criterion=entropy,  
randomforestclassifier__max_features=0.33,  
randomforestclassifier__min_samples_leaf=15,  
randomforestclassifier__min_samples_split=2,  
randomforestclassifier__n_estimators=100;; score=0.814 total time=  
5.4s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\  
preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to  
`sparse_output` in version 1.2 and will be removed in 1.4.  
`sparse_output` is ignored unless you leave `sparse` to its default  
value.
```

```
warnings.warn()
```

```
[CV 5/5] END randomforestclassifier__criterion=entropy,  
randomforestclassifier__max_features=0.33,  
randomforestclassifier__min_samples_leaf=15,  
randomforestclassifier__min_samples_split=2,
```

```
randomforestclassifier__n_estimators=100;; score=0.827 total time=5.5s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to `sparse_output` in version 1.2 and will be removed in 1.4. `sparse_output` is ignored unless you leave `sparse` to its default value.
```

```
warnings.warn(
```

```
[CV 1/5] END randomforestclassifier__criterion=entropy, randomforestclassifier__max_features=0.33, randomforestclassifier__min_samples_leaf=15, randomforestclassifier__min_samples_split=2, randomforestclassifier__n_estimators=150;; score=0.832 total time=8.4s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to `sparse_output` in version 1.2 and will be removed in 1.4. `sparse_output` is ignored unless you leave `sparse` to its default value.
```

```
warnings.warn(
```

```
[CV 2/5] END randomforestclassifier__criterion=entropy, randomforestclassifier__max_features=0.33, randomforestclassifier__min_samples_leaf=15, randomforestclassifier__min_samples_split=2, randomforestclassifier__n_estimators=150;; score=0.819 total time=8.3s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to `sparse_output` in version 1.2 and will be removed in 1.4. `sparse_output` is ignored unless you leave `sparse` to its default value.
```

```
warnings.warn(
```

```
[CV 3/5] END randomforestclassifier__criterion=entropy, randomforestclassifier__max_features=0.33, randomforestclassifier__min_samples_leaf=15, randomforestclassifier__min_samples_split=2, randomforestclassifier__n_estimators=150;; score=0.808 total time=8.2s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to `sparse_output` in version 1.2 and will be removed in 1.4. `sparse_output` is ignored unless you leave `sparse` to its default value.
```

```
warnings.warn(
```

```
[CV 4/5] END randomforestclassifier__criterion=entropy,  
randomforestclassifier__max_features=0.33,  
randomforestclassifier__min_samples_leaf=15,  
randomforestclassifier__min_samples_split=2,  
randomforestclassifier__n_estimators=150;; score=0.821 total time=  
8.3s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\  
preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to  
`sparse_output` in version 1.2 and will be removed in 1.4.  
`sparse_output` is ignored unless you leave `sparse` to its default  
value.
```

```
warnings.warn(
```

```
[CV 5/5] END randomforestclassifier__criterion=entropy,  
randomforestclassifier__max_features=0.33,  
randomforestclassifier__min_samples_leaf=15,  
randomforestclassifier__min_samples_split=2,  
randomforestclassifier__n_estimators=150;; score=0.820 total time=  
8.3s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\  
preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to  
`sparse_output` in version 1.2 and will be removed in 1.4.  
`sparse_output` is ignored unless you leave `sparse` to its default  
value.
```

```
warnings.warn(
```

```
[CV 1/5] END randomforestclassifier__criterion=entropy,  
randomforestclassifier__max_features=0.33,  
randomforestclassifier__min_samples_leaf=15,  
randomforestclassifier__min_samples_split=3,  
randomforestclassifier__n_estimators=50;; score=0.826 total time=  
2.8s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\  
preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to  
`sparse_output` in version 1.2 and will be removed in 1.4.  
`sparse_output` is ignored unless you leave `sparse` to its default  
value.
```

```
warnings.warn(
```

```
[CV 2/5] END randomforestclassifier__criterion=entropy,  
randomforestclassifier__max_features=0.33,  
randomforestclassifier__min_samples_leaf=15,  
randomforestclassifier__min_samples_split=3,  
randomforestclassifier__n_estimators=50;; score=0.810 total time=  
2.9s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\  
preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to
```

```
`sparse_output` in version 1.2 and will be removed in 1.4.  
`sparse_output` is ignored unless you leave `sparse` to its default  
value.
```

```
warnings.warn()
```

```
[CV 3/5] END randomforestclassifier__criterion=entropy,  
randomforestclassifier__max_features=0.33,  
randomforestclassifier__min_samples_leaf=15,  
randomforestclassifier__min_samples_split=3,  
randomforestclassifier__n_estimators=50;; score=0.806 total time=  
3.0s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\  
preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to  
`sparse_output` in version 1.2 and will be removed in 1.4.  
`sparse_output` is ignored unless you leave `sparse` to its default  
value.
```

```
warnings.warn()
```

```
[CV 4/5] END randomforestclassifier__criterion=entropy,  
randomforestclassifier__max_features=0.33,  
randomforestclassifier__min_samples_leaf=15,  
randomforestclassifier__min_samples_split=3,  
randomforestclassifier__n_estimators=50;; score=0.818 total time=  
2.9s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\  
preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to  
`sparse_output` in version 1.2 and will be removed in 1.4.  
`sparse_output` is ignored unless you leave `sparse` to its default  
value.
```

```
warnings.warn()
```

```
[CV 5/5] END randomforestclassifier__criterion=entropy,  
randomforestclassifier__max_features=0.33,  
randomforestclassifier__min_samples_leaf=15,  
randomforestclassifier__min_samples_split=3,  
randomforestclassifier__n_estimators=50;; score=0.826 total time=  
3.0s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\  
preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to  
`sparse_output` in version 1.2 and will be removed in 1.4.  
`sparse_output` is ignored unless you leave `sparse` to its default  
value.
```

```
warnings.warn()
```

```
[CV 1/5] END randomforestclassifier__criterion=entropy,  
randomforestclassifier__max_features=0.33,  
randomforestclassifier__min_samples_leaf=15,  
randomforestclassifier__min_samples_split=3,
```

```
randomforestclassifier__n_estimators=100;; score=0.831 total time=6.1s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to `sparse_output` in version 1.2 and will be removed in 1.4.
`sparse_output` is ignored unless you leave `sparse` to its default value.
```

```
warnings.warn(
```

```
[CV 2/5] END randomforestclassifier__criterion=entropy,
randomforestclassifier__max_features=0.33,
randomforestclassifier__min_samples_leaf=15,
randomforestclassifier__min_samples_split=3,
randomforestclassifier__n_estimators=100;; score=0.824 total time=6.0s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to `sparse_output` in version 1.2 and will be removed in 1.4.
`sparse_output` is ignored unless you leave `sparse` to its default value.
```

```
warnings.warn(
```

```
[CV 3/5] END randomforestclassifier__criterion=entropy,
randomforestclassifier__max_features=0.33,
randomforestclassifier__min_samples_leaf=15,
randomforestclassifier__min_samples_split=3,
randomforestclassifier__n_estimators=100;; score=0.806 total time=5.6s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to `sparse_output` in version 1.2 and will be removed in 1.4.
`sparse_output` is ignored unless you leave `sparse` to its default value.
```

```
warnings.warn(
```

```
[CV 4/5] END randomforestclassifier__criterion=entropy,
randomforestclassifier__max_features=0.33,
randomforestclassifier__min_samples_leaf=15,
randomforestclassifier__min_samples_split=3,
randomforestclassifier__n_estimators=100;; score=0.821 total time=5.9s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to `sparse_output` in version 1.2 and will be removed in 1.4.
`sparse_output` is ignored unless you leave `sparse` to its default value.
```

```
warnings.warn(
```

```
[CV 5/5] END randomforestclassifier__criterion=entropy,  
randomforestclassifier__max_features=0.33,  
randomforestclassifier__min_samples_leaf=15,  
randomforestclassifier__min_samples_split=3,  
randomforestclassifier__n_estimators=100;; score=0.824 total time=  
5.8s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\  
preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to  
`sparse_output` in version 1.2 and will be removed in 1.4.  
`sparse_output` is ignored unless you leave `sparse` to its default  
value.
```

```
warnings.warn(
```

```
[CV 1/5] END randomforestclassifier__criterion=entropy,  
randomforestclassifier__max_features=0.33,  
randomforestclassifier__min_samples_leaf=15,  
randomforestclassifier__min_samples_split=3,  
randomforestclassifier__n_estimators=150;; score=0.826 total time=  
8.7s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\  
preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to  
`sparse_output` in version 1.2 and will be removed in 1.4.  
`sparse_output` is ignored unless you leave `sparse` to its default  
value.
```

```
warnings.warn(
```

```
[CV 2/5] END randomforestclassifier__criterion=entropy,  
randomforestclassifier__max_features=0.33,  
randomforestclassifier__min_samples_leaf=15,  
randomforestclassifier__min_samples_split=3,  
randomforestclassifier__n_estimators=150;; score=0.818 total time=  
8.6s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\  
preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to  
`sparse_output` in version 1.2 and will be removed in 1.4.  
`sparse_output` is ignored unless you leave `sparse` to its default  
value.
```

```
warnings.warn(
```

```
[CV 3/5] END randomforestclassifier__criterion=entropy,  
randomforestclassifier__max_features=0.33,  
randomforestclassifier__min_samples_leaf=15,  
randomforestclassifier__min_samples_split=3,  
randomforestclassifier__n_estimators=150;; score=0.807 total time=  
8.2s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\  
preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to
```



```
`sparse_output` in version 1.2 and will be removed in 1.4.  
`sparse_output` is ignored unless you leave `sparse` to its default  
value.
```

```
warnings.warn()
```

```
[CV 4/5] END randomforestclassifier__criterion=entropy,  
randomforestclassifier__max_features=0.33,  
randomforestclassifier__min_samples_leaf=15,  
randomforestclassifier__min_samples_split=3,  
randomforestclassifier__n_estimators=150;; score=0.811 total time=  
9.0s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\  
preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to  
`sparse_output` in version 1.2 and will be removed in 1.4.  
`sparse_output` is ignored unless you leave `sparse` to its default  
value.
```

```
warnings.warn()
```

```
[CV 5/5] END randomforestclassifier__criterion=entropy,  
randomforestclassifier__max_features=0.33,  
randomforestclassifier__min_samples_leaf=15,  
randomforestclassifier__min_samples_split=3,  
randomforestclassifier__n_estimators=150;; score=0.831 total time=  
8.5s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\  
preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to  
`sparse_output` in version 1.2 and will be removed in 1.4.  
`sparse_output` is ignored unless you leave `sparse` to its default  
value.
```

```
warnings.warn()
```

```
[CV 1/5] END randomforestclassifier__criterion=entropy,  
randomforestclassifier__max_features=0.33,  
randomforestclassifier__min_samples_leaf=15,  
randomforestclassifier__min_samples_split=4,  
randomforestclassifier__n_estimators=50;; score=0.831 total time=  
2.8s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\  
preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to  
`sparse_output` in version 1.2 and will be removed in 1.4.  
`sparse_output` is ignored unless you leave `sparse` to its default  
value.
```

```
warnings.warn()
```

```
[CV 2/5] END randomforestclassifier__criterion=entropy,  
randomforestclassifier__max_features=0.33,  
randomforestclassifier__min_samples_leaf=15,  
randomforestclassifier__min_samples_split=4,
```

```
randomforestclassifier__n_estimators=50;; score=0.816 total time=2.8s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to `sparse_output` in version 1.2 and will be removed in 1.4. `sparse_output` is ignored unless you leave `sparse` to its default value.
```

```
warnings.warn(
```

```
[CV 3/5] END randomforestclassifier__criterion=entropy, randomforestclassifier__max_features=0.33, randomforestclassifier__min_samples_leaf=15, randomforestclassifier__min_samples_split=4, randomforestclassifier__n_estimators=50;; score=0.802 total time=2.8s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to `sparse_output` in version 1.2 and will be removed in 1.4. `sparse_output` is ignored unless you leave `sparse` to its default value.
```

```
warnings.warn(
```

```
[CV 4/5] END randomforestclassifier__criterion=entropy, randomforestclassifier__max_features=0.33, randomforestclassifier__min_samples_leaf=15, randomforestclassifier__min_samples_split=4, randomforestclassifier__n_estimators=50;; score=0.819 total time=2.7s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to `sparse_output` in version 1.2 and will be removed in 1.4. `sparse_output` is ignored unless you leave `sparse` to its default value.
```

```
warnings.warn(
```

```
[CV 5/5] END randomforestclassifier__criterion=entropy, randomforestclassifier__max_features=0.33, randomforestclassifier__min_samples_leaf=15, randomforestclassifier__min_samples_split=4, randomforestclassifier__n_estimators=50;; score=0.826 total time=2.9s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to `sparse_output` in version 1.2 and will be removed in 1.4. `sparse_output` is ignored unless you leave `sparse` to its default value.
```

```
warnings.warn(
```

```
[CV 1/5] END randomforestclassifier__criterion=entropy,  
randomforestclassifier__max_features=0.33,  
randomforestclassifier__min_samples_leaf=15,  
randomforestclassifier__min_samples_split=4,  
randomforestclassifier__n_estimators=100;; score=0.826 total time=  
5.6s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\  
preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to  
`sparse_output` in version 1.2 and will be removed in 1.4.  
`sparse_output` is ignored unless you leave `sparse` to its default  
value.
```

```
warnings.warn(
```

```
[CV 2/5] END randomforestclassifier__criterion=entropy,  
randomforestclassifier__max_features=0.33,  
randomforestclassifier__min_samples_leaf=15,  
randomforestclassifier__min_samples_split=4,  
randomforestclassifier__n_estimators=100;; score=0.821 total time=  
5.4s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\  
preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to  
`sparse_output` in version 1.2 and will be removed in 1.4.  
`sparse_output` is ignored unless you leave `sparse` to its default  
value.
```

```
warnings.warn(
```

```
[CV 3/5] END randomforestclassifier__criterion=entropy,  
randomforestclassifier__max_features=0.33,  
randomforestclassifier__min_samples_leaf=15,  
randomforestclassifier__min_samples_split=4,  
randomforestclassifier__n_estimators=100;; score=0.806 total time=  
5.7s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\  
preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to  
`sparse_output` in version 1.2 and will be removed in 1.4.  
`sparse_output` is ignored unless you leave `sparse` to its default  
value.
```

```
warnings.warn(
```

```
[CV 4/5] END randomforestclassifier__criterion=entropy,  
randomforestclassifier__max_features=0.33,  
randomforestclassifier__min_samples_leaf=15,  
randomforestclassifier__min_samples_split=4,  
randomforestclassifier__n_estimators=100;; score=0.820 total time=  
5.7s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\  
preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to
```

```
`sparse_output` in version 1.2 and will be removed in 1.4.  
`sparse_output` is ignored unless you leave `sparse` to its default  
value.
```

```
warnings.warn()
```

```
[CV 5/5] END randomforestclassifier__criterion=entropy,  
randomforestclassifier__max_features=0.33,  
randomforestclassifier__min_samples_leaf=15,  
randomforestclassifier__min_samples_split=4,  
randomforestclassifier__n_estimators=100;; score=0.826 total time=  
5.5s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\  
preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to  
`sparse_output` in version 1.2 and will be removed in 1.4.  
`sparse_output` is ignored unless you leave `sparse` to its default  
value.
```

```
warnings.warn()
```

```
[CV 1/5] END randomforestclassifier__criterion=entropy,  
randomforestclassifier__max_features=0.33,  
randomforestclassifier__min_samples_leaf=15,  
randomforestclassifier__min_samples_split=4,  
randomforestclassifier__n_estimators=150;; score=0.828 total time=  
8.2s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\  
preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to  
`sparse_output` in version 1.2 and will be removed in 1.4.  
`sparse_output` is ignored unless you leave `sparse` to its default  
value.
```

```
warnings.warn()
```

```
[CV 2/5] END randomforestclassifier__criterion=entropy,  
randomforestclassifier__max_features=0.33,  
randomforestclassifier__min_samples_leaf=15,  
randomforestclassifier__min_samples_split=4,  
randomforestclassifier__n_estimators=150;; score=0.817 total time=  
8.3s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\  
preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to  
`sparse_output` in version 1.2 and will be removed in 1.4.  
`sparse_output` is ignored unless you leave `sparse` to its default  
value.
```

```
warnings.warn()
```

```
[CV 3/5] END randomforestclassifier__criterion=entropy,  
randomforestclassifier__max_features=0.33,  
randomforestclassifier__min_samples_leaf=15,  
randomforestclassifier__min_samples_split=4,
```

```
randomforestclassifier__n_estimators=150;; score=0.807 total time=
8.1s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\
preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to
`sparse_output` in version 1.2 and will be removed in 1.4.
`sparse_output` is ignored unless you leave `sparse` to its default
value.
```

```
warnings.warn(
```

```
[CV 4/5] END randomforestclassifier__criterion=entropy,
randomforestclassifier__max_features=0.33,
randomforestclassifier__min_samples_leaf=15,
randomforestclassifier__min_samples_split=4,
randomforestclassifier__n_estimators=150;; score=0.817 total time=
8.2s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\
preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to
`sparse_output` in version 1.2 and will be removed in 1.4.
`sparse_output` is ignored unless you leave `sparse` to its default
value.
```

```
warnings.warn(
```

```
[CV 5/5] END randomforestclassifier__criterion=entropy,
randomforestclassifier__max_features=0.33,
randomforestclassifier__min_samples_leaf=15,
randomforestclassifier__min_samples_split=4,
randomforestclassifier__n_estimators=150;; score=0.824 total time=
8.3s
```

```
C:\Users\susha\anaconda3\envs\inf200jan\lib\site-packages\sklearn\
preprocessing\_encoders.py:975: FutureWarning: `sparse` was renamed to
`sparse_output` in version 1.2 and will be removed in 1.4.
`sparse_output` is ignored unless you leave `sparse` to its default
value.
```

```
warnings.warn(
```

```
GridSearchCV(cv=5,
              estimator=Pipeline(steps=[('columntransformer',
```

```
ColumnTransformer(transformers=[('minmaxscaler',
```

```
MinMaxScaler()),
```

```
[0, 3,
```

```
4, 5,
```

```
6, 7,
```

```

8, 9,
10,
11]),
('onehotencoder',
OneHotEncoder(sparse=False),
[1,
2])))),
('smote',
SMOTE(random_state=10)),
('randomforestclassifier',
RandomForestClassifier()),
param_grid={'randomforestclassifier__criterion': ['gini',
'entropy'],
'randomforestclassifier__max_features':
['sqrt', 0.33],
'randomforestclassifier__min_samples_leaf':
[1, 5, 10,
15],
'randomforestclassifier__min_samples_split':
[2, 3, 4],
'randomforestclassifier__n_estimators': [50,
100,
150]},
scoring='accuracy', verbose=3)

print(rf_grid.best_params_)
print(rf_grid.best_score_)

{'randomforestclassifier__criterion': 'entropy',
'randomforestclassifier__max_features': 0.33,
'randomforestclassifier__min_samples_leaf': 1,
'randomforestclassifier__min_samples_split': 2,
'randomforestclassifier__n_estimators': 50}
0.8390000000000001

print(f"Training Data Score: {rf_grid.score(X_train, y_train)}")
print(f"Testing Data Score: {rf_grid.score(X_test, y_test)}")

Training Data Score: 0.9998571428571429
Testing Data Score: 0.836

```

A perfect training data score could indicate potential overfitting, where the model memorizes the training data but struggles to generalize to unseen data. Further evaluation and potentially adjusting the model's complexity may be necessary.

```
predictions = rf_grid.predict(X_test)
cm3 = confusion_matrix(y_test, predictions)
print(cm3)

[[2134  255]
 [ 237  374]]
```

True Positives (TP): 374 instances correctly predicted as positive. True Negatives (TN): 2134 instances correctly predicted as negative. False Positives (FP): 255 instances incorrectly predicted as positive when they are actually negative. False Negatives (FN): 234 instances incorrectly predicted as negative when they are actually positive.

Using ANN

```
# Import the train_test_split function from scikit-learn
from sklearn.model_selection import train_test_split

# Split the dataset into training and testing sets
X_train, X_test, y_train, y_test = train_test_split(X, y,
test_size=0.10, random_state=5)

# Further split the training set into training and validation sets
X_train, X_val, y_train, y_val = train_test_split(X_train, y_train,
test_size=0.10, random_state=5)

# Display the sizes of the resulting sets
print("The size of X_train is {}".format(X_train.shape[0]))
print("The size of X_val is {}".format(X_val.shape[0]))
print("The size of X_test is {}".format(X_test.shape[0]))

The size of X_train is 8100
The size of X_val is 900
The size of X_test is 1000
```

Standardizing numerical features is a common preprocessing step to improve the performance, stability, and interpretability of machine learning models. It ensures that the model can effectively learn from and generalize to the data.

```
# Standardizing the train, validation, and test data
from sklearn.preprocessing import StandardScaler

# Initialize the StandardScaler
scaler = StandardScaler()

# Define the numerical columns to be standardized
num_cols = ['CreditScore', 'Age', 'Tenure', 'Balance',
```

```

'NumOfProducts', 'EstimatedSalary']

# Standardize the training data
num_subset_train = scaler.fit_transform(X_train[num_cols])
X_train_num_df = pd.DataFrame(num_subset_train, columns=num_cols)
X_train_num_df['Geography'] = list(X_train['Geography'])
X_train_num_df['Gender'] = list(X_train['Gender'])
X_train_num_df['HasCrCard'] = list(X_train['HasCrCard'])
X_train_num_df['IsActiveMember'] = list(X_train['IsActiveMember'])

# Standardize the validation data
num_subset_val = scaler.fit_transform(X_val[num_cols])
X_val_num_df = pd.DataFrame(num_subset_val, columns=num_cols)
X_val_num_df['Geography'] = list(X_val['Geography'])
X_val_num_df['Gender'] = list(X_val['Gender'])
X_val_num_df['HasCrCard'] = list(X_val['HasCrCard'])
X_val_num_df['IsActiveMember'] = list(X_val['IsActiveMember'])

# Standardize the test data
num_subset_test = scaler.fit_transform(X_test[num_cols])
X_test_num_df = pd.DataFrame(num_subset_test, columns=num_cols)
X_test_num_df['Geography'] = list(X_test['Geography'])
X_test_num_df['Gender'] = list(X_test['Gender'])
X_test_num_df['HasCrCard'] = list(X_test['HasCrCard'])
X_test_num_df['IsActiveMember'] = list(X_test['IsActiveMember'])

# Convert the categorical features to numerical using one-hot encoding
X_train_num_df = pd.get_dummies(X_train_num_df, columns=['Geography',
'Gender'])
X_test_num_df = pd.get_dummies(X_test_num_df, columns=['Geography',
'Gender'])
X_val_num_df = pd.get_dummies(X_val_num_df, columns=['Geography',
'Gender'])

# Display the head of the transformed training dataset
X_train_num_df.head()

```

	CreditScore	Age	Tenure	Balance	NumOfProducts	EstimatedSalary \
0	-1.178587	-1.041960	-1.732257	0.198686	0.820905	1.560315
1	-0.380169	-1.326982	1.730718	-0.022020	-0.907991	-0.713592
2	-0.349062	1.808258	-0.693364	0.681178	0.820905	-1.126515
3	0.625629	2.378302	-0.347067	-1.229191	0.820905	-1.682740
4	-0.203895	-1.136967	1.730718	0.924256	-0.907991	1.332535

	HasCrCard	IsActiveMember	Geography_Denmark	Geography_Finland	\
0	1	1	0	0	
1	1	0	1	0	
2	1	0	0	1	
3	1	1	0	0	
4	1	1	1	0	

	Geography_Sweden	Gender_Female	Gender_Male
0	1	0	1
1	0	1	0
2	0	1	0
3	1	0	1
4	0	0	1

In this code, the categorical features in the training, validation, and test datasets ('Geography' and 'Gender') are converted into numerical format using one-hot encoding. One-hot encoding creates binary columns for each category, representing the presence or absence of that category in each observation. This transformation allows the machine learning model to effectively process and learn from categorical data

Initialize and build the model

```
from tensorflow.keras import Sequential
from tensorflow.keras.layers import Dense
import tensorflow as tf

model_ANN=Sequential()
model_ANN.add(Dense(7,activation='relu'))
model_ANN.add(Dense(10,activation='relu'))
model_ANN.add(Dense(1,activation='sigmoid'))
optimizer=tf.keras.optimizers.Adam(0.01)
model_ANN.compile(loss='binary_crossentropy',optimizer=optimizer,metrics=['accuracy'])
```

This code sets up a basic feedforward neural network with one input layer, two hidden layers, and one output layer for binary classification. The model is compiled with the specified optimizer and loss function, making it ready for training.

```
model_ANN.fit(X_train_num_df,y_train,epochs=100,batch_size=10,verbose=1)

Epoch 1/100
810/810 [=====] - 4s 3ms/step - loss: 0.3958
- accuracy: 0.8307
Epoch 2/100
810/810 [=====] - 3s 3ms/step - loss: 0.3534
- accuracy: 0.8548
Epoch 3/100
810/810 [=====] - 2s 3ms/step - loss: 0.3454
```

```
- accuracy: 0.8593
Epoch 4/100
810/810 [=====] - 2s 3ms/step - loss: 0.3431
- accuracy: 0.8601
Epoch 5/100
810/810 [=====] - 3s 3ms/step - loss: 0.3420
- accuracy: 0.8627
Epoch 6/100
810/810 [=====] - 3s 3ms/step - loss: 0.3427
- accuracy: 0.8614
Epoch 7/100
810/810 [=====] - 2s 3ms/step - loss: 0.3391
- accuracy: 0.8631
Epoch 8/100
810/810 [=====] - 3s 4ms/step - loss: 0.3383
- accuracy: 0.8614
Epoch 9/100
810/810 [=====] - 3s 3ms/step - loss: 0.3367
- accuracy: 0.8619
Epoch 10/100
810/810 [=====] - 3s 4ms/step - loss: 0.3361
- accuracy: 0.8646
Epoch 11/100
810/810 [=====] - 3s 4ms/step - loss: 0.3337
- accuracy: 0.8633
Epoch 12/100
810/810 [=====] - 4s 5ms/step - loss: 0.3349
- accuracy: 0.8615
Epoch 13/100
810/810 [=====] - 3s 3ms/step - loss: 0.3333
- accuracy: 0.8635
Epoch 14/100
810/810 [=====] - 3s 3ms/step - loss: 0.3345
- accuracy: 0.8607
Epoch 15/100
810/810 [=====] - 4s 5ms/step - loss: 0.3329
- accuracy: 0.8610
Epoch 16/100
810/810 [=====] - 4s 5ms/step - loss: 0.3322
- accuracy: 0.8633
Epoch 17/100
810/810 [=====] - 4s 4ms/step - loss: 0.3303
- accuracy: 0.8636
Epoch 18/100
810/810 [=====] - 3s 3ms/step - loss: 0.3299
- accuracy: 0.8653
Epoch 19/100
810/810 [=====] - 2s 3ms/step - loss: 0.3308
- accuracy: 0.8620
```

```
Epoch 20/100
810/810 [=====] - 3s 3ms/step - loss: 0.3304
- accuracy: 0.8641
Epoch 21/100
810/810 [=====] - 4s 5ms/step - loss: 0.3295
- accuracy: 0.8643
Epoch 22/100
810/810 [=====] - 4s 4ms/step - loss: 0.3316
- accuracy: 0.8638
Epoch 23/100
810/810 [=====] - 3s 3ms/step - loss: 0.3293
- accuracy: 0.8656
Epoch 24/100
810/810 [=====] - 3s 3ms/step - loss: 0.3305
- accuracy: 0.8635
Epoch 25/100
810/810 [=====] - 3s 4ms/step - loss: 0.3302
- accuracy: 0.8646
Epoch 26/100
810/810 [=====] - 4s 4ms/step - loss: 0.3300
- accuracy: 0.8665
Epoch 27/100
810/810 [=====] - 4s 5ms/step - loss: 0.3290
- accuracy: 0.8627
Epoch 28/100
810/810 [=====] - 4s 5ms/step - loss: 0.3293
- accuracy: 0.8626
Epoch 29/100
810/810 [=====] - 4s 5ms/step - loss: 0.3289
- accuracy: 0.8662
Epoch 30/100
810/810 [=====] - 3s 4ms/step - loss: 0.3300
- accuracy: 0.8653
Epoch 31/100
810/810 [=====] - 4s 5ms/step - loss: 0.3292
- accuracy: 0.8654
Epoch 32/100
810/810 [=====] - 4s 5ms/step - loss: 0.3298
- accuracy: 0.8652
Epoch 33/100
810/810 [=====] - 3s 3ms/step - loss: 0.3293
- accuracy: 0.8647
Epoch 34/100
810/810 [=====] - 4s 5ms/step - loss: 0.3279
- accuracy: 0.8665
Epoch 35/100
810/810 [=====] - 4s 5ms/step - loss: 0.3291
- accuracy: 0.8651
Epoch 36/100
```

```
810/810 [=====] - 3s 3ms/step - loss: 0.3277
- accuracy: 0.8662
Epoch 37/100
810/810 [=====] - 2s 3ms/step - loss: 0.3292
- accuracy: 0.8652
Epoch 38/100
810/810 [=====] - 4s 5ms/step - loss: 0.3287
- accuracy: 0.8649
Epoch 39/100
810/810 [=====] - 3s 4ms/step - loss: 0.3272
- accuracy: 0.8647
Epoch 40/100
810/810 [=====] - 3s 4ms/step - loss: 0.3274
- accuracy: 0.8647
Epoch 41/100
810/810 [=====] - 3s 4ms/step - loss: 0.3272
- accuracy: 0.8669
Epoch 42/100
810/810 [=====] - 3s 4ms/step - loss: 0.3280
- accuracy: 0.8646
Epoch 43/100
810/810 [=====] - 3s 3ms/step - loss: 0.3282
- accuracy: 0.8642
Epoch 44/100
810/810 [=====] - 3s 4ms/step - loss: 0.3269
- accuracy: 0.8673
Epoch 45/100
810/810 [=====] - 3s 4ms/step - loss: 0.3273
- accuracy: 0.8665
Epoch 46/100
810/810 [=====] - 3s 4ms/step - loss: 0.3257
- accuracy: 0.8657
Epoch 47/100
810/810 [=====] - 3s 3ms/step - loss: 0.3268
- accuracy: 0.8669
Epoch 48/100
810/810 [=====] - 3s 4ms/step - loss: 0.3275
- accuracy: 0.8672
Epoch 49/100
810/810 [=====] - 3s 4ms/step - loss: 0.3279
- accuracy: 0.8673
Epoch 50/100
810/810 [=====] - 3s 4ms/step - loss: 0.3277
- accuracy: 0.8673
Epoch 51/100
810/810 [=====] - 3s 4ms/step - loss: 0.3278
- accuracy: 0.8651
Epoch 52/100
810/810 [=====] - 3s 4ms/step - loss: 0.3270
```

```
- accuracy: 0.8672
Epoch 53/100
810/810 [=====] - 3s 3ms/step - loss: 0.3266
- accuracy: 0.8657
Epoch 54/100
810/810 [=====] - 3s 4ms/step - loss: 0.3273
- accuracy: 0.8642
Epoch 55/100
810/810 [=====] - 3s 4ms/step - loss: 0.3275
- accuracy: 0.8649
Epoch 56/100
810/810 [=====] - 3s 4ms/step - loss: 0.3279
- accuracy: 0.8667
Epoch 57/100
810/810 [=====] - 3s 4ms/step - loss: 0.3267
- accuracy: 0.8649
Epoch 58/100
810/810 [=====] - 3s 4ms/step - loss: 0.3278
- accuracy: 0.8652
Epoch 59/100
810/810 [=====] - 4s 5ms/step - loss: 0.3256
- accuracy: 0.8657
Epoch 60/100
810/810 [=====] - 3s 4ms/step - loss: 0.3286
- accuracy: 0.8662
Epoch 61/100
810/810 [=====] - 3s 4ms/step - loss: 0.3248
- accuracy: 0.8667
Epoch 62/100
810/810 [=====] - 4s 4ms/step - loss: 0.3260
- accuracy: 0.8662
Epoch 63/100
810/810 [=====] - 3s 4ms/step - loss: 0.3268
- accuracy: 0.8665
Epoch 64/100
810/810 [=====] - 4s 5ms/step - loss: 0.3265
- accuracy: 0.8659
Epoch 65/100
810/810 [=====] - 3s 4ms/step - loss: 0.3284
- accuracy: 0.8675
Epoch 66/100
810/810 [=====] - 4s 5ms/step - loss: 0.3258
- accuracy: 0.8643
Epoch 67/100
810/810 [=====] - 4s 5ms/step - loss: 0.3288
- accuracy: 0.8638
Epoch 68/100
810/810 [=====] - 3s 4ms/step - loss: 0.3260
- accuracy: 0.8677
```

```
Epoch 69/100
810/810 [=====] - 3s 4ms/step - loss: 0.3260
- accuracy: 0.8675
Epoch 70/100
810/810 [=====] - 3s 4ms/step - loss: 0.3267
- accuracy: 0.8673
Epoch 71/100
810/810 [=====] - 3s 3ms/step - loss: 0.3265
- accuracy: 0.8660
Epoch 72/100
810/810 [=====] - 3s 3ms/step - loss: 0.3255
- accuracy: 0.8680
Epoch 73/100
810/810 [=====] - 3s 3ms/step - loss: 0.3265
- accuracy: 0.8674
Epoch 74/100
810/810 [=====] - 4s 5ms/step - loss: 0.3252
- accuracy: 0.8677
Epoch 75/100
810/810 [=====] - 3s 4ms/step - loss: 0.3268
- accuracy: 0.8658
Epoch 76/100
810/810 [=====] - 3s 4ms/step - loss: 0.3255
- accuracy: 0.8670
Epoch 77/100
810/810 [=====] - 3s 3ms/step - loss: 0.3257
- accuracy: 0.8672
Epoch 78/100
810/810 [=====] - 3s 3ms/step - loss: 0.3250
- accuracy: 0.8678
Epoch 79/100
810/810 [=====] - 3s 4ms/step - loss: 0.3257
- accuracy: 0.8681
Epoch 80/100
810/810 [=====] - 3s 4ms/step - loss: 0.3257
- accuracy: 0.8664
Epoch 81/100
810/810 [=====] - 3s 3ms/step - loss: 0.3262
- accuracy: 0.8649
Epoch 82/100
810/810 [=====] - 3s 4ms/step - loss: 0.3264
- accuracy: 0.8664
Epoch 83/100
810/810 [=====] - 3s 4ms/step - loss: 0.3252
- accuracy: 0.8662
Epoch 84/100
810/810 [=====] - 3s 4ms/step - loss: 0.3248
- accuracy: 0.8705
Epoch 85/100
```

```
810/810 [=====] - 3s 4ms/step - loss: 0.3261
- accuracy: 0.8669
Epoch 86/100
810/810 [=====] - 3s 4ms/step - loss: 0.3245
- accuracy: 0.8638
Epoch 87/100
810/810 [=====] - 3s 3ms/step - loss: 0.3261
- accuracy: 0.8677
Epoch 88/100
810/810 [=====] - 3s 3ms/step - loss: 0.3249
- accuracy: 0.8656
Epoch 89/100
810/810 [=====] - 3s 3ms/step - loss: 0.3243
- accuracy: 0.8644
Epoch 90/100
810/810 [=====] - 3s 4ms/step - loss: 0.3250
- accuracy: 0.8674
Epoch 91/100
810/810 [=====] - 3s 3ms/step - loss: 0.3257
- accuracy: 0.8652
Epoch 92/100
810/810 [=====] - 3s 3ms/step - loss: 0.3247
- accuracy: 0.8665
Epoch 93/100
810/810 [=====] - 2s 3ms/step - loss: 0.3260
- accuracy: 0.8672
Epoch 94/100
810/810 [=====] - 3s 3ms/step - loss: 0.3250
- accuracy: 0.8673
Epoch 95/100
810/810 [=====] - 3s 4ms/step - loss: 0.3246
- accuracy: 0.8659
Epoch 96/100
810/810 [=====] - 3s 4ms/step - loss: 0.3263
- accuracy: 0.8665
Epoch 97/100
810/810 [=====] - 3s 4ms/step - loss: 0.3242
- accuracy: 0.8685
Epoch 98/100
810/810 [=====] - 3s 4ms/step - loss: 0.3264
- accuracy: 0.8662
Epoch 99/100
810/810 [=====] - 3s 3ms/step - loss: 0.3250
- accuracy: 0.8660
Epoch 100/100
810/810 [=====] - 3s 3ms/step - loss: 0.3247
- accuracy: 0.8684
```

```
<keras.callbacks.History at 0x1472d2c7c40>
```

Predicting the Results using 0.5 threshold

```
y_pred_val=model_ANN.predict(X_val_num_df)
y_pred_val[y_pred_val>0.5]=1
y_pred_val[y_pred_val <0.5]=0
```

```
29/29 [=====] - 0s 4ms/step
```

This code transforms the continuous predictions from the ANN into binary predictions by applying a threshold of 0.5. Values above the threshold are considered as class 1, and values below the threshold are considered as class 0.

```
y_pred_val=y_pred_val.tolist()
X_compare_val=X_val.copy()
X_compare_val['y_actual']=y_val
X_compare_val['y_pred']=y_pred_val
X_compare_val.head(10)
```

	CreditScore	Geography	Gender	Age	Tenure	Balance
NumOfProducts \						
340	642	Finland	Female	40	6	129502.49
2						
8622	706	Finland	Male	36	9	58571.18
2						
8401	535	Denmark	Male	58	1	0.00
2						
4338	714	Denmark	Male	25	2	0.00
1						
8915	606	Sweden	Male	36	1	155655.46
1						
2624	605	Denmark	Female	29	3	116805.82
1						
2234	720	Sweden	Female	38	10	0.00
2						
349	582	Sweden	Male	39	5	0.00
2						
3719	850	Sweden	Female	62	1	124678.35
1						
2171	526	Finland	Male	58	9	190298.89
2						

	HasCrCard	IsActiveMember	EstimatedSalary
creditscore_age_ratio \			
340	0	1	86099.23
16.050000			
8622	1	0	40774.01
19.611111			
8401	1	1	11779.98
9.224138			
4338	1	1	132979.43

28.560000			
8915	1	1	192387.51
16.833333			
2624	0	0	4092.75
20.862069			
2234	1	1	56229.72
18.947368			
349	1	1	129892.93
14.923077			
3719	1	0	70916.00
13.709677			
2171	1	1	191263.76
9.068966			

	balance_salary_ratio	y_actual	y_pred
340	1.504107	1	[0.0]
8622	1.436483	0	[0.0]
8401	0.000000	1	[0.0]
4338	0.000000	0	[0.0]
8915	0.809073	1	[0.0]
2624	28.539691	0	[0.0]
2234	0.000000	1	[0.0]
349	0.000000	0	[0.0]
3719	1.758113	1	[1.0]
2171	0.994955	0	[0.0]

Confusion Matrix of the Validation set

```
from sklearn.metrics import confusion_matrix
cm_val=confusion_matrix(y_val,y_pred_val)
cm_val

array([[697,  19],
       [111,  73]], dtype=int64)
```

True Positives (TP): 73 instances correctly predicted as positive. True Negatives (TN): 697 instances correctly predicted as negative. False Positives (FP): 19 instances incorrectly predicted as positive when they are actually negative. False Negatives (FN): 111 instances incorrectly predicted as negative when they are actually positive.

From the above confusion matrix, Out of 900 Validation dataset observations, our model accurately predicted 692+86=780 and made 98+24=122 incorrect predictions.

```
loss1,accuracy1=model_ANN.evaluate(X_train_num_df,y_train,verbose=False)
loss2,accuracy2=model_ANN.evaluate(X_val_num_df,y_val,verbose=False)
print("Train Loss {}".format(loss1))
print("Train Accuracy {}".format(accuracy1))
```

```
print("Val Loss {}".format(loss2))
print("Val Accuracy {}".format(accuracy2))
```

```
Train Loss 0.3308352828025818
Train Accuracy 0.86543208360672
Val Loss 0.35867661237716675
Val Accuracy 0.85555534362793
```

Since our Training Accuracy and Validation Accuracy are pretty close, we can conclude that our model generalises well. So, let's apply the model on the Test set and make predictions and evaluate the model against the Test

```
from sklearn import metrics
y_pred_test=model_ANN.predict(X_test_num_df)
y_pred_test[y_pred_test>0.5]=1
y_pred_test[y_pred_test <0.5]=0
cm_test=metrics.confusion_matrix(y_test,y_pred_test)
cm_test
print("Test Confusion Matrix")

32/32 [=====] - 0s 3ms/step
Test Confusion Matrix

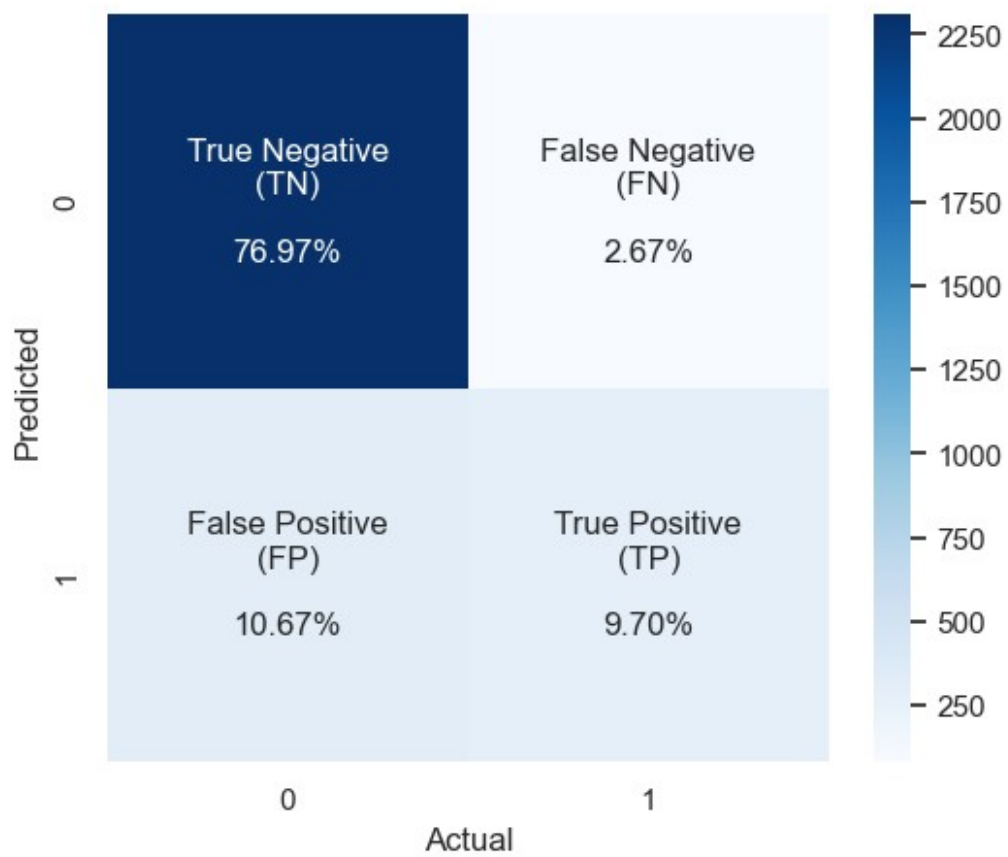
cm_test
array([[770, 24],
       [133, 73]], dtype=int64)

loss3,accuracy3=model_ANN.evaluate(X_test_num_df,y_test,verbose=False)
print("Test Accuracy is {}".format(accuracy3))
print("Test loss is {}".format(loss3))

Test Accuracy is 0.8429999947547913
Test loss is 0.38113588094711304

plot_cm(cm1,'Confusion Matrix of SVM without SMOTE')
plot_cm(cm2,'Confusion Matrix of SVM with SMOTE')
plot_cm(cm3,'Confusion Matrix of Random Forest')
plot_cm(cm_val,'Confusion Matrix of ANN')
```

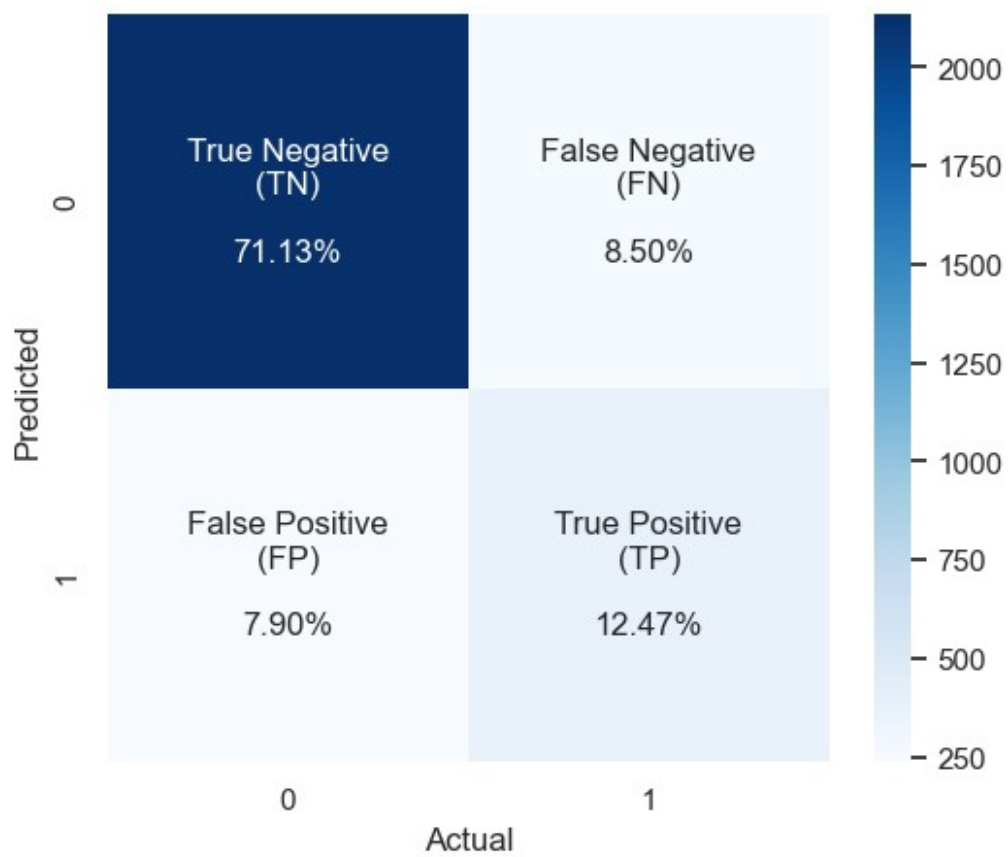
Confusion Matrix of Confusion Matrix of SVM without SMOTE



Confusion Matrix of Confusion Matrix of SVM with SMOTE



Confusion Matrix of Confusion Matrix of Random Forest



Confusion Matrix of Confusion Matrix of ANN



In the context of customer churn analysis, the primary aim is to identify customers at risk of churning for effective retention strategies. The effectiveness of a model is determined by its ability to make accurate predictions. However, in this business context, the focus is on minimizing False Negatives (FN), where the model incorrectly predicts that a customer will not churn when they actually do. False negatives are crucial as they represent missed opportunities to intervene and retain customers.

From the above evaluated machine learning models, I found that the Neural Network Model performs with the best accuracy of around 86%, also producing the least False negatives of around 2.11% indicating it predicts the best in case of a customer will churn and they actually do.