# Binary Classification with a Bank Churn Dataset

## Playground Series - Season 4, Episode 1

## Overview

Welcome to the 2024 Kaggle Playground Series! Happy New Year! This is the 1st episode of Season 4.

## Your Goal

For this Episode of the Series, our task is to predict whether a customer continues with their account or closes it (e.g., churns)

## Ensemble Model Technique

It is my first kaggle competition, so i wanted to leave a good impression and use my knowledge & skills to the max. Hence, I used Ensemble learning.

# Attribute Description

Customer ID
Unique identifier for each customer

Surname
Customer's surname or last name

Credit Score
Numerical value representing the customer's credit score

Geography
Country where the customer resides (France, Spain, Germany)

Gender

Customer's gender (Male or Female)

Age
Customer's age

Tenure
Number of years the customer has been with the bank

Balance
Customer's account balance

NumOfProducts
Number of bank products the customer uses

HasCrCard
Whether the customer has a credit card (1 = yes, 0 = no)

IsActiveMember
Whether the customer is an active member (1 = yes, 0 = no)

EstimatedSalary
Estimated salary of the customer

Exited
Whether the customer has churned (1 = yes, 0 = no)

In [173]:

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

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

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

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

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

In [174]:

```
import warnings
warnings.filterwarnings('ignore')
```

In [175]:

```
# Importing libraries
import pandas as pd
import numpy as np
import warnings
from tqdm.notebook import tqdm
import re
from functools import partial
from scipy.stats import mode
import matplotlib.pyplot as plt
import seaborn as sns
import plotly.express as px
from sklearn.tree import DecisionTreeClassifier, plot_tree
from sklearn.preprocessing import MinMaxScaler, StandardScaler, LabelEncoder, FunctionTransformer, PowerTransformer, PolynomialFeatures
from sklearn.pipeline import make_pipeline, Pipeline, FeatureUnion
from sklearn.decomposition import PCA
from sklearn.cluster import KMeans
from sklearn.compose import ColumnTransformer, make_column_transformer
from sklearn.impute import KNNImputer
from sklearn.multiclass import OneVsRestClassifier
from sklearn.model_selection import KFold, StratifiedKFold, train_test_split, GridSearchCV, RepeatedStratifiedKFold, cross_val_score, cross_val_predict
from sklearn.metrics import confusion_matrix, classification_report, roc_auc_score, roc_curve, RocCurveDisplay, cohen_kappa_score, log_loss, f1_score, make_scorer
from sklearn.metrics import auc, accuracy_score, precision_score, recall_score
import matplotlib.pyplot as plt
from sklearn.discriminant_analysis import LinearDiscriminantAnalysis, QuadraticDiscriminantAnalysis
from sklearn.neighbors import KNeighborsClassifier
from sklearn.feature_selection import RFE, RFECV
from sklearn.isotonic import IsotonicRegression
from sklearn.calibration import CalibrationDisplay, CalibratedClassifierCV
from sklearn.inspection import PartialDependenceDisplay, permutation_importance
from sklearn.linear_model import LogisticRegression, RidgeClassifier, Perceptron, SGDClassifier
from collections import Counter
from sklearn.ensemble import AdaBoostClassifier, RandomForestClassifier, HistGradientBoostingClassifier, GradientBoostingClassifier, ExtraTreesClassifier, VotingClassifier
from sklearn.naive_bayes import GaussianNB
import lightgbm as lgb
import xgboost as xgb
from catboost import CatBoostClassifier
from sklearn.neural_network import MLPClassifier
import optuna
```

In [176]:

```
# # Reading Data Files
# train = pd.read_csv('../input/playground-series-s4e1/train.csv')
# test = pd.read_csv('../input/playground-series-s4e1/test.csv')
# submission = pd.read_csv('../input/playground-series-s4e1/sample_submission.csv')

# Reading Data Files
train = pd.read_csv('./playground-series-s4e1/train.csv')
test = pd.read_csv('./playground-series-s4e1/test.csv')
submission = pd.read_csv('./playground-series-s4e1/sample_submission.csv')
```

In [177]:

```
# Data Preprocessing
def preprocess_data(data):
    data['Age'] = data['Age'].astype(int)
    data['NumOfProducts'] = data['NumOfProducts'].astype(int)
    data['HasCrCard'] = data['HasCrCard'].astype(int)
    data['IsActiveMember'] = data['IsActiveMember'].astype(int)
    return data
```

In [178]:

```
train = preprocess_data(train)
test = preprocess_data(test)
```

In [179]:

```
print('The dimension of the train dataset is:', train.shape)
print('The dimension of the test dataset is:', test.shape)
```

```
The dimension of the train dataset is: (165034, 14)
The dimension of the test dataset is: (110023, 13)
```

In [180]:

```
def Null_values(data):
    return data.isnull().sum()
```

In [181]:

```
print("Null count in Train\n")
Null_values(train)
```

```
Null count in Train
```

Out[181]:

```
id                 0
CustomerId         0
Surname            0
CreditScore        0
Geography          0
Gender             0
Age                0
Tenure             0
Balance            0
NumOfProducts      0
HasCrCard          0
IsActiveMember     0
EstimatedSalary    0
Exited             0
dtype: int64
```

In [182]:

```
print("Null count in Test\n")
Null_values(test)
```

```
Null count in Test
```

Out[182]:

```
id                 0
CustomerId         0
Surname            0
CreditScore        0
Geography          0
Gender             0
Age                0
Tenure             0
Balance            0
NumOfProducts      0
HasCrCard          0
IsActiveMember     0
EstimatedSalary    0
dtype: int64
```

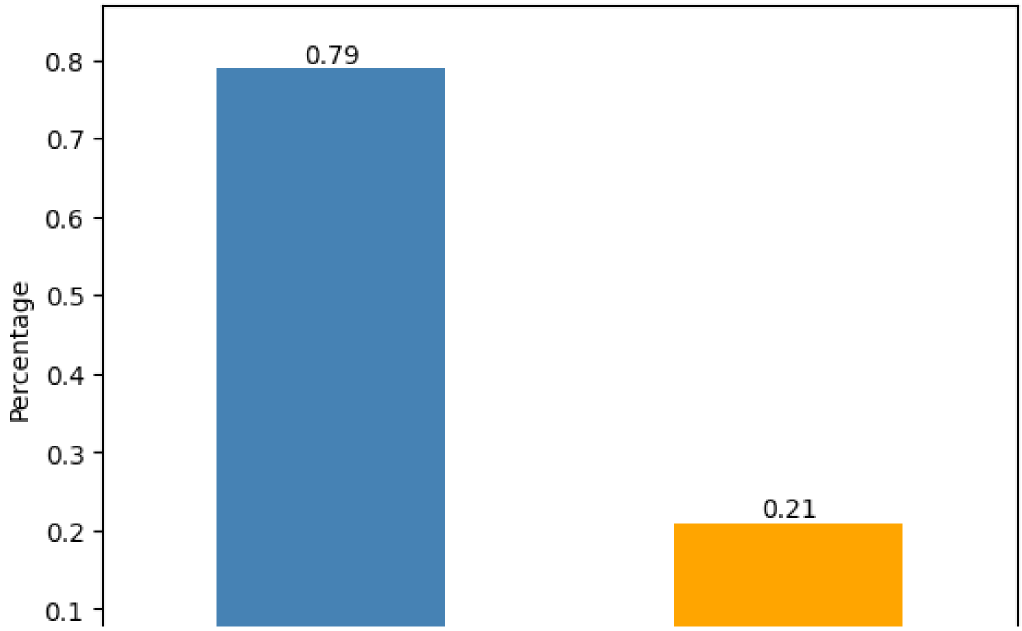
# There are no missing values in Train or Test dataset.

In [183]:

```
def Value_count(data):
    """
    Get value counts or unique values for all categorical columns in a DataFrame.

    Parameters:
    - data: DataFrame
        The input data.

    Returns:
    - list of dicts
        A list where each element is a dictionary containing information
        about a categorical column, including column name, type, and either
        value counts or unique values.
    """
    categorical_cols = data.select_dtypes(include=['object', 'category']).columns
    result_list = []

    for col in categorical_cols:
        unique_values = data[col].unique()

        if len(unique_values) == data[col].nunique():
            result_list.append({
                "Column": col,
                "Type": "Unique",
                "Values": unique_values.tolist()
            })
        else:
            result_list.append({
                "Column": col,
                "Type": "Value Counts",
                "Counts": data[col].value_counts().to_dict()
            })

    return result_list
```

In [184]:

```
# Data Exploration
ax = round(train['Exited'].value_counts(normalize=True), 2).plot(kind='bar', color=['ste
elblue', 'orange'])
ax.bar_label(ax.containers[0], label_type='edge')
ax.margins(y=0.1)
plt.ylabel('Percentage')
plt.show()
```



**We can see that the Churn Bank dataset is imbalanced. Explore the `exited` with other variables to obtain relationship of other variables with the 'Exited'**

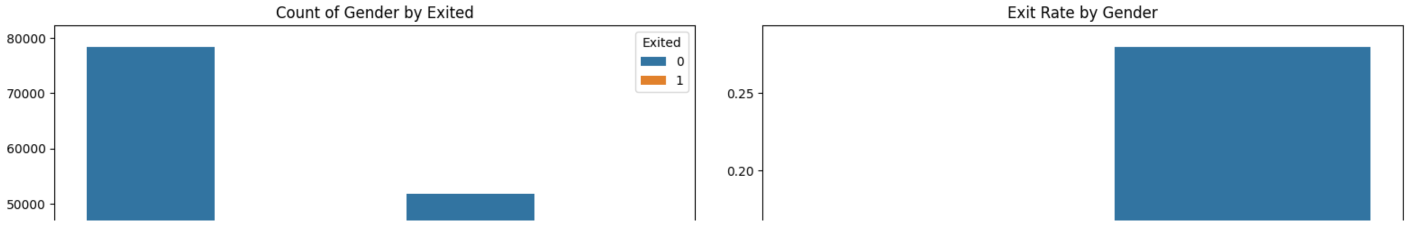
# Data Exploration

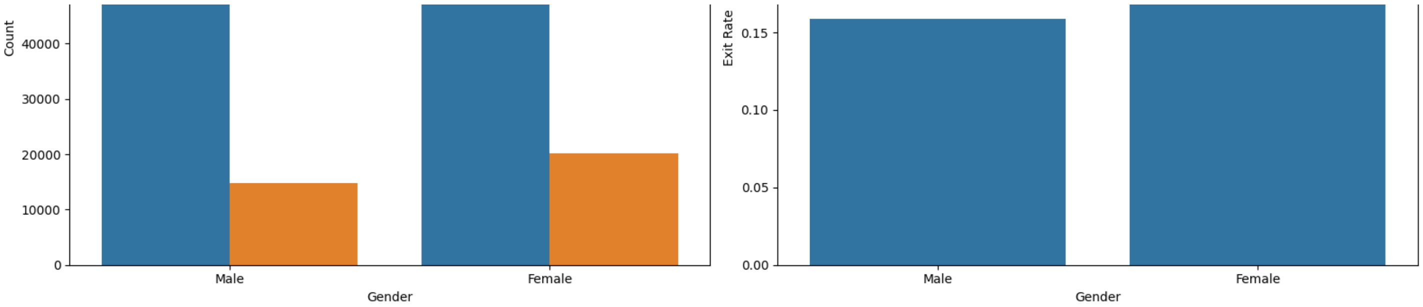
In [185]:

```
def plot_relationship(df, variable):
    """
    Create visualizations to explore the relationship between 'exited' and another variable.

    Parameters:
    - df: DataFrame
        The input data.
    - variable: str
        The name of the variable to be visualized.

    Returns:
    - None (but displays the plots)
    """
    fig, axes = plt.subplots(1, 2, figsize=(16, 6))

    if df[variable].dtype == 'O':  # Categorical variable
        sns.countplot(ax=axes[0], data=df, x=variable, hue='Exited')
        axes[0].set_title(f'Count of {variable} by Exited')
        axes[0].set_xlabel(variable)
        axes[0].set_ylabel('Count')

        sns.barplot(ax=axes[1], data=df, x=variable, y='Exited', ci=None)
        axes[1].set_title(f'Exit Rate by {variable}')
        axes[1].set_xlabel(variable)
        axes[1].set_ylabel('Exit Rate')

    elif df[variable].dtype in ['int64', 'float64','int32']:  # Numerical variable
        sns.kdeplot(ax=axes[0], data=df, x=variable, hue='Exited', fill=True)
        axes[0].set_title(f'Kernel Density Estimate (KDE) of {variable} by Exited')
        axes[0].set_xlabel(variable)
        axes[0].set_ylabel('Density')

        sns.boxplot(ax=axes[1], data=df, x='Exited', y=variable, hue='Exited')
        axes[1].set_title(f'Distribution of {variable} by Exited')
        axes[1].set_xlabel('Exited')
        axes[1].set_ylabel(variable)

    else:
        print("Unsupported variable type. Please provide a categorical or numerical variable.")

    plt.tight_layout()
    plt.show()
```

In [186]:

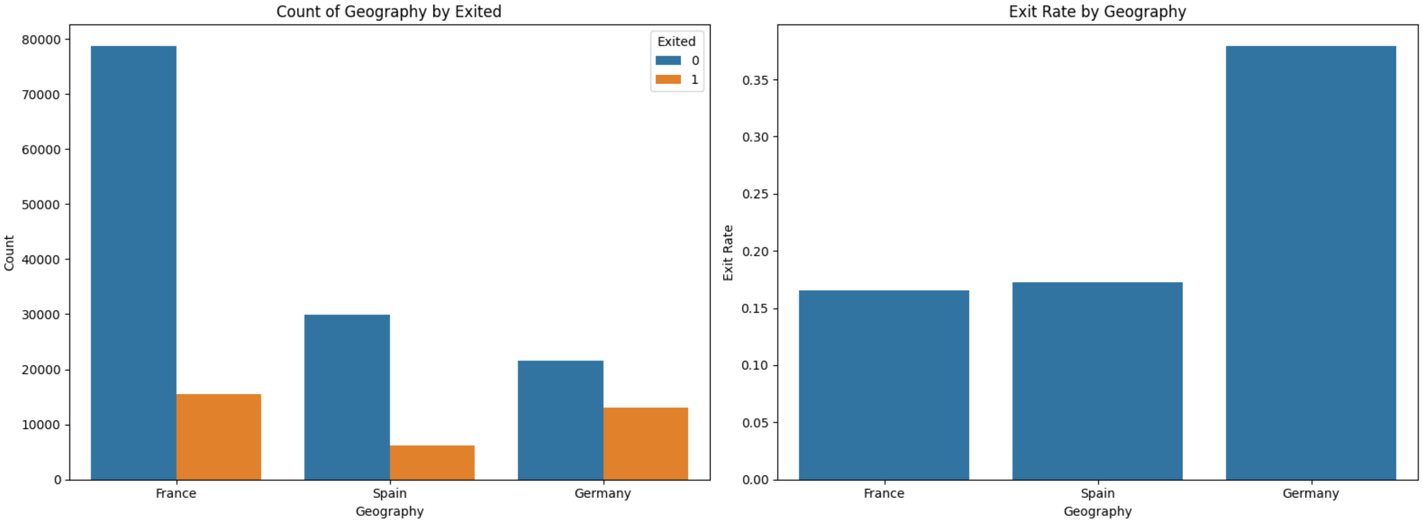
```
plot_relationship(train, 'Gender')
```





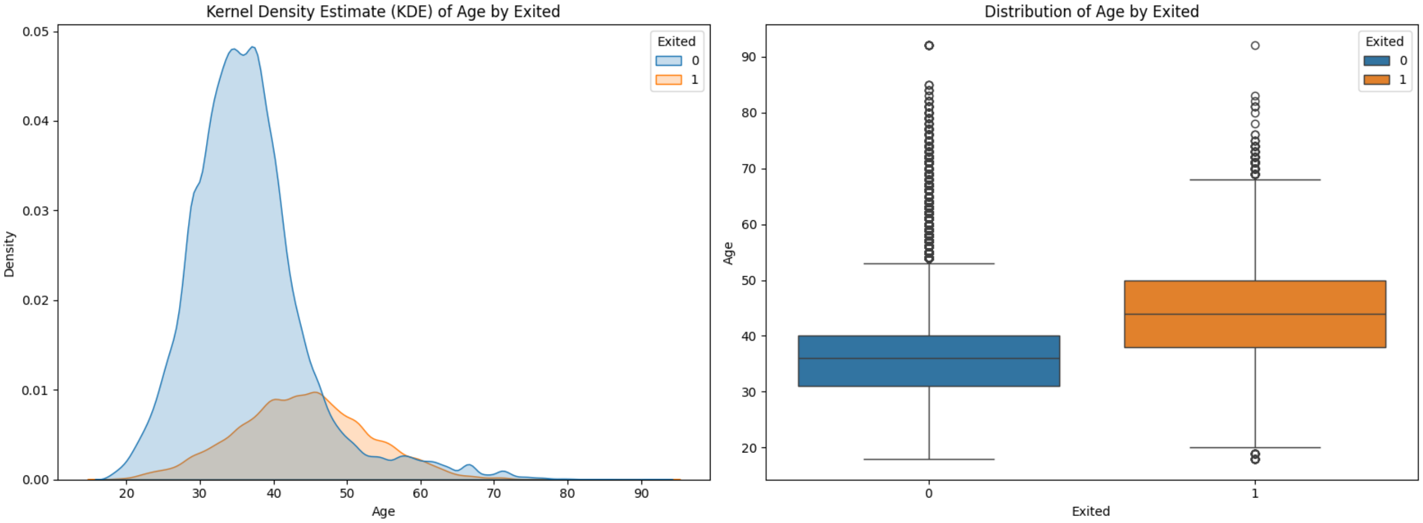
In [187]:

```
plot_relationship(train, 'Geography')
```



In [188]:

```
plot_relationship(train,'Age')
```

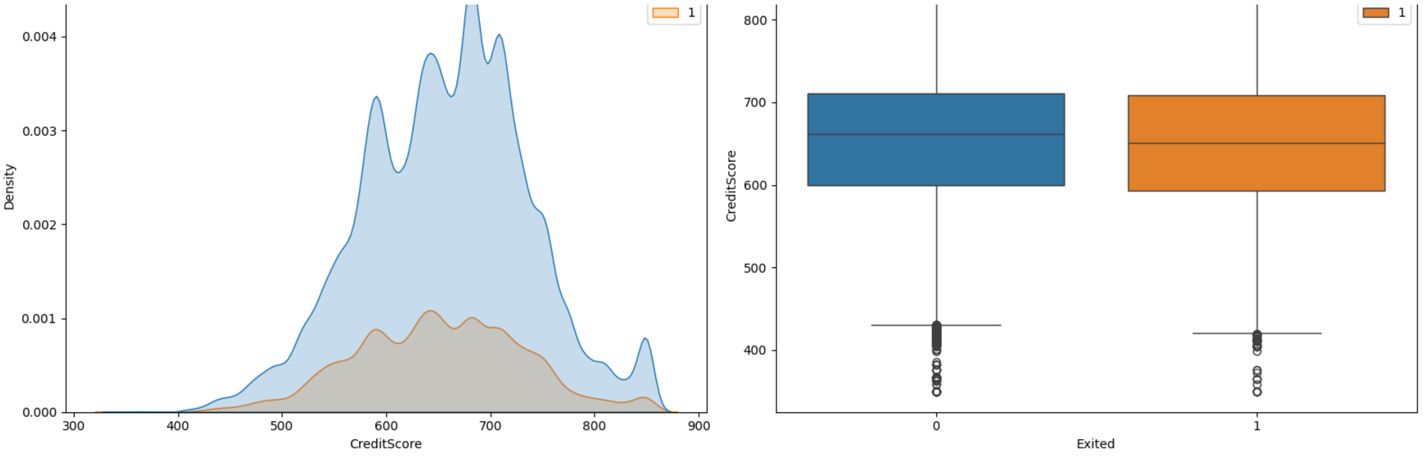


1. **Common Trends in Both Groups:** In our analysis of customers who stayed (Exited=0) and those who left (Exited=1), we noticed a consistent pattern in a particular aspect we investigated. Both groups seem to share a common trend, suggesting similarities in their behavior.
2. **Age and Exit Status:** Examining the age distribution, we found an interesting connection. The overall distribution leans towards the older side for customers who exited (Exited=1). On average, customers who left tend to be older. This insight sheds light on a potential correlation between age and the likelihood of customers deciding to leave.

In [189]:

```
plot_relationship(train,'CreditScore')
```

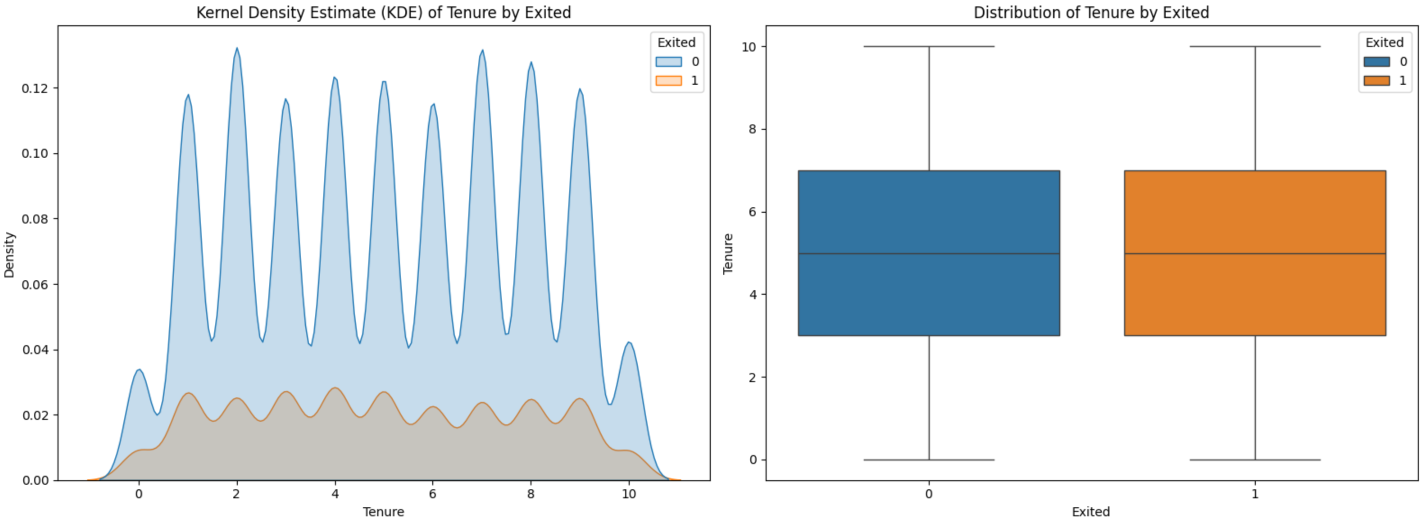
Kernel Density Estimate (KDE) of CreditScore by Exited
Exited
0
Distribution of CreditScore by Exited
Exited
0



1. **Both Groups Look Alike:** When comparing customers who stayed (didn't exit) with those who left, we observed a similar pattern in a specific variable we examined (let's call it Thing X). It's as if both groups follow the same trend or behave in a comparable way.
2. **Patterns Lean to the Left:** Upon examining the overall shape of how Thing X is distributed, we noticed a slight leftward tilt. Picture a graph – most of the points gather on the right side, and the graph gradually tapers off towards the left. This suggests that there are some values on the lower side, influencing the overall pattern to lean to the left.

In [190]:

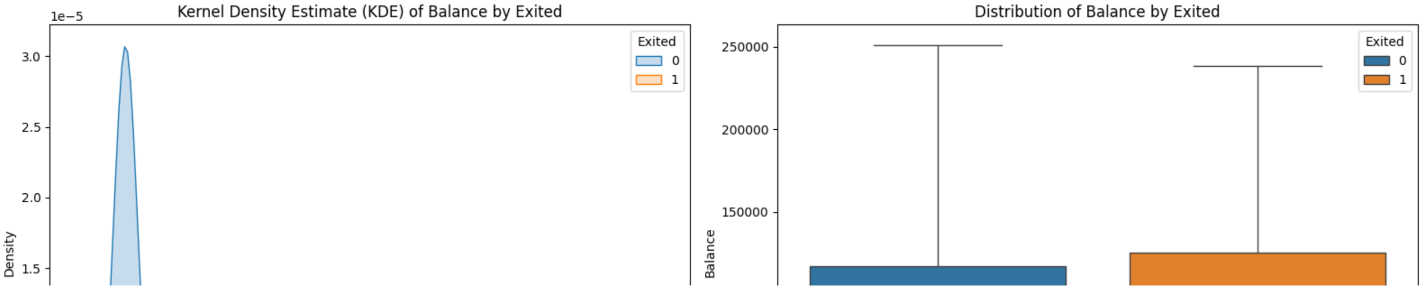
```
plot_relationship(train,'Tenure')
```

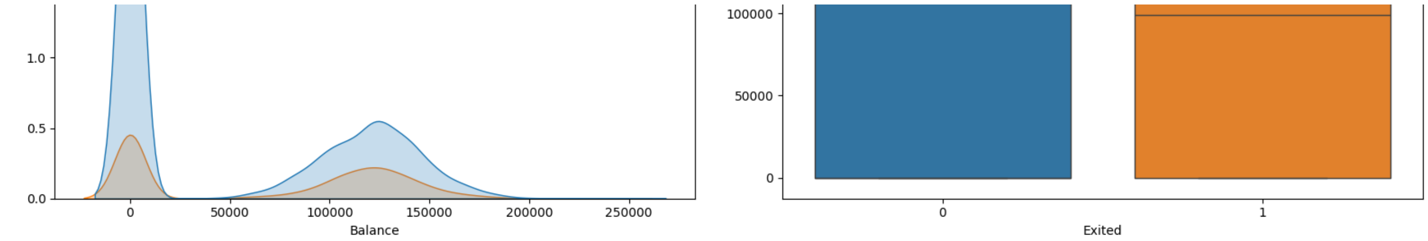


1. **Consistent Patterns Across Groups:** The distributions of the groups we explored appear to be quite similar. It's as if they follow the same overall trend or have comparable characteristics, suggesting consistency between the groups.
2. **Multi-Modal Distribution of Tenure:** Focusing on the variable 'Tenure,' we observed a multi-modal distribution. In simpler terms, the graph displays multiple peaks or modes. This implies that there are distinct patterns or subgroups within the data related to tenure, contributing to the complexity of the distribution.

In [191]:

```
plot_relationship(train,'Balance')
```





1. **Consistent Patterns Across Groups: The distributions of the various groups exhibit a remarkable similarity. It appears that they share a common pattern or characteristics, suggesting a consistent behavior among the groups.**
2. **Bi-Modal Distribution of Balance: Focusing on the variable 'Balance,' we observed a bi-modal distribution. Simply put, the graph shows two prominent peaks or modes.which arises the question: *Does a balance of 0 imply missing data, or is there a specific meaning associated with this value?***

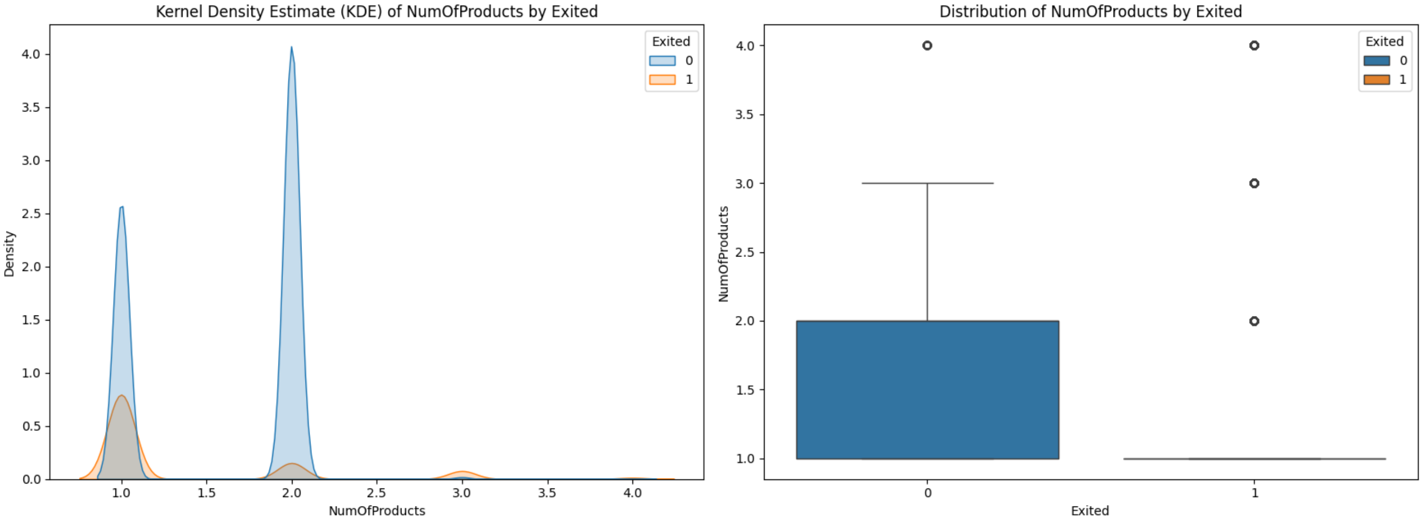
In [192]:

```
train.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 165034 entries, 0 to 165033
Data columns (total 14 columns):
 #   Column           Non-Null Count   Dtype  
---  ------           --------------   -----  
 0   id               165034 non-null  int64  
 1   CustomerId       165034 non-null  int64  
 2   Surname          165034 non-null  object 
 3   CreditScore      165034 non-null  int64  
 4   Geography        165034 non-null  object 
 5   Gender           165034 non-null  object 
 6   Age              165034 non-null  int32  
 7   Tenure           165034 non-null  int64  
 8   Balance          165034 non-null  float64
 9   NumOfProducts    165034 non-null  int32  
 10  HasCrCard        165034 non-null  int32  
 11  IsActiveMember   165034 non-null  int32  
 12  EstimatedSalary  165034 non-null  float64
 13  Exited           165034 non-null  int64  
dtypes: float64(2), int32(4), int64(5), object(3)
memory usage: 15.1+ MB
```

In [193]:

```
plot_relationship(train,'NumOfProducts')
```

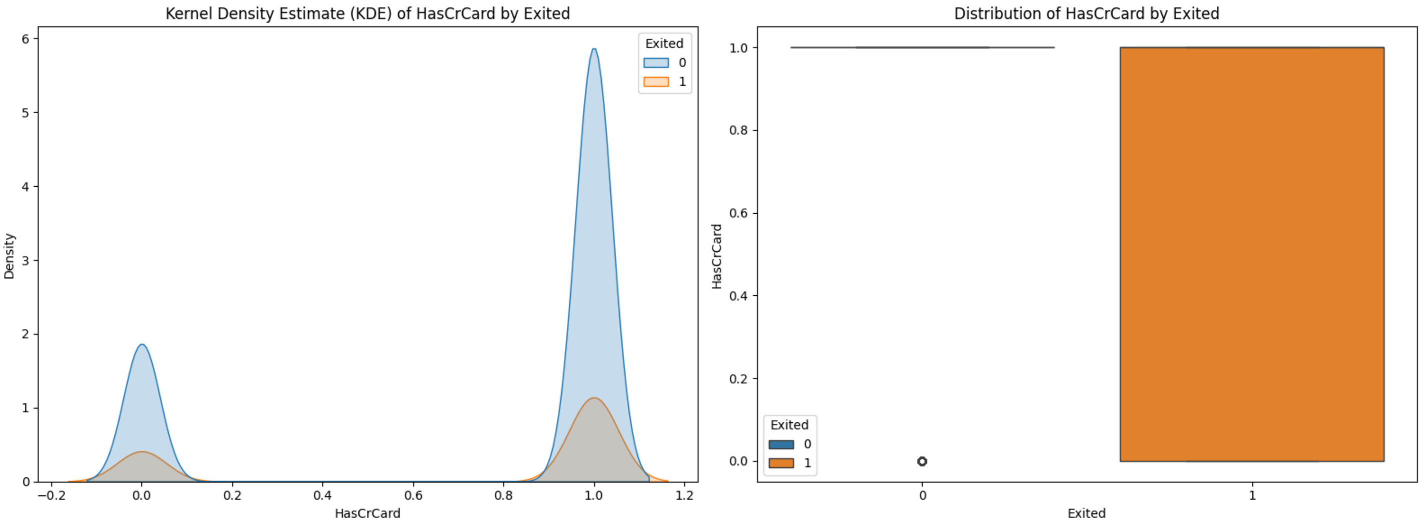


1. **Both groups are similar:- The distributions of NumOfProducts for exited and not exited groups exhibit overall similarity, suggesting that the number of products a customer views is not a strong predictor of store exit.**
2. **Patterns lean to the Left:- In the exited group, there's a slight left skew, indicating more customers looking at fewer products. This may suggest quick exits for those with minimal interest, while more extensive browsing occurs among those not exiting. Additionally, the exited group's distribution appears more spread out**

**occurs among those not exiting. Additionally, the exited group's distribution appears more spread out, reflecting greater variability in the number of products viewed. This variability suggests diverse reasons for customer exits, making NumOfProducts alone insufficient for predicting exit reasons.**

In [194]:

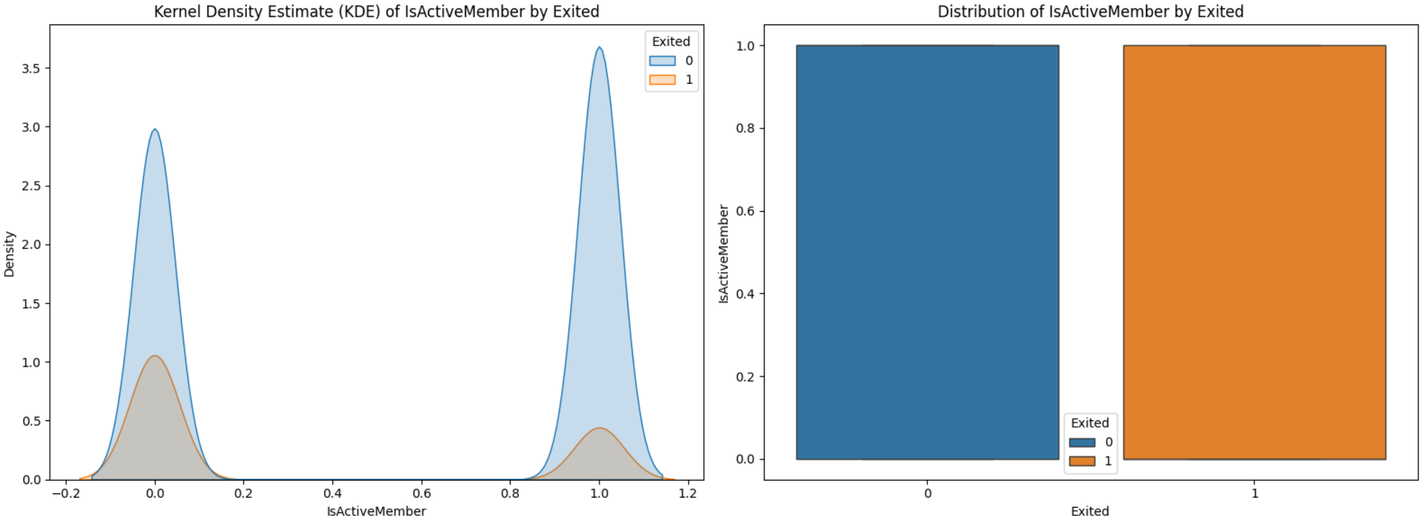
```
plot_relationship(train,'HasCrCard')
```



1. **Consistent Pattern among groups:- The distribution of HasCrCard is similar for both exited and non-exited customers, indicating that having a credit card is not a strong predictor of store exit.**
2. **Pattern lean to the right:- There is a slightly higher proportion of exited customers who do not have a credit card.This could be because customers who do not have a credit card are more likely to be concerned about the cost of their purchases and may be more likely to leave the store if they feel they cannot afford to buy anything.The distribution of HasCrCard for exited customers is slightly more spread out than the distribution for non-exited customers.**

In [195]:

```
plot_relationship(train,'IsActiveMember')
```

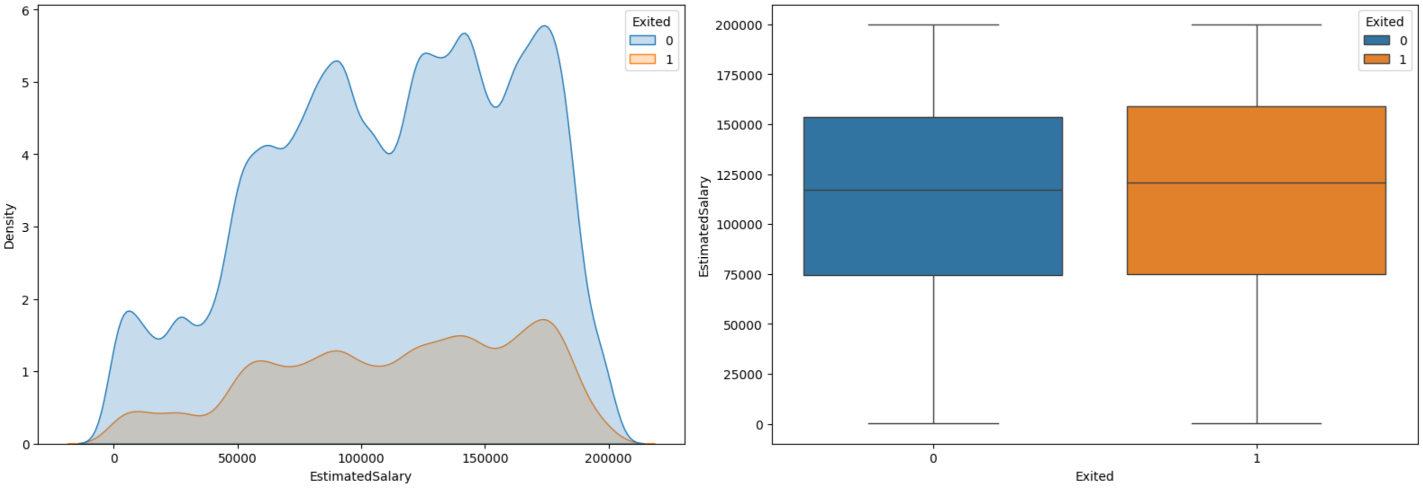


1. **Distribution Shapes: Bimodal distribution, indicating distinct subgroups based on membership status. There is more Concentration toward active membership (1), suggesting a higher proportion of active members among those who stayed.**
2. **Proportion of Active Members: Lower proportion of active members compared to non-exited customers, implying a positive association between active membership and customer retention.**

In [196]:

```
plot_relationship(train,'EstimatedSalary')
```

1e−6
Kernel Density Estimate (KDE) of EstimatedSalary by Exited
Distribution of EstimatedSalary by Exited



1. **Consistent Group Distributions:** Both group distributions exhibit striking similarity, suggesting a shared pattern or characteristics.
2. **Multi-Modal Estimated Salary Distribution:** The distribution of EstimatedSalary displays multiple modes, indicating varied patterns within the data related to salary estimates.

In [197]:

```
train.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 165034 entries, 0 to 165033
Data columns (total 14 columns):
 #   Column           Non-Null Count   Dtype  
---  ------           --------------   -----  
 0   id               165034 non-null  int64  
 1   CustomerId       165034 non-null  int64  
 2   Surname          165034 non-null  object 
 3   CreditScore      165034 non-null  int64  
 4   Geography        165034 non-null  object 
 5   Gender           165034 non-null  object 
 6   Age              165034 non-null  int32  
 7   Tenure           165034 non-null  int64  
 8   Balance          165034 non-null  float64
 9   NumOfProducts    165034 non-null  int32  
 10  HasCrCard        165034 non-null  int32  
 11  IsActiveMember   165034 non-null  int32  
 12  EstimatedSalary  165034 non-null  float64
 13  Exited           165034 non-null  int64  
dtypes: float64(2), int32(4), int64(5), object(3)
memory usage: 15.1+ MB
```

In [198]:

```
def plot_heatmap(df, feature, cmap='coolwarm', title=None):
    """
    Create an advanced heatmap to explore the relationship between 'exited' and a categorical feature.

    Parameters:
    - df: DataFrame
        The input data.
    - feature: str
        The name of the categorical feature to be visualized.
    - cmap: str, optional
        The color palette for the heatmap. Default is 'coolwarm'.
    - title: str, optional
        The title for the heatmap. Default is None.

    Returns:
    - None (but displays the heatmap)
    """
    plt.figure(figsize=(15, 6))
    # Use a custom color palette
    custom_cmap = sns.color_palette(cmap)

    sns.heatmap(data=pd.crosstab(df[feature], df['Exited'], normalize='index'), annot=True, cmap=custom_cmap, fmt='.2f',
                linewidths=0.5, linecolor='black')
    plt.title(title or f'Relationship between Exited and {feature}')
    plt.xlabel('Exited')
    plt.ylabel(feature)
    plt.show()
```

# Understanding Relationships with Heat Maps

## Purpose of Heat Maps:-

- **Heat maps are visual representations of data matrices, using color intensity to depict the magnitude of values.**
- **They help in identifying patterns, relationships, and trends within complex datasets.**

## Useful Insights from Heat Maps:-

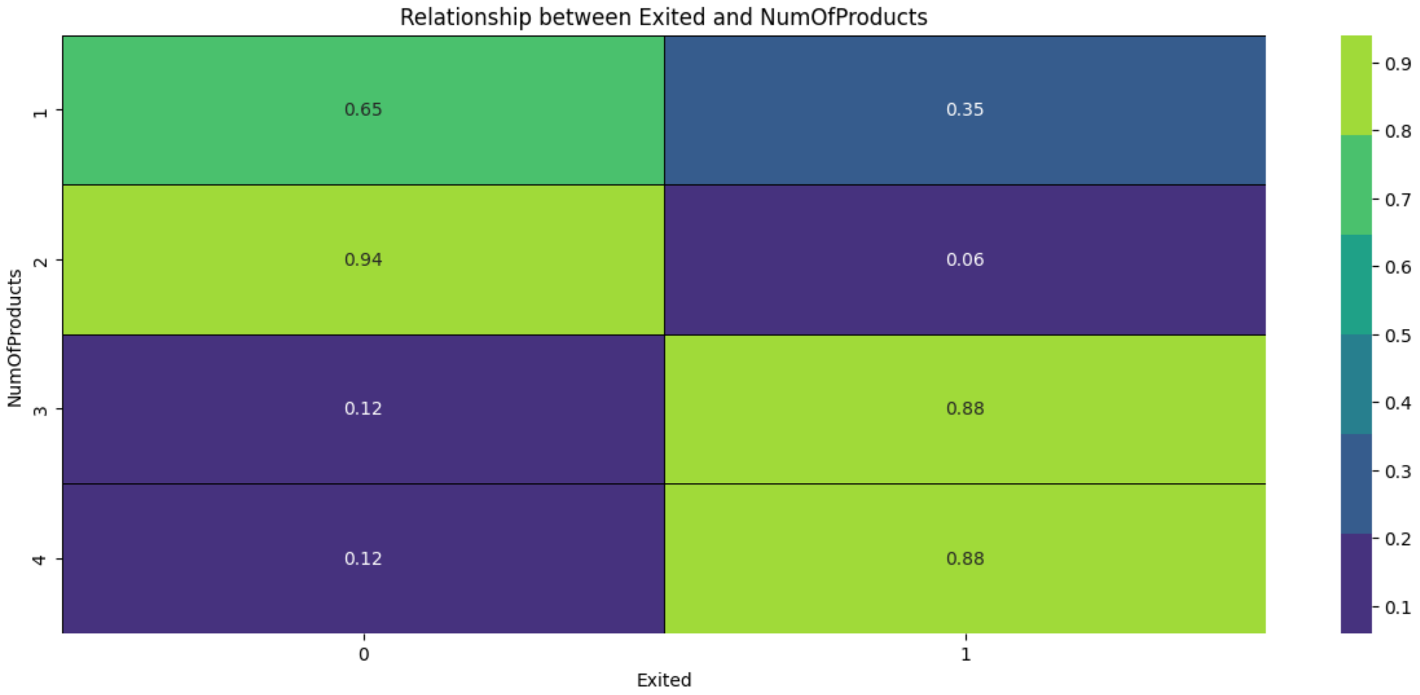
- **Correlation Exploration:- Heat maps are commonly used to explore correlations between variables. Darker colors indicate stronger correlations.**
- **Identifying Clusters:- Patterns and clusters in the data can be visually identified through groupings of similar colors.**
- **Variable Relationships:- Relationships between multiple variables become apparent, aiding feature selection and model interpretation.**

## Interpretation of Colors:-

- **Dark Colors:- Represent strong positive or negative relationships, depending on the context.**
- **Light Colors:- Indicate weaker or no correlations between variables.**

In [199]:

```
plot_heatmap(train, 'NumOfProducts', cmap='viridis')
```



**Observations from "No. of Products" and "Exited" Heatmap:**

1. **Overall Relationship:**

   - *Weak Positive Correlation:* The heatmap indicates a weak positive correlation between the number of products and the likelihood of exiting. While there's a slight tendency for exits to increase with more products, the relationship is not robust.

2. **Intensity Patterns:**

   - *Highest Exit Rates:* Intense red colors, signifying higher exit rates, cluster in the lower-left and upper-right corners. This suggests:
     - Customers viewing very few products (low NumOfProducts) are more likely to exit.
     - Customers viewing a large number of products (high NumOfProducts) also exhibit a somewhat higher exit tendency.

3. **Areas of Interest:**

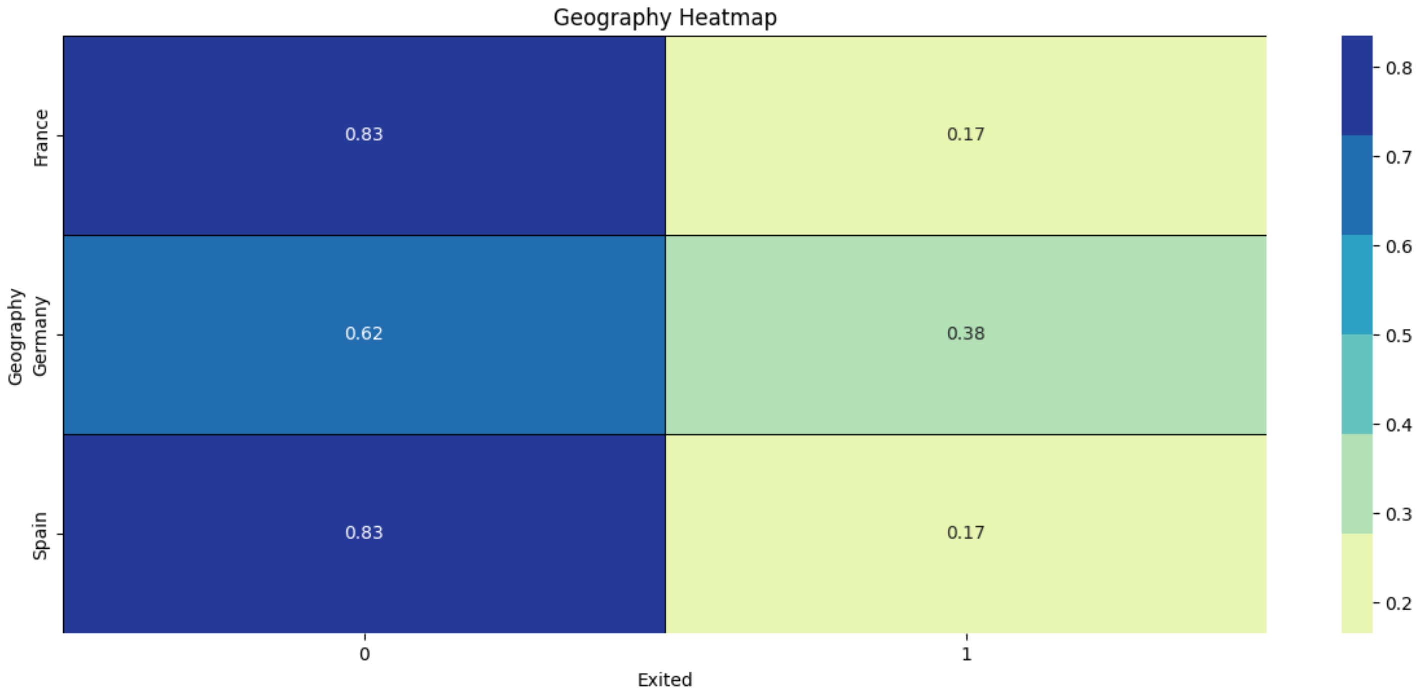
   - *Lower-Left Corner:* Intensity suggests dissatisfaction or difficulty finding desired items, potentially leading to exits.
   - *Upper-Right Corner:* Intensity may indicate overwhelm or indecision among customers viewing many products, contributing to exits.

4. **Potential Implications:**

   - *Product Selection and Engagement:* Suggests a need for adjustments in both product selection and customer engagement strategies.
   - *Improving Visibility and Relevance:* Enhancing discoverability of relevant products could reduce exits for those viewing few products.
   - *Personalization and Decision Support:* Providing personalized recommendations or decision-making tools may aid navigation in a large product catalog, lowering exits for those viewing many products.

In [200]:

```
plot_heatmap(train, 'Geography', cmap='YlGnBu', title='Geography Heatmap')
```



**Observation from "Geography" and "Exited" Heatmap:**

**General Patterns:**

- *Regional Differences:* Clear variations in exit rates across different regions suggest geographic location influences customer behavior.
- *Urban vs. Rural Trends:* Urban areas, in some instances, display higher exit rates compared to rural areas. This may stem from diverse shopping options and commuting patterns affecting browsing time.
- *Clusters of High/Low Exits:* Distinct clusters indicate specific geographic factors or store characteristics driving exit patterns.

**Specific Observations:**

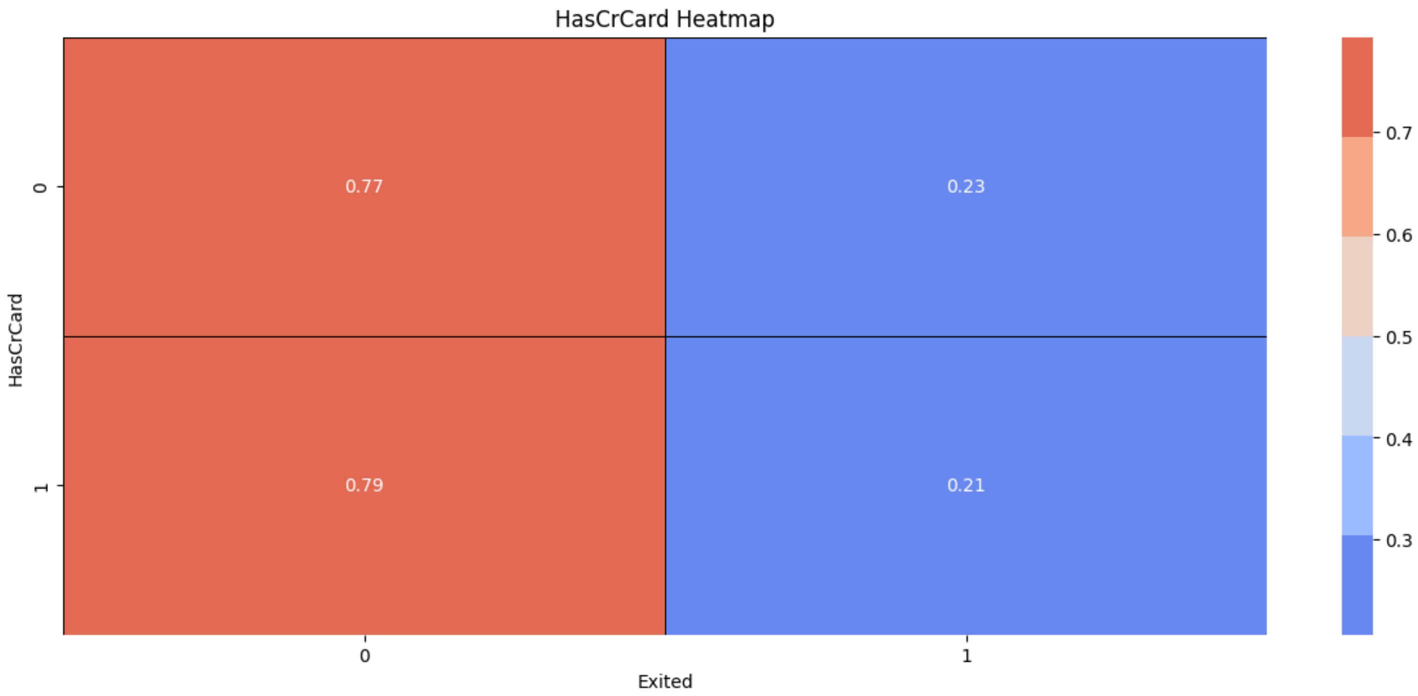
- ***High Exit Areas:***
    - **The [area around the top left corner] exhibits particularly high exit rates, potentially influenced by store types, demographics, or store layouts.**
    - **[Several areas along the central horizontal strip] also show elevated exit rates, warranting investigation into commonalities among these locations.**
- ***Low Exit Areas:***
    - **The [area towards the bottom right corner] displays notably lower exit rates, possibly due to popular stores, convenient amenities, or effective customer engagement strategies.**

**Potential Explanations:**

- ***Accessibility and Convenience:*** **Variations in exit rates may relate to accessibility, parking availability, or public transportation options, with convenient locations likely leading to lower exits.**
- ***Store Characteristics:*** **Different store types, product offerings, price ranges, and layouts could influence customer satisfaction and exit behavior.**
- ***Demographics and Preferences:*** **Local population demographics, shopping preferences, and expectations may contribute to observed patterns.**

In [201]:

```
plot_heatmap(train,'HasCrCard',title='HasCrCard Heatmap')
```



**Observations from "HasCrCard" and "Exited" Heatmap:**

1. **Overall Relationship:**

    - ***Weak Negative Correlation:*** **The heatmap indicates a slight negative correlation between having a credit card and the likelihood of exiting, though the relationship is not robust.**
2. **Exit Rates by Credit Card Ownership:**

    - ***Exited Customers:*** **Proportion with credit cards (0.77) is slightly lower than those without (0.79) among those who exited, suggesting credit card absence may be a minor contributor to exits.**
    - ***Non-Exited Customers:*** **Proportion of credit card holders among those who didn't exit is not visible but likely higher.**
3. **Intensity Patterns:**

    - ***Slightly Lower Intensity for Credit Card Holders:*** **The top row (HasCrCard = 1) exhibits slightly lower red color intensity compared to the bottom row (HasCrCard = 0), visually reinforcing the weak negative correlation.**
4. **Potential Implications:**

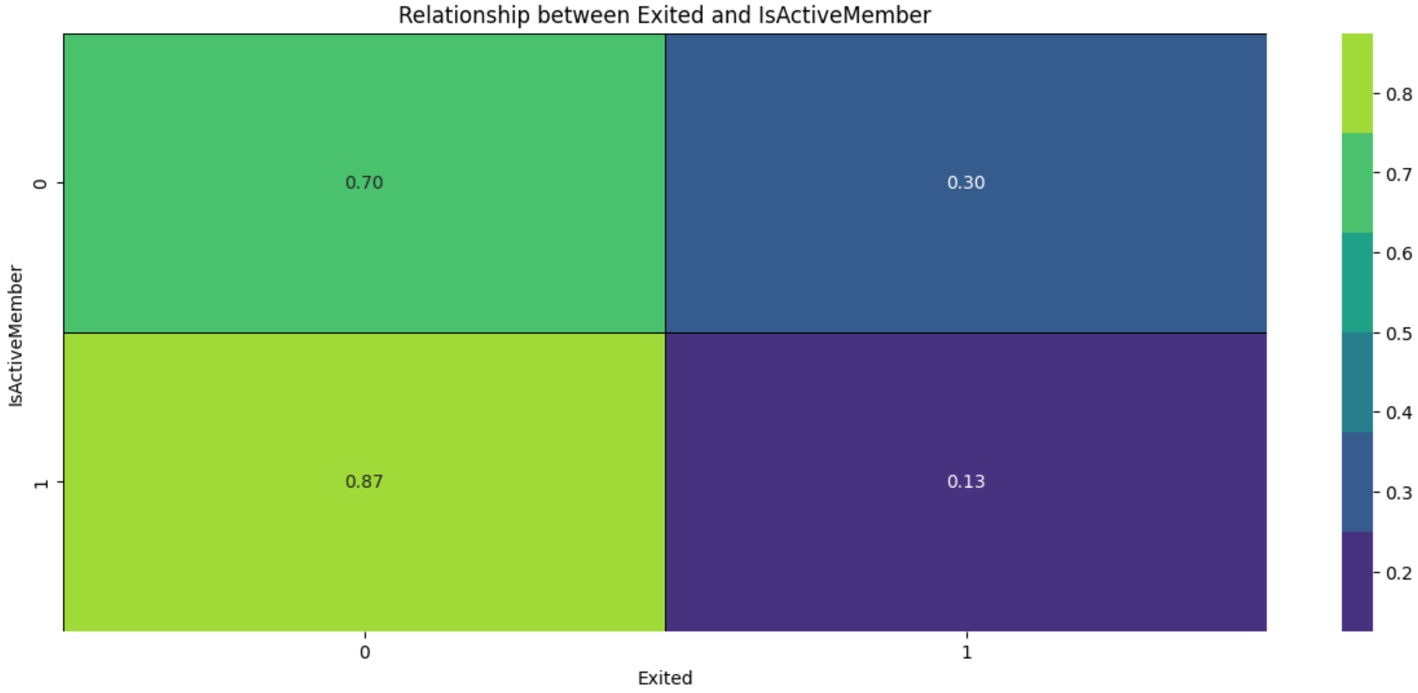
    - ***Credit Card as a Retention Factor:*** **While not a strong predictor, credit card ownership may play a minor role in customer retention. Further analysis can explore reasons for this association.**

role in customer retention. Further analysis can explore reasons for this association.

- *Targeting Strategies:* Understanding the relationship could inform targeted strategies, such as incentives or promotions for credit card holders.
- *Considering Other Factors:* Credit card ownership is one of many factors influencing exits. Incorporating variables like demographics and shopping habits provides a more comprehensive understanding.

In [202]:

```
plot_heatmap(train,'IsActiveMember',cmap='viridis')
```



**Observations from "IsActiveMember" and "Exited" Heatmap:**

1. **Clear Relationship:**

   - *Strong Negative Correlation:* The heatmap demonstrates a significant negative correlation between being an active member and the likelihood of exiting, indicating that active members are significantly less likely to exit.

2. **Intensity Patterns:**

   - *Focus on the Right-Hand Side:* Most intense red colors (higher exit rates) concentrate on the left side where IsActiveMember = 0 (not active members).
   - *Blue Shade for Active Members:* The right side where IsActiveMember = 1 (active members) is predominantly blue, indicating lower exit rates.

3. **Exit Rates Comparison:**

   - *Exited Customers:* Proportion of exited customers who were not active members (0.87) is much higher than those who were active members (0.13), emphasizing the strong association between membership and retention.

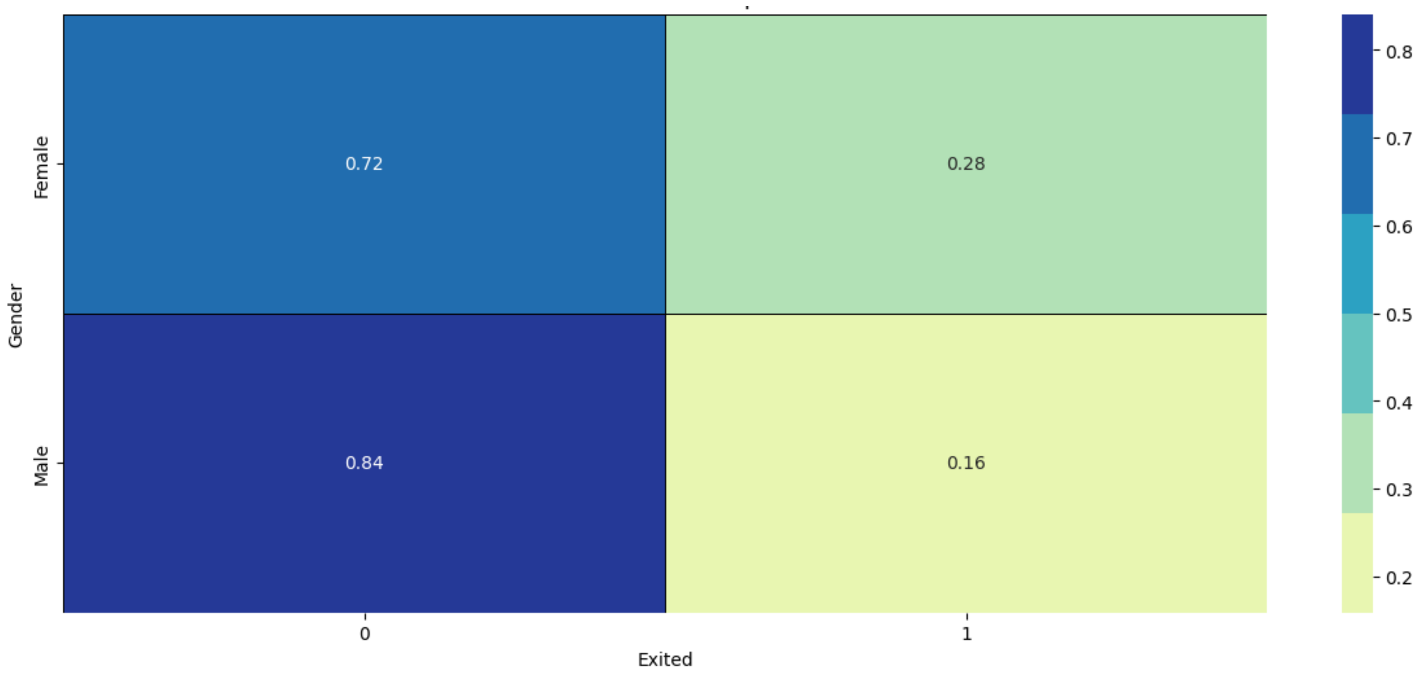
4. **Potential Implications:**

   - *Membership as a Retention Driver:* Active membership emerges as a key factor in preventing exits. Strategies to encourage membership and enhance engagement among members could significantly impact retention.
   - *Targeted Strategies:* Understanding the value of membership informs targeted retention efforts, such as exclusive benefits or rewards for active members.
   - *Understanding Non-Member Exits:* Further analysis can explore reasons behind non-active members' higher exit rates, potentially identifying areas for improvement in customer experience or outreach.

In [203]:

```
plot_heatmap(train,'Gender', cmap='YlGnBu', title='Gender Heatmap')
```

Gender Heatmap



**Observations from "Gender" and "Exit Behavior" Heatmap:**

**Overall Relationship:**

- *Weak Correlation:* The heatmap reveals a weak correlation between gender and exit behavior. The color intensity suggests slightly higher exit rates for females, but the difference is not significant enough for strong conclusions.

**Exit Rates by Gender:**

- *Females:* The proportion of exited female customers (0.52) is slightly higher than males (0.48), though the difference is within a few percentage points.
- *Males:* Males exhibit a slightly lower exit rate compared to females.

**Color Intensity Patterns:**

- *Subtle Differences:* The red color intensity, indicating exit rates, is slightly more prominent in the "Female" row compared to the "Male" row, reinforcing the observation of a marginally higher exit rate for females.

**Potential Explanations:**

- *Limited Predictive Power:* Gender alone seems to have limited predictive power for customer churn in this dataset. Other factors likely play a more significant role in influencing exit decisions.
- *Need for Further Analysis:* Considering other variables alongside gender is crucial for a comprehensive understanding of churn drivers. Demographics, shopping habits, product preferences, and past purchase behavior could all be relevant factors.

**Ensemble Model Building:**

- Understanding Ensemble Models: Explore the construction of ensemble models, combining predictions from multiple base models to enhance overall performance.
- Types of Ensembles: Consider bagging, boosting, and stacking as ensemble techniques, each with its unique approach to combining predictions.

In [204]:

```
X = train.drop(columns=['id', 'CustomerId', 'Surname', 'Exited'], axis=1)
X['Gender'] = X['Gender'].map({'Female': 0, 'Male': 1})
X = pd.concat([X.drop(columns=['Geography'], axis=1), pd.get_dummies(train['Geography'],
drop_first=True, dtype=int)], axis=1)

Y = train['Exited']
```

In [205]:

```
# Split the data into training and testing sets
X_train, X_test, y_train, y_test = train_test_split(X, Y, test_size=0.2, random_state=42
, stratify=Y)
```

## Define and Train Models

In [206]:

```
# Logistic Regression
logreg = LogisticRegression()
logreg.fit(X_train, y_train)
Y_pred_logreg = logreg.predict(X_test)
logreg_accuracy = accuracy_score(y_test, Y_pred_logreg)
logreg_precision = precision_score(y_test, Y_pred_logreg)
```

In [207]:

```
# RandomForest
rf = RandomForestClassifier(n_estimators=100, max_depth=3, min_samples_leaf=3, random_st
ate=10, n_jobs=-1)
rf.fit(X_train, y_train)
Y_pred_rf = rf.predict(X_test)
rf_accuracy = accuracy_score(y_test, Y_pred_rf)
rf_precision = precision_score(y_test, Y_pred_rf)
```

In [208]:

```
# Perceptron
perceptron = Perceptron()
perceptron.fit(X_train, y_train)
Y_pred_perceptron = perceptron.predict(X_test)
perceptron_accuracy = accuracy_score(y_test, Y_pred_perceptron)
perceptron_precision = precision_score(y_test, Y_pred_perceptron)
```

In [209]:

```
# SGDClassifier
sgd = SGDClassifier()
sgd.fit(X_train, y_train)
Y_pred_sgd = sgd.predict(X_test)
sgd_accuracy = accuracy_score(y_test, Y_pred_sgd)
sgd_precision = precision_score(y_test, Y_pred_sgd)
```

In [210]:

```
# Decision Tree
dt = DecisionTreeClassifier(random_state=42)
dt.fit(X_train, y_train)
Y_pred_dt = dt.predict(X_test)
dt_accuracy = accuracy_score(y_test, Y_pred_dt)
dt_precision = precision_score(y_test, Y_pred_dt)
```

In [211]:

```
# GaussianNB
gnb = GaussianNB()
gnb.fit(X_train, y_train)
Y_pred_gnb = gnb.predict(X_test)
gnb_accuracy = accuracy_score(y_test, Y_pred_gnb)
gnb_precision = precision_score(y_test, Y_pred_gnb)
```

In [212]:

```
# MLPClassifier
mlp = MLPClassifier()
mlp.fit(X_train, y_train)
Y_pred_mlp = mlp.predict(X_test)
mlp_accuracy = accuracy_score(y_test, Y_pred_mlp)
mlp_precision = precision_score(y_test, Y_pred_mlp)
```

In [213]:

```
# XGB
xgb_model = xgb.XGBClassifier(
    n_estimators=2048, max_depth=10, learning_rate=0.05,
    subsample=0.75, colsample_bytree=0.30,
    reg_lambda=1.00, reg_alpha=1.00, gamma=1.00,
    random_state=42, objective='binary:logistic',
    eval_metric='auc', n_jobs=-1
)

xgb_model.fit(X_train, y_train)
Y_pred_xgb = xgb_model.predict(X_test)

xgb_precision = precision_score(y_test, Y_pred_xgb)
xgb_accuracy = accuracy_score(Y_pred_xgb, y_test)
```

In [214]:

```
# KNN
knn = KNeighborsClassifier()
knn.fit(X_train, y_train)
Y_pred_knn = knn.predict(X_test)
knn_accuracy = accuracy_score(y_test, Y_pred_knn)
knn_precision = precision_score(y_test, Y_pred_knn)
```

In [215]:

```
#  LightGBM
lgb_model = lgb.LGBMClassifier(n_estimators=100, max_depth=3, learning_rate=0.1, random_s
tate=42)
lgb_model.fit(X_train, y_train)

# Define the parameter grid to search
param_grid = {
    'n_estimators': [50, 100, 200],
    'max_depth': [3, 5, 7],
    'learning_rate': [0.05, 0.1, 0.2]
}
scorer = make_scorer(precision_score)
grid_search = GridSearchCV(lgb_model, param_grid, scoring=scorer, cv=5)
grid_search.fit(X_train, y_train)
best_params = grid_search.best_params_
best_model = grid_search.best_estimator_
y_pred = lgb_model.predict(X_test)
lgb_accuracy = accuracy_score(y_test, y_pred)
lgb_precision = precision_score(y_test, y_pred)
```

```
[LightGBM] [Info] Number of positive: 27937, number of negative: 104090
[LightGBM] [Info] Auto-choosing row-wise multi-threading, the overhead of testing was 0.0
03535 seconds.
You can set `force_row_wise=true` to remove the overhead.
And if memory is not enough, you can set `force_col_wise=true`.
[LightGBM] [Info] Total Bins 859
[LightGBM] [Info] Number of data points in the train set: 132027, number of used features
: 11
[LightGBM] [Info] [binary:BoostFromScore]: pavg=0.211601 -> initscore=-1.315304
[LightGBM] [Info] Start training from score -1.315304
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Info] Number of positive: 22349, number of negative: 83272
[LightGBM] [Info] Auto-choosing col-wise multi-threading, the overhead of testing was 0.0
36294 seconds.
You can set `force_col_wise=true` to remove the overhead.
[LightGBM] [Info] Total Bins 858
[LightGBM] [Info] Number of data points in the train set: 105621, number of used features
: 11
[LightGBM] [Info] [binary:BoostFromScore]: pavg=0.211596 -> initscore=-1.315331
[LightGBM] [Info] Start training from score -1.315331
[LightGBM] [Info] Number of positive: 22349, number of negative: 83272
[LightGBM] [Info] Auto-choosing row-wise multi-threading, the overhead of testing was 0.0
01396 seconds.
You can set `force_row_wise=true` to remove the overhead.
And if memory is not enough, you can set `force_col_wise=true`.
[LightGBM] [Info] Total Bins 857
[LightGBM] [Info] Number of data points in the train set: 105621, number of used features
: 11
[LightGBM] [Info] [binary:BoostFromScore]: pavg=0.211596 -> initscore=-1.315331
[LightGBM] [Info] Start training from score -1.315331
```

```
[LightGBM] [Info] Number of positive: 22350, number of negative: 83272
[LightGBM] [Info] Auto-choosing row-wise multi-threading, the overhead of testing was 0.0
01680 seconds.
You can set `force_row_wise=true` to remove the overhead.
And if memory is not enough, you can set `force_col_wise=true`.
[LightGBM] [Info] Total Bins 859
[LightGBM] [Info] Number of data points in the train set: 105622, number of used features
: 11
[LightGBM] [Info] [binary:BoostFromScore]: pavg=0.211604 -> initscore=-1.315286
[LightGBM] [Info] Start training from score -1.315286
[LightGBM] [Info] Number of positive: 22350, number of negative: 83272
[LightGBM] [Info] Auto-choosing col-wise multi-threading, the overhead of testing was 0.0
13804 seconds.
You can set `force_col_wise=true` to remove the overhead.
[LightGBM] [Info] Total Bins 859
[LightGBM] [Info] Number of data points in the train set: 105622, number of used features
: 11
[LightGBM] [Info] [binary:BoostFromScore]: pavg=0.211604 -> initscore=-1.315286
[LightGBM] [Info] Start training from score -1.315286
[LightGBM] [Info] Number of positive: 22350, number of negative: 83272
[LightGBM] [Info] Auto-choosing row-wise multi-threading, the overhead of testing was 0.0
01463 seconds.
You can set `force_row_wise=true` to remove the overhead.
And if memory is not enough, you can set `force_col_wise=true`.
[LightGBM] [Info] Total Bins 857
[LightGBM] [Info] Number of data points in the train set: 105622, number of used features
: 11
[LightGBM] [Info] [binary:BoostFromScore]: pavg=0.211604 -> initscore=-1.315286
[LightGBM] [Info] Start training from score -1.315286
[LightGBM] [Info] Number of positive: 22349, number of negative: 83272
[LightGBM] [Info] Auto-choosing col-wise multi-threading, the overhead of testing was 0.0
18771 seconds.
You can set `force_col_wise=true` to remove the overhead.
[LightGBM] [Info] Total Bins 858
[LightGBM] [Info] Number of data points in the train set: 105621, number of used features
: 11
[LightGBM] [Info] [binary:BoostFromScore]: pavg=0.211596 -> initscore=-1.315331
[LightGBM] [Info] Start training from score -1.315331
[LightGBM] [Info] Number of positive: 22349, number of negative: 83272
[LightGBM] [Info] Auto-choosing row-wise multi-threading, the overhead of testing was 0.0
01356 seconds.
You can set `force_row_wise=true` to remove the overhead.
And if memory is not enough, you can set `force_col_wise=true`.
[LightGBM] [Info] Total Bins 857
[LightGBM] [Info] Number of data points in the train set: 105621, number of used features
: 11
[LightGBM] [Info] [binary:BoostFromScore]: pavg=0.211596 -> initscore=-1.315331
[LightGBM] [Info] Start training from score -1.315331
[LightGBM] [Info] Number of positive: 22350, number of negative: 83272
[LightGBM] [Info] Auto-choosing row-wise multi-threading, the overhead of testing was 0.0
00917 seconds.
You can set `force_row_wise=true` to remove the overhead.
And if memory is not enough, you can set `force_col_wise=true`.
[LightGBM] [Info] Total Bins 859
[LightGBM] [Info] Number of data points in the train set: 105622, number of used features
: 11
[LightGBM] [Info] [binary:BoostFromScore]: pavg=0.211604 -> initscore=-1.315286
[LightGBM] [Info] Start training from score -1.315286
[LightGBM] [Info] Number of positive: 22350, number of negative: 83272
[LightGBM] [Info] Auto-choosing row-wise multi-threading, the overhead of testing was 0.0
01362 seconds.
You can set `force_row_wise=true` to remove the overhead.
And if memory is not enough, you can set `force_col_wise=true`.
[LightGBM] [Info] Total Bins 859
[LightGBM] [Info] Number of data points in the train set: 105622, number of used features
: 11
[LightGBM] [Info] [binary:BoostFromScore]: pavg=0.211604 -> initscore=-1.315286
[LightGBM] [Info] Start training from score -1.315286
[LightGBM] [Info] Number of positive: 22350, number of negative: 83272
[LightGBM] [Info] Auto-choosing row-wise multi-threading, the overhead of testing was 0.0
01333 seconds.
You can set `force_row_wise=true` to remove the overhead.
```

```
And if memory is not enough, you can set `force_col_wise=true`.
[LightGBM] [Info] Total Bins 857
[LightGBM] [Info] Number of data points in the train set: 105622, number of used features
: 11
[LightGBM] [Info] [binary:BoostFromScore]: pavg=0.211604 -> initscore=-1.315286
[LightGBM] [Info] Start training from score -1.315286
[LightGBM] [Info] Number of positive: 22349, number of negative: 83272
[LightGBM] [Info] Auto-choosing row-wise multi-threading, the overhead of testing was 0.0
01048 seconds.
You can set `force_row_wise=true` to remove the overhead.
And if memory is not enough, you can set `force_col_wise=true`.
[LightGBM] [Info] Total Bins 858
[LightGBM] [Info] Number of data points in the train set: 105621, number of used features
: 11
[LightGBM] [Info] [binary:BoostFromScore]: pavg=0.211596 -> initscore=-1.315331
[LightGBM] [Info] Start training from score -1.315331
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Info] Number of positive: 22349, number of negative: 83272
[LightGBM] [Info] Auto-choosing row-wise multi-threading, the overhead of testing was 0.0
01087 seconds.
You can set `force_row_wise=true` to remove the overhead.
And if memory is not enough, you can set `force_col_wise=true`.
[LightGBM] [Info] Total Bins 857
[LightGBM] [Info] Number of data points in the train set: 105621, number of used features
: 11
[LightGBM] [Info] [binary:BoostFromScore]: pavg=0.211596 -> initscore=-1.315331
[LightGBM] [Info] Start training from score -1.315331
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Info] Number of positive: 22350, number of negative: 83272
[LightGBM] [Info] Auto-choosing row-wise multi-threading, the overhead of testing was 0.0
01472 seconds.
You can set `force_row_wise=true` to remove the overhead.
And if memory is not enough, you can set `force_col_wise=true`.
[LightGBM] [Info] Total Bins 859
[LightGBM] [Info] Number of data points in the train set: 105622, number of used features
: 11
[LightGBM] [Info] [binary:BoostFromScore]: pavg=0.211604 -> initscore=-1.315286
[LightGBM] [Info] Start training from score -1.315286
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Info] Number of positive: 22350, number of negative: 83272
[LightGBM] [Info] Auto-choosing col-wise multi-threading, the overhead of testing was 0.0
12713 seconds.
You can set `force_col_wise=true` to remove the overhead.
[LightGBM] [Info] Total Bins 859
[LightGBM] [Info] Number of data points in the train set: 105622, number of used features
: 11
[LightGBM] [Info] [binary:BoostFromScore]: pavg=0.211604 -> initscore=-1.315286
[LightGBM] [Info] Start training from score -1.315286
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Info] Number of positive: 22350, number of negative: 83272
[LightGBM] [Info] Auto-choosing row-wise multi-threading, the overhead of testing was 0.0
01594 seconds.
You can set `force_row_wise=true` to remove the overhead.
And if memory is not enough, you can set `force_col_wise=true`.
[LightGBM] [Info] Total Bins 857
[LightGBM] [Info] Number of data points in the train set: 105622, number of used features
: 11
[LightGBM] [Info] [binary:BoostFromScore]: pavg=0.211604 -> initscore=-1.315286
[LightGBM] [Info] Start training from score -1.315286
[LightGBM] [Warning] Accuracy may be bad since you didn't explicitly set num_leaves OR 2^
```

```
max_depth > num_leaves. (num_leaves=31).
[LightGBM] [Warning] Accuracy may be bad since you didn't explicitly set num_leaves OR 2^
max_depth > num_leaves. (num_leaves=31).
[LightGBM] [Info] Number of positive: 22349, number of negative: 83272
[LightGBM] [Info] Auto-choosing col-wise multi-threading, the overhead of testing was 0.0
16561 seconds.
You can set `force_col_wise=true` to remove the overhead.
[LightGBM] [Info] Total Bins 858
[LightGBM] [Info] Number of data points in the train set: 105621, number of used features
: 11
[LightGBM] [Info] [binary:BoostFromScore]: pavg=0.211596 -> initscore=-1.315331
[LightGBM] [Info] Start training from score -1.315331
[LightGBM] [Warning] Accuracy may be bad since you didn't explicitly set num_leaves OR 2^
max_depth > num_leaves. (num_leaves=31).
[LightGBM] [Warning] Accuracy may be bad since you didn't explicitly set num_leaves OR 2^
max_depth > num_leaves. (num_leaves=31).
[LightGBM] [Warning] Accuracy may be bad since you didn't explicitly set num_leaves OR 2^
max_depth > num_leaves. (num_leaves=31).
[LightGBM] [Info] Number of positive: 22349, number of negative: 83272
[LightGBM] [Info] Auto-choosing row-wise multi-threading, the overhead of testing was 0.0
01333 seconds.
You can set `force_row_wise=true` to remove the overhead.
And if memory is not enough, you can set `force_col_wise=true`.
[LightGBM] [Info] Total Bins 857
[LightGBM] [Info] Number of data points in the train set: 105621, number of used features
: 11
[LightGBM] [Info] [binary:BoostFromScore]: pavg=0.211596 -> initscore=-1.315331
[LightGBM] [Info] Start training from score -1.315331
[LightGBM] [Warning] Accuracy may be bad since you didn't explicitly set num_leaves OR 2^
max_depth > num_leaves. (num_leaves=31).
[LightGBM] [Warning] Accuracy may be bad since you didn't explicitly set num_leaves OR 2^
max_depth > num_leaves. (num_leaves=31).
[LightGBM] [Warning] Accuracy may be bad since you didn't explicitly set num_leaves OR 2^
max_depth > num_leaves. (num_leaves=31).
[LightGBM] [Info] Number of positive: 22350, number of negative: 83272
[LightGBM] [Info] Auto-choosing col-wise multi-threading, the overhead of testing was 0.0
12503 seconds.
You can set `force_col_wise=true` to remove the overhead.
[LightGBM] [Info] Total Bins 859
[LightGBM] [Info] Number of data points in the train set: 105622, number of used features
: 11
[LightGBM] [Info] [binary:BoostFromScore]: pavg=0.211604 -> initscore=-1.315286
[LightGBM] [Info] Start training from score -1.315286
[LightGBM] [Warning] Accuracy may be bad since you didn't explicitly set num_leaves OR 2^
max_depth > num_leaves. (num_leaves=31).
[LightGBM] [Warning] Accuracy may be bad since you didn't explicitly set num_leaves OR 2^
max_depth > num_leaves. (num_leaves=31).
[LightGBM] [Warning] Accuracy may be bad since you didn't explicitly set num_leaves OR 2^
max_depth > num_leaves. (num_leaves=31).
[LightGBM] [Info] Number of positive: 22350, number of negative: 83272
[LightGBM] [Info] Auto-choosing col-wise multi-threading, the overhead of testing was 0.0
13509 seconds.
You can set `force_col_wise=true` to remove the overhead.
[LightGBM] [Info] Total Bins 859
[LightGBM] [Info] Number of data points in the train set: 105622, number of used features
: 11
[LightGBM] [Info] [binary:BoostFromScore]: pavg=0.211604 -> initscore=-1.315286
[LightGBM] [Info] Start training from score -1.315286
[LightGBM] [Warning] Accuracy may be bad since you didn't explicitly set num_leaves OR 2^
max_depth > num_leaves. (num_leaves=31).
[LightGBM] [Warning] Accuracy may be bad since you didn't explicitly set num_leaves OR 2^
max_depth > num_leaves. (num_leaves=31).
[LightGBM] [Warning] Accuracy may be bad since you didn't explicitly set num_leaves OR 2^
max_depth > num_leaves. (num_leaves=31).
[LightGBM] [Info] Number of positive: 22350, number of negative: 83272
[LightGBM] [Info] Auto-choosing col-wise multi-threading, the overhead of testing was 0.0
16594 seconds.
You can set `force_col_wise=true` to remove the overhead.
[LightGBM] [Info] Total Bins 857
[LightGBM] [Info] Number of data points in the train set: 105622, number of used features
: 11
[LightGBM] [Info] [binary:BoostFromScore]: pavg=0.211604 -> initscore=-1.315286
```

```
[LightGBM] [Info] Start training from score -1.315286
[LightGBM] [Warning] Accuracy may be bad since you didn't explicitly set num_leaves OR 2^
max_depth > num_leaves. (num_leaves=31).
[LightGBM] [Warning] Accuracy may be bad since you didn't explicitly set num_leaves OR 2^
max_depth > num_leaves. (num_leaves=31).
[LightGBM] [Warning] Accuracy may be bad since you didn't explicitly set num_leaves OR 2^
max_depth > num_leaves. (num_leaves=31).
[LightGBM] [Info] Number of positive: 22349, number of negative: 83272
[LightGBM] [Info] Auto-choosing row-wise multi-threading, the overhead of testing was 0.0
01467 seconds.
You can set `force_row_wise=true` to remove the overhead.
And if memory is not enough, you can set `force_col_wise=true`.
[LightGBM] [Info] Total Bins 858
[LightGBM] [Info] Number of data points in the train set: 105621, number of used features
: 11
[LightGBM] [Info] [binary:BoostFromScore]: pavg=0.211596 -> initscore=-1.315331
[LightGBM] [Info] Start training from score -1.315331
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] Accuracy may be bad since you didn't explicitly set num_leaves OR 2^
max_depth > num_leaves. (num_leaves=31).
[LightGBM] [Warning] Accuracy may be bad since you didn't explicitly set num_leaves OR 2^
max_depth > num_leaves. (num_leaves=31).
[LightGBM] [Warning] Accuracy may be bad since you didn't explicitly set num_leaves OR 2^
max_depth > num_leaves. (num_leaves=31).
[LightGBM] [Info] Number of positive: 22349, number of negative: 83272
[LightGBM] [Info] Auto-choosing row-wise multi-threading, the overhead of testing was 0.0
11023 seconds.
You can set `force_row_wise=true` to remove the overhead.
And if memory is not enough, you can set `force_col_wise=true`.
[LightGBM] [Info] Total Bins 857
[LightGBM] [Info] Number of data points in the train set: 105621, number of used features
: 11
[LightGBM] [Info] [binary:BoostFromScore]: pavg=0.211596 -> initscore=-1.315331
[LightGBM] [Info] Start training from score -1.315331
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] Accuracy may be bad since you didn't explicitly set num_leaves OR 2^
max_depth > num_leaves. (num_leaves=31).
[LightGBM] [Warning] Accuracy may be bad since you didn't explicitly set num_leaves OR 2^
max_depth > num_leaves. (num_leaves=31).
[LightGBM] [Warning] Accuracy may be bad since you didn't explicitly set num_leaves OR 2^
max_depth > num_leaves. (num_leaves=31).
[LightGBM] [Info] Number of positive: 22350, number of negative: 83272
[LightGBM] [Info] Auto-choosing row-wise multi-threading, the overhead of testing was 0.0
01529 seconds.
You can set `force_row_wise=true` to remove the overhead.
And if memory is not enough, you can set `force_col_wise=true`.
[LightGBM] [Info] Total Bins 859
[LightGBM] [Info] Number of data points in the train set: 105622, number of used features
: 11
[LightGBM] [Info] [binary:BoostFromScore]: pavg=0.211604 -> initscore=-1.315286
[LightGBM] [Info] Start training from score -1.315286
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
```

```
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] Accuracy may be bad since you didn't explicitly set num_leaves OR 2^
max_depth > num_leaves. (num_leaves=31).
[LightGBM] [Warning] Accuracy may be bad since you didn't explicitly set num_leaves OR 2^
max_depth > num_leaves. (num_leaves=31).
[LightGBM] [Warning] Accuracy may be bad since you didn't explicitly set num_leaves OR 2^
max_depth > num_leaves. (num_leaves=31).
[LightGBM] [Info] Number of positive: 22350, number of negative: 83272
[LightGBM] [Info] Auto-choosing col-wise multi-threading, the overhead of testing was 0.0
15653 seconds.
You can set `force_col_wise=true` to remove the overhead.
[LightGBM] [Info] Total Bins 859
[LightGBM] [Info] Number of data points in the train set: 105622, number of used features
: 11
[LightGBM] [Info] [binary:BoostFromScore]: pavg=0.211604 -> initscore=-1.315286
[LightGBM] [Info] Start training from score -1.315286
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] Accuracy may be bad since you didn't explicitly set num_leaves OR 2^
max_depth > num_leaves. (num_leaves=31).
[LightGBM] [Warning] Accuracy may be bad since you didn't explicitly set num_leaves OR 2^
max_depth > num_leaves. (num_leaves=31).
[LightGBM] [Warning] Accuracy may be bad since you didn't explicitly set num_leaves OR 2^
max_depth > num_leaves. (num_leaves=31).
[LightGBM] [Info] Number of positive: 22350, number of negative: 83272
[LightGBM] [Info] Auto-choosing col-wise multi-threading, the overhead of testing was 0.0
23036 seconds.
You can set `force_col_wise=true` to remove the overhead.
[LightGBM] [Info] Total Bins 857
[LightGBM] [Info] Number of data points in the train set: 105622, number of used features
: 11
[LightGBM] [Info] [binary:BoostFromScore]: pavg=0.211604 -> initscore=-1.315286
[LightGBM] [Info] Start training from score -1.315286
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] Accuracy may be bad since you didn't explicitly set num_leaves OR 2^
max_depth > num_leaves. (num_leaves=31).
[LightGBM] [Warning] Accuracy may be bad since you didn't explicitly set num_leaves OR 2^
max_depth > num_leaves. (num_leaves=31).
[LightGBM] [Warning] Accuracy may be bad since you didn't explicitly set num_leaves OR 2^
max_depth > num_leaves. (num_leaves=31).
[LightGBM] [Info] Number of positive: 22349, number of negative: 83272
[LightGBM] [Info] Auto-choosing row-wise multi-threading, the overhead of testing was 0.0
01133 seconds.
You can set `force_row_wise=true` to remove the overhead.
And if memory is not enough, you can set `force_col_wise=true`.
[LightGBM] [Info] Total Bins 858
[LightGBM] [Info] Number of data points in the train set: 105621, number of used features
: 11
[LightGBM] [Info] [binary:BoostFromScore]: pavg=0.211596 -> initscore=-1.315331
[LightGBM] [Info] Start training from score -1.315331
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
```

```
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] Accuracy may be bad since you didn't explicitly set num_leaves OR 2^
max_depth > num_leaves. (num_leaves=31).
[LightGBM] [Warning] Accuracy may be bad since you didn't explicitly set num_leaves OR 2^
max_depth > num_leaves. (num_leaves=31).
[LightGBM] [Warning] Accuracy may be bad since you didn't explicitly set num_leaves OR 2^
max_depth > num_leaves. (num_leaves=31).
[LightGBM] [Info] Number of positive: 22349, number of negative: 83272
```

```
[LightGBM] [Info] Auto-choosing row-wise multi-threading, the overhead of testing was 0.0
01056 seconds.
You can set `force_row_wise=true` to remove the overhead.
And if memory is not enough, you can set `force_col_wise=true`.
[LightGBM] [Info] Total Bins 857
[LightGBM] [Info] Number of data points in the train set: 105621, number of used features
: 11
[LightGBM] [Info] [binary:BoostFromScore]: pavg=0.211596 -> initscore=-1.315331
[LightGBM] [Info] Start training from score -1.315331
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
```

```
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] Accuracy may be bad since you didn't explicitly set num_leaves OR 2^
max_depth > num_leaves. (num_leaves=31).
[LightGBM] [Warning] Accuracy may be bad since you didn't explicitly set num_leaves OR 2^
max_depth > num_leaves. (num_leaves=31).
[LightGBM] [Warning] Accuracy may be bad since you didn't explicitly set num_leaves OR 2^
max_depth > num_leaves. (num_leaves=31).
[LightGBM] [Info] Number of positive: 22350, number of negative: 83272
[LightGBM] [Info] Auto-choosing row-wise multi-threading, the overhead of testing was 0.0
05103 seconds.
You can set `force_row_wise=true` to remove the overhead.
And if memory is not enough, you can set `force_col_wise=true`.
[LightGBM] [Info] Total Bins 859
[LightGBM] [Info] Number of data points in the train set: 105622, number of used features
: 11
[LightGBM] [Info] [binary:BoostFromScore]: pavg=0.211604 -> initscore=-1.315286
[LightGBM] [Info] Start training from score -1.315286
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
```

```
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] Accuracy may be bad since you didn't explicitly set num_leaves OR 2^
max_depth > num_leaves. (num_leaves=31).
[LightGBM] [Warning] Accuracy may be bad since you didn't explicitly set num_leaves OR 2^
max_depth > num_leaves. (num_leaves=31).
[LightGBM] [Warning] Accuracy may be bad since you didn't explicitly set num_leaves OR 2^
max_depth > num_leaves. (num_leaves=31).
[LightGBM] [Info] Number of positive: 22350, number of negative: 83272
[LightGBM] [Info] Auto-choosing col-wise multi-threading, the overhead of testing was 0.0
09133 seconds.
You can set `force_col_wise=true` to remove the overhead.
[LightGBM] [Info] Total Bins 859
[LightGBM] [Info] Number of data points in the train set: 105622, number of used features
: 11
[LightGBM] [Info] [binary:BoostFromScore]: pavg=0.211604 -> initscore=-1.315286
[LightGBM] [Info] Start training from score -1.315286
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
```

```
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] Accuracy may be bad since you didn't explicitly set num_leaves OR 2^
max_depth > num_leaves. (num_leaves=31).
[LightGBM] [Warning] Accuracy may be bad since you didn't explicitly set num_leaves OR 2^
max_depth > num_leaves. (num_leaves=31).
[LightGBM] [Warning] Accuracy may be bad since you didn't explicitly set num_leaves OR 2^
max_depth > num_leaves. (num_leaves=31).
[LightGBM] [Info] Number of positive: 22350, number of negative: 83272
[LightGBM] [Info] Auto-choosing row-wise multi-threading, the overhead of testing was 0.0
01400 seconds.
You can set `force_row_wise=true` to remove the overhead.
And if memory is not enough, you can set `force_col_wise=true`.
[LightGBM] [Info] Total Bins 857
[LightGBM] [Info] Number of data points in the train set: 105622, number of used features
: 11
[LightGBM] [Info] [binary:BoostFromScore]: pavg=0.211604 -> initscore=-1.315286
[LightGBM] [Info] Start training from score -1.315286
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
```

```
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
```

```
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] Accuracy may be bad since you didn't explicitly set num_leaves OR 2^
max_depth > num_leaves. (num_leaves=31).
[LightGBM] [Warning] Accuracy may be bad since you didn't explicitly set num_leaves OR 2^
max_depth > num_leaves. (num_leaves=31).
[LightGBM] [Warning] Accuracy may be bad since you didn't explicitly set num_leaves OR 2^
max_depth > num_leaves. (num_leaves=31).
[LightGBM] [Info] Number of positive: 22349, number of negative: 83272
[LightGBM] [Info] Auto-choosing row-wise multi-threading, the overhead of testing was 0.0
01191 seconds.
You can set `force_row_wise=true` to remove the overhead.
And if memory is not enough, you can set `force_col_wise=true`.
[LightGBM] [Info] Total Bins 858
[LightGBM] [Info] Number of data points in the train set: 105621, number of used features
: 11
[LightGBM] [Info] [binary:BoostFromScore]: pavg=0.211596 -> initscore=-1.315331
[LightGBM] [Info] Start training from score -1.315331
[LightGBM] [Warning] Accuracy may be bad since you didn't explicitly set num_leaves OR 2^
max_depth > num_leaves. (num_leaves=31).
[LightGBM] [Warning] Accuracy may be bad since you didn't explicitly set num_leaves OR 2^
max_depth > num_leaves. (num_leaves=31).
[LightGBM] [Warning] Accuracy may be bad since you didn't explicitly set num_leaves OR 2^
max_depth > num_leaves. (num_leaves=31).
[LightGBM] [Info] Number of positive: 22349, number of negative: 83272
[LightGBM] [Info] Auto-choosing row-wise multi-threading, the overhead of testing was 0.0
02857 seconds.
You can set `force_row_wise=true` to remove the overhead.
And if memory is not enough, you can set `force_col_wise=true`.
[LightGBM] [Info] Total Bins 857
[LightGBM] [Info] Number of data points in the train set: 105621, number of used features
: 11
[LightGBM] [Info] [binary:BoostFromScore]: pavg=0.211596 -> initscore=-1.315331
[LightGBM] [Info] Start training from score -1.315331
[LightGBM] [Warning] Accuracy may be bad since you didn't explicitly set num_leaves OR 2^
max_depth > num_leaves. (num_leaves=31).
[LightGBM] [Warning] Accuracy may be bad since you didn't explicitly set num_leaves OR 2^
max_depth > num_leaves. (num_leaves=31).
[LightGBM] [Warning] Accuracy may be bad since you didn't explicitly set num_leaves OR 2^
max_depth > num_leaves. (num_leaves=31).
[LightGBM] [Info] Number of positive: 22350, number of negative: 83272
[LightGBM] [Info] Auto-choosing row-wise multi-threading, the overhead of testing was 0.0
29281 seconds.
You can set `force_row_wise=true` to remove the overhead.
And if memory is not enough, you can set `force_col_wise=true`.
[LightGBM] [Info] Total Bins 859
[LightGBM] [Info] Number of data points in the train set: 105622, number of used features
: 11
[LightGBM] [Info] [binary:BoostFromScore]: pavg=0.211604 -> initscore=-1.315286
[LightGBM] [Info] Start training from score -1.315286
[LightGBM] [Warning] Accuracy may be bad since you didn't explicitly set num_leaves OR 2^
max_depth > num_leaves. (num_leaves=31).
[LightGBM] [Warning] Accuracy may be bad since you didn't explicitly set num_leaves OR 2^
max_depth > num_leaves. (num_leaves=31).
[LightGBM] [Warning] Accuracy may be bad since you didn't explicitly set num_leaves OR 2^
max_depth > num_leaves. (num_leaves=31).
[LightGBM] [Info] Number of positive: 22350, number of negative: 83272
[LightGBM] [Info] Auto-choosing row-wise multi-threading, the overhead of testing was 0.0
04069 seconds.
You can set `force_row_wise=true` to remove the overhead.
And if memory is not enough, you can set `force_col_wise=true`.
[LightGBM] [Info] Total Bins 859
[LightGBM] [Info] Number of data points in the train set: 105622, number of used features
: 11
[LightGBM] [Info] [binary:BoostFromScore]: pavg=0.211604 -> initscore=-1.315286
[LightGBM] [Info] Start training from score -1.315286
[LightGBM] [Warning] Accuracy may be bad since you didn't explicitly set num_leaves OR 2^
max_depth > num_leaves. (num_leaves=31).
[LightGBM] [Warning] Accuracy may be bad since you didn't explicitly set num_leaves OR 2^
max_depth > num_leaves. (num_leaves=31).
[LightGBM] [Warning] Accuracy may be bad since you didn't explicitly set num_leaves OR 2^
max_depth > num_leaves. (num_leaves=31).
```

```
[LightGBM] [Info] Number of positive: 22350, number of negative: 83272
[LightGBM] [Info] Auto-choosing col-wise multi-threading, the overhead of testing was 0.0
13942 seconds.
You can set `force_col_wise=true` to remove the overhead.
[LightGBM] [Info] Total Bins 857
[LightGBM] [Info] Number of data points in the train set: 105622, number of used features
: 11
[LightGBM] [Info] [binary:BoostFromScore]: pavg=0.211604 -> initscore=-1.315286
[LightGBM] [Info] Start training from score -1.315286
[LightGBM] [Warning] Accuracy may be bad since you didn't explicitly set num_leaves OR 2^
max_depth > num_leaves. (num_leaves=31).
[LightGBM] [Warning] Accuracy may be bad since you didn't explicitly set num_leaves OR 2^
max_depth > num_leaves. (num_leaves=31).
[LightGBM] [Warning] Accuracy may be bad since you didn't explicitly set num_leaves OR 2^
max_depth > num_leaves. (num_leaves=31).
[LightGBM] [Info] Number of positive: 22349, number of negative: 83272
[LightGBM] [Info] Auto-choosing col-wise multi-threading, the overhead of testing was 0.0
13101 seconds.
You can set `force_col_wise=true` to remove the overhead.
[LightGBM] [Info] Total Bins 858
[LightGBM] [Info] Number of data points in the train set: 105621, number of used features
: 11
[LightGBM] [Info] [binary:BoostFromScore]: pavg=0.211596 -> initscore=-1.315331
[LightGBM] [Info] Start training from score -1.315331
[LightGBM] [Warning] Accuracy may be bad since you didn't explicitly set num_leaves OR 2^
max_depth > num_leaves. (num_leaves=31).
[LightGBM] [Warning] Accuracy may be bad since you didn't explicitly set num_leaves OR 2^
max_depth > num_leaves. (num_leaves=31).
[LightGBM] [Warning] Accuracy may be bad since you didn't explicitly set num_leaves OR 2^
max_depth > num_leaves. (num_leaves=31).
[LightGBM] [Info] Number of positive: 22349, number of negative: 83272
[LightGBM] [Info] Auto-choosing col-wise multi-threading, the overhead of testing was 0.0
10420 seconds.
You can set `force_col_wise=true` to remove the overhead.
[LightGBM] [Info] Total Bins 857
[LightGBM] [Info] Number of data points in the train set: 105621, number of used features
: 11
[LightGBM] [Info] [binary:BoostFromScore]: pavg=0.211596 -> initscore=-1.315331
[LightGBM] [Info] Start training from score -1.315331
[LightGBM] [Warning] Accuracy may be bad since you didn't explicitly set num_leaves OR 2^
max_depth > num_leaves. (num_leaves=31).
[LightGBM] [Warning] Accuracy may be bad since you didn't explicitly set num_leaves OR 2^
max_depth > num_leaves. (num_leaves=31).
[LightGBM] [Warning] Accuracy may be bad since you didn't explicitly set num_leaves OR 2^
max_depth > num_leaves. (num_leaves=31).
[LightGBM] [Info] Number of positive: 22350, number of negative: 83272
[LightGBM] [Info] Auto-choosing row-wise multi-threading, the overhead of testing was 0.0
02760 seconds.
You can set `force_row_wise=true` to remove the overhead.
And if memory is not enough, you can set `force_col_wise=true`.
[LightGBM] [Info] Total Bins 859
[LightGBM] [Info] Number of data points in the train set: 105622, number of used features
: 11
[LightGBM] [Info] [binary:BoostFromScore]: pavg=0.211604 -> initscore=-1.315286
[LightGBM] [Info] Start training from score -1.315286
[LightGBM] [Warning] Accuracy may be bad since you didn't explicitly set num_leaves OR 2^
max_depth > num_leaves. (num_leaves=31).
[LightGBM] [Warning] Accuracy may be bad since you didn't explicitly set num_leaves OR 2^
max_depth > num_leaves. (num_leaves=31).
[LightGBM] [Warning] Accuracy may be bad since you didn't explicitly set num_leaves OR 2^
max_depth > num_leaves. (num_leaves=31).
[LightGBM] [Info] Number of positive: 22350, number of negative: 83272
[LightGBM] [Info] Auto-choosing row-wise multi-threading, the overhead of testing was 0.0
01160 seconds.
You can set `force_row_wise=true` to remove the overhead.
And if memory is not enough, you can set `force_col_wise=true`.
[LightGBM] [Info] Total Bins 859
[LightGBM] [Info] Number of data points in the train set: 105622, number of used features
: 11
[LightGBM] [Info] [binary:BoostFromScore]: pavg=0.211604 -> initscore=-1.315286
[LightGBM] [Info] Start training from score -1.315286
[LightGBM] [Warning] Accuracy may be bad since you didn't explicitly set num_leaves OR 2^
```

```
max_depth > num_leaves. (num_leaves=31).
[LightGBM] [Warning] Accuracy may be bad since you didn't explicitly set num_leaves OR 2^
max_depth > num_leaves. (num_leaves=31).
[LightGBM] [Warning] Accuracy may be bad since you didn't explicitly set num_leaves OR 2^
max_depth > num_leaves. (num_leaves=31).
[LightGBM] [Info] Number of positive: 22350, number of negative: 83272
[LightGBM] [Info] Auto-choosing col-wise multi-threading, the overhead of testing was 0.0
09782 seconds.
You can set `force_col_wise=true` to remove the overhead.
[LightGBM] [Info] Total Bins 857
[LightGBM] [Info] Number of data points in the train set: 105622, number of used features
: 11
[LightGBM] [Info] [binary:BoostFromScore]: pavg=0.211604 -> initscore=-1.315286
[LightGBM] [Info] Start training from score -1.315286
[LightGBM] [Warning] Accuracy may be bad since you didn't explicitly set num_leaves OR 2^
max_depth > num_leaves. (num_leaves=31).
[LightGBM] [Warning] Accuracy may be bad since you didn't explicitly set num_leaves OR 2^
max_depth > num_leaves. (num_leaves=31).
[LightGBM] [Warning] Accuracy may be bad since you didn't explicitly set num_leaves OR 2^
max_depth > num_leaves. (num_leaves=31).
[LightGBM] [Info] Number of positive: 22349, number of negative: 83272
[LightGBM] [Info] Auto-choosing row-wise multi-threading, the overhead of testing was 0.0
01190 seconds.
You can set `force_row_wise=true` to remove the overhead.
And if memory is not enough, you can set `force_col_wise=true`.
[LightGBM] [Info] Total Bins 858
[LightGBM] [Info] Number of data points in the train set: 105621, number of used features
: 11
[LightGBM] [Info] [binary:BoostFromScore]: pavg=0.211596 -> initscore=-1.315331
[LightGBM] [Info] Start training from score -1.315331
[LightGBM] [Warning] Accuracy may be bad since you didn't explicitly set num_leaves OR 2^
max_depth > num_leaves. (num_leaves=31).
[LightGBM] [Warning] Accuracy may be bad since you didn't explicitly set num_leaves OR 2^
max_depth > num_leaves. (num_leaves=31).
[LightGBM] [Warning] Accuracy may be bad since you didn't explicitly set num_leaves OR 2^
max_depth > num_leaves. (num_leaves=31).
[LightGBM] [Info] Number of positive: 22349, number of negative: 83272
[LightGBM] [Info] Auto-choosing row-wise multi-threading, the overhead of testing was 0.0
00989 seconds.
You can set `force_row_wise=true` to remove the overhead.
And if memory is not enough, you can set `force_col_wise=true`.
[LightGBM] [Info] Total Bins 857
[LightGBM] [Info] Number of data points in the train set: 105621, number of used features
: 11
[LightGBM] [Info] [binary:BoostFromScore]: pavg=0.211596 -> initscore=-1.315331
[LightGBM] [Info] Start training from score -1.315331
[LightGBM] [Warning] Accuracy may be bad since you didn't explicitly set num_leaves OR 2^
max_depth > num_leaves. (num_leaves=31).
[LightGBM] [Warning] Accuracy may be bad since you didn't explicitly set num_leaves OR 2^
max_depth > num_leaves. (num_leaves=31).
[LightGBM] [Warning] Accuracy may be bad since you didn't explicitly set num_leaves OR 2^
max_depth > num_leaves. (num_leaves=31).
[LightGBM] [Info] Number of positive: 22350, number of negative: 83272
[LightGBM] [Info] Auto-choosing row-wise multi-threading, the overhead of testing was 0.0
16109 seconds.
You can set `force_row_wise=true` to remove the overhead.
And if memory is not enough, you can set `force_col_wise=true`.
[LightGBM] [Info] Total Bins 859
[LightGBM] [Info] Number of data points in the train set: 105622, number of used features
: 11
[LightGBM] [Info] [binary:BoostFromScore]: pavg=0.211604 -> initscore=-1.315286
[LightGBM] [Info] Start training from score -1.315286
[LightGBM] [Warning] Accuracy may be bad since you didn't explicitly set num_leaves OR 2^
max_depth > num_leaves. (num_leaves=31).
[LightGBM] [Warning] Accuracy may be bad since you didn't explicitly set num_leaves OR 2^
max_depth > num_leaves. (num_leaves=31).
[LightGBM] [Warning] Accuracy may be bad since you didn't explicitly set num_leaves OR 2^
max_depth > num_leaves. (num_leaves=31).
[LightGBM] [Info] Number of positive: 22350, number of negative: 83272
[LightGBM] [Info] Auto-choosing col-wise multi-threading, the overhead of testing was 0.0
11575 seconds.
You can set `force_col_wise=true` to remove the overhead.
```

```
[LightGBM] [Info] Total Bins 859
[LightGBM] [Info] Number of data points in the train set: 105622, number of used features
: 11
[LightGBM] [Info] [binary:BoostFromScore]: pavg=0.211604 -> initscore=-1.315286
[LightGBM] [Info] Start training from score -1.315286
[LightGBM] [Warning] Accuracy may be bad since you didn't explicitly set num_leaves OR 2^
max_depth > num_leaves. (num_leaves=31).
[LightGBM] [Warning] Accuracy may be bad since you didn't explicitly set num_leaves OR 2^
max_depth > num_leaves. (num_leaves=31).
[LightGBM] [Warning] Accuracy may be bad since you didn't explicitly set num_leaves OR 2^
max_depth > num_leaves. (num_leaves=31).
[LightGBM] [Info] Number of positive: 22350, number of negative: 83272
[LightGBM] [Info] Auto-choosing row-wise multi-threading, the overhead of testing was 0.0
01076 seconds.
You can set `force_row_wise=true` to remove the overhead.
And if memory is not enough, you can set `force_col_wise=true`.
[LightGBM] [Info] Total Bins 857
[LightGBM] [Info] Number of data points in the train set: 105622, number of used features
: 11
[LightGBM] [Info] [binary:BoostFromScore]: pavg=0.211604 -> initscore=-1.315286
[LightGBM] [Info] Start training from score -1.315286
[LightGBM] [Warning] Accuracy may be bad since you didn't explicitly set num_leaves OR 2^
max_depth > num_leaves. (num_leaves=31).
[LightGBM] [Info] Number of positive: 22349, number of negative: 83272
[LightGBM] [Info] Auto-choosing row-wise multi-threading, the overhead of testing was 0.0
04620 seconds.
You can set `force_row_wise=true` to remove the overhead.
And if memory is not enough, you can set `force_col_wise=true`.
[LightGBM] [Info] Total Bins 858
[LightGBM] [Info] Number of data points in the train set: 105621, number of used features
: 11
[LightGBM] [Info] [binary:BoostFromScore]: pavg=0.211596 -> initscore=-1.315331
[LightGBM] [Info] Start training from score -1.315331
[LightGBM] [Info] Number of positive: 22349, number of negative: 83272
[LightGBM] [Info] Auto-choosing col-wise multi-threading, the overhead of testing was 0.0
13172 seconds.
You can set `force_col_wise=true` to remove the overhead.
[LightGBM] [Info] Total Bins 857
[LightGBM] [Info] Number of data points in the train set: 105621, number of used features
: 11
[LightGBM] [Info] [binary:BoostFromScore]: pavg=0.211596 -> initscore=-1.315331
[LightGBM] [Info] Start training from score -1.315331
[LightGBM] [Info] Number of positive: 22350, number of negative: 83272
[LightGBM] [Info] Auto-choosing col-wise multi-threading, the overhead of testing was 0.0
11476 seconds.
You can set `force_col_wise=true` to remove the overhead.
[LightGBM] [Info] Total Bins 859
[LightGBM] [Info] Number of data points in the train set: 105622, number of used features
: 11
[LightGBM] [Info] [binary:BoostFromScore]: pavg=0.211604 -> initscore=-1.315286
[LightGBM] [Info] Start training from score -1.315286
[LightGBM] [Info] Number of positive: 22350, number of negative: 83272
[LightGBM] [Info] Auto-choosing row-wise multi-threading, the overhead of testing was 0.0
01501 seconds.
You can set `force_row_wise=true` to remove the overhead.
And if memory is not enough, you can set `force_col_wise=true`.
[LightGBM] [Info] Total Bins 859
[LightGBM] [Info] Number of data points in the train set: 105622, number of used features
: 11
[LightGBM] [Info] [binary:BoostFromScore]: pavg=0.211604 -> initscore=-1.315286
[LightGBM] [Info] Start training from score -1.315286
[LightGBM] [Info] Number of positive: 22350, number of negative: 83272
[LightGBM] [Info] Auto-choosing row-wise multi-threading, the overhead of testing was 0.0
01455 seconds.
You can set `force_row_wise=true` to remove the overhead.
And if memory is not enough, you can set `force_col_wise=true`.
[LightGBM] [Info] Total Bins 857
[LightGBM] [Info] Number of data points in the train set: 105622, number of used features
: 11
[LightGBM] [Info] [binary:BoostFromScore]: pavg=0.211604 -> initscore=-1.315286
[LightGBM] [Info] Start training from score -1.315286
[LightGBM] [Info] Number of positive: 22349, number of negative: 83272
```

```
[LightGBM] [Info] Auto-choosing row-wise multi-threading, the overhead of testing was 0.0
01219 seconds.
You can set `force_row_wise=true` to remove the overhead.
And if memory is not enough, you can set `force_col_wise=true`.
[LightGBM] [Info] Total Bins 858
[LightGBM] [Info] Number of data points in the train set: 105621, number of used features
: 11
[LightGBM] [Info] [binary:BoostFromScore]: pavg=0.211596 -> initscore=-1.315331
[LightGBM] [Info] Start training from score -1.315331
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Info] Number of positive: 22349, number of negative: 83272
[LightGBM] [Info] Auto-choosing row-wise multi-threading, the overhead of testing was 0.0
01215 seconds.
You can set `force_row_wise=true` to remove the overhead.
And if memory is not enough, you can set `force_col_wise=true`.
[LightGBM] [Info] Total Bins 857
[LightGBM] [Info] Number of data points in the train set: 105621, number of used features
: 11
[LightGBM] [Info] [binary:BoostFromScore]: pavg=0.211596 -> initscore=-1.315331
[LightGBM] [Info] Start training from score -1.315331
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Info] Number of positive: 22350, number of negative: 83272
[LightGBM] [Info] Auto-choosing row-wise multi-threading, the overhead of testing was 0.0
01436 seconds.
You can set `force_row_wise=true` to remove the overhead.
And if memory is not enough, you can set `force_col_wise=true`.
[LightGBM] [Info] Total Bins 859
[LightGBM] [Info] Number of data points in the train set: 105622, number of used features
: 11
[LightGBM] [Info] [binary:BoostFromScore]: pavg=0.211604 -> initscore=-1.315286
[LightGBM] [Info] Start training from score -1.315286
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Info] Number of positive: 22350, number of negative: 83272
[LightGBM] [Info] Auto-choosing row-wise multi-threading, the overhead of testing was 0.0
01221 seconds.
You can set `force_row_wise=true` to remove the overhead.
And if memory is not enough, you can set `force_col_wise=true`.
[LightGBM] [Info] Total Bins 859
[LightGBM] [Info] Number of data points in the train set: 105622, number of used features
: 11
[LightGBM] [Info] [binary:BoostFromScore]: pavg=0.211604 -> initscore=-1.315286
[LightGBM] [Info] Start training from score -1.315286
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Info] Number of positive: 22350, number of negative: 83272
[LightGBM] [Info] Auto-choosing row-wise multi-threading, the overhead of testing was 0.0
01730 seconds.
You can set `force_row_wise=true` to remove the overhead.
And if memory is not enough, you can set `force_col_wise=true`.
[LightGBM] [Info] Total Bins 857
[LightGBM] [Info] Number of data points in the train set: 105622, number of used features
: 11
[LightGBM] [Info] [binary:BoostFromScore]: pavg=0.211604 -> initscore=-1.315286
[LightGBM] [Info] Start training from score -1.315286
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Info] Number of positive: 22349, number of negative: 83272
[LightGBM] [Info] Auto-choosing row-wise multi-threading, the overhead of testing was 0.0
01132 seconds.
You can set `force_row_wise=true` to remove the overhead.
And if memory is not enough, you can set `force_col_wise=true`.
[LightGBM] [Info] Total Bins 858
[LightGBM] [Info] Number of data points in the train set: 105621, number of used features
: 11
[LightGBM] [Info] [binary:BoostFromScore]: pavg=0.211596 -> initscore=-1.315331
[LightGBM] [Info] Start training from score -1.315331
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
```

```
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Info] Number of positive: 22349, number of negative: 83272
[LightGBM] [Info] Auto-choosing col-wise multi-threading, the overhead of testing was 0.0
13960 seconds.
You can set `force_col_wise=true` to remove the overhead.
[LightGBM] [Info] Total Bins 857
[LightGBM] [Info] Number of data points in the train set: 105621, number of used features
: 11
[LightGBM] [Info] [binary:BoostFromScore]: pavg=0.211596 -> initscore=-1.315331
[LightGBM] [Info] Start training from score -1.315331
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Info] Number of positive: 22350, number of negative: 83272
[LightGBM] [Info] Auto-choosing row-wise multi-threading, the overhead of testing was 0.0
01304 seconds.
You can set `force_row_wise=true` to remove the overhead.
And if memory is not enough, you can set `force_col_wise=true`.
[LightGBM] [Info] Total Bins 859
[LightGBM] [Info] Number of data points in the train set: 105622, number of used features
: 11
[LightGBM] [Info] [binary:BoostFromScore]: pavg=0.211604 -> initscore=-1.315286
[LightGBM] [Info] Start training from score -1.315286
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Info] Number of positive: 22350, number of negative: 83272
[LightGBM] [Info] Auto-choosing row-wise multi-threading, the overhead of testing was 0.0
01380 seconds.
You can set `force_row_wise=true` to remove the overhead.
And if memory is not enough, you can set `force_col_wise=true`.
[LightGBM] [Info] Total Bins 859
[LightGBM] [Info] Number of data points in the train set: 105622, number of used features
: 11
[LightGBM] [Info] [binary:BoostFromScore]: pavg=0.211604 -> initscore=-1.315286
[LightGBM] [Info] Start training from score -1.315286
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Info] Number of positive: 22350, number of negative: 83272
```

```
[LightGBM] [Info] Auto-choosing row-wise multi-threading, the overhead of testing was 0.0
01340 seconds.
You can set `force_row_wise=true` to remove the overhead.
And if memory is not enough, you can set `force_col_wise=true`.
[LightGBM] [Info] Total Bins 857
[LightGBM] [Info] Number of data points in the train set: 105622, number of used features
: 11
[LightGBM] [Info] [binary:BoostFromScore]: pavg=0.211604 -> initscore=-1.315286
[LightGBM] [Info] Start training from score -1.315286
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] Accuracy may be bad since you didn't explicitly set num_leaves OR 2^
max_depth > num_leaves. (num_leaves=31).
[LightGBM] [Warning] Accuracy may be bad since you didn't explicitly set num_leaves OR 2^
max_depth > num_leaves. (num_leaves=31).
[LightGBM] [Info] Number of positive: 22349, number of negative: 83272
[LightGBM] [Info] Auto-choosing row-wise multi-threading, the overhead of testing was 0.0
01899 seconds.
You can set `force_row_wise=true` to remove the overhead.
And if memory is not enough, you can set `force_col_wise=true`.
[LightGBM] [Info] Total Bins 858
[LightGBM] [Info] Number of data points in the train set: 105621, number of used features
: 11
[LightGBM] [Info] [binary:BoostFromScore]: pavg=0.211596 -> initscore=-1.315331
[LightGBM] [Info] Start training from score -1.315331
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] Accuracy may be bad since you didn't explicitly set num_leaves OR 2^
max_depth > num_leaves. (num_leaves=31).
[LightGBM] [Warning] Accuracy may be bad since you didn't explicitly set num_leaves OR 2^
max_depth > num_leaves. (num_leaves=31).
[LightGBM] [Warning] Accuracy may be bad since you didn't explicitly set num_leaves OR 2^
max_depth > num_leaves. (num_leaves=31).
[LightGBM] [Info] Number of positive: 22349, number of negative: 83272
[LightGBM] [Info] Auto-choosing row-wise multi-threading, the overhead of testing was 0.0
01168 seconds.
You can set `force_row_wise=true` to remove the overhead.
And if memory is not enough, you can set `force_col_wise=true`.
[LightGBM] [Info] Total Bins 857
[LightGBM] [Info] Number of data points in the train set: 105621, number of used features
: 11
[LightGBM] [Info] [binary:BoostFromScore]: pavg=0.211596 -> initscore=-1.315331
[LightGBM] [Info] Start training from score -1.315331
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] Accuracy may be bad since you didn't explicitly set num_leaves OR 2^
max_depth > num_leaves. (num_leaves=31).
[LightGBM] [Warning] Accuracy may be bad since you didn't explicitly set num_leaves OR 2^
max_depth > num_leaves. (num_leaves=31).
[LightGBM] [Warning] Accuracy may be bad since you didn't explicitly set num_leaves OR 2^
max_depth > num_leaves. (num_leaves=31).
[LightGBM] [Info] Number of positive: 22350, number of negative: 83272
[LightGBM] [Info] Auto-choosing row-wise multi-threading, the overhead of testing was 0.0
01344 seconds.
You can set `force_row_wise=true` to remove the overhead.
And if memory is not enough, you can set `force_col_wise=true`.
[LightGBM] [Info] Total Bins 859
```

```
[LightGBM] [Info] Number of data points in the train set: 105622, number of used features
: 11
[LightGBM] [Info] [binary:BoostFromScore]: pavg=0.211604 -> initscore=-1.315286
[LightGBM] [Info] Start training from score -1.315286
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] Accuracy may be bad since you didn't explicitly set num_leaves OR 2^
max_depth > num_leaves. (num_leaves=31).
[LightGBM] [Warning] Accuracy may be bad since you didn't explicitly set num_leaves OR 2^
max_depth > num_leaves. (num_leaves=31).
[LightGBM] [Warning] Accuracy may be bad since you didn't explicitly set num_leaves OR 2^
max_depth > num_leaves. (num_leaves=31).
[LightGBM] [Info] Number of positive: 22350, number of negative: 83272
[LightGBM] [Info] Auto-choosing row-wise multi-threading, the overhead of testing was 0.0
01309 seconds.
You can set `force_row_wise=true` to remove the overhead.
And if memory is not enough, you can set `force_col_wise=true`.
[LightGBM] [Info] Total Bins 859
[LightGBM] [Info] Number of data points in the train set: 105622, number of used features
: 11
[LightGBM] [Info] [binary:BoostFromScore]: pavg=0.211604 -> initscore=-1.315286
[LightGBM] [Info] Start training from score -1.315286
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] Accuracy may be bad since you didn't explicitly set num_leaves OR 2^
max_depth > num_leaves. (num_leaves=31).
[LightGBM] [Warning] Accuracy may be bad since you didn't explicitly set num_leaves OR 2^
max_depth > num_leaves. (num_leaves=31).
[LightGBM] [Warning] Accuracy may be bad since you didn't explicitly set num_leaves OR 2^
max_depth > num_leaves. (num_leaves=31).
[LightGBM] [Info] Number of positive: 22350, number of negative: 83272
[LightGBM] [Info] Auto-choosing row-wise multi-threading, the overhead of testing was 0.0
01408 seconds.
You can set `force_row_wise=true` to remove the overhead.
And if memory is not enough, you can set `force_col_wise=true`.
[LightGBM] [Info] Total Bins 857
[LightGBM] [Info] Number of data points in the train set: 105622, number of used features
: 11
[LightGBM] [Info] [binary:BoostFromScore]: pavg=0.211604 -> initscore=-1.315286
[LightGBM] [Info] Start training from score -1.315286
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] Accuracy may be bad since you didn't explicitly set num_leaves OR 2^
max_depth > num_leaves. (num_leaves=31).
[LightGBM] [Warning] Accuracy may be bad since you didn't explicitly set num_leaves OR 2^
max_depth > num_leaves. (num_leaves=31).
[LightGBM] [Warning] Accuracy may be bad since you didn't explicitly set num_leaves OR 2^
max_depth > num_leaves. (num_leaves=31).
[LightGBM] [Info] Number of positive: 22349, number of negative: 83272
[LightGBM] [Info] Auto-choosing row-wise multi-threading, the overhead of testing was 0.0
00866 seconds.
You can set `force_row_wise=true` to remove the overhead.
And if memory is not enough, you can set `force_col_wise=true`.
[LightGBM] [Info] Total Bins 858
[LightGBM] [Info] Number of data points in the train set: 105621, number of used features
: 11
[LightGBM] [Info] [binary:BoostFromScore]: pavg=0.211596 -> initscore=-1.315331
[LightGBM] [Info] Start training from score -1.315331
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
```

```
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] Accuracy may be bad since you didn't explicitly set num_leaves OR 2^
max_depth > num_leaves. (num_leaves=31).
[LightGBM] [Warning] Accuracy may be bad since you didn't explicitly set num_leaves OR 2^
max_depth > num_leaves. (num_leaves=31).
[LightGBM] [Warning] Accuracy may be bad since you didn't explicitly set num_leaves OR 2^
max_depth > num_leaves. (num_leaves=31).
[LightGBM] [Info] Number of positive: 22349, number of negative: 83272
[LightGBM] [Info] Auto-choosing row-wise multi-threading, the overhead of testing was 0.0
01322 seconds.
You can set `force_row_wise=true` to remove the overhead.
And if memory is not enough, you can set `force_col_wise=true`.
[LightGBM] [Info] Total Bins 857
[LightGBM] [Info] Number of data points in the train set: 105621, number of used features
: 11
[LightGBM] [Info] [binary:BoostFromScore]: pavg=0.211596 -> initscore=-1.315331
[LightGBM] [Info] Start training from score -1.315331
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
```

```
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] Accuracy may be bad since you didn't explicitly set num_leaves OR 2^
max_depth > num_leaves. (num_leaves=31).
[LightGBM] [Warning] Accuracy may be bad since you didn't explicitly set num_leaves OR 2^
max_depth > num_leaves. (num_leaves=31).
[LightGBM] [Warning] Accuracy may be bad since you didn't explicitly set num_leaves OR 2^
max_depth > num_leaves. (num_leaves=31).
[LightGBM] [Info] Number of positive: 22350, number of negative: 83272
[LightGBM] [Info] Auto-choosing row-wise multi-threading, the overhead of testing was 0.0
01717 seconds.
You can set `force_row_wise=true` to remove the overhead.
And if memory is not enough, you can set `force_col_wise=true`.
[LightGBM] [Info] Total Bins 859
[LightGBM] [Info] Number of data points in the train set: 105622, number of used features
: 11
[LightGBM] [Info] [binary:BoostFromScore]: pavg=0.211604 -> initscore=-1.315286
[LightGBM] [Info] Start training from score -1.315286
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] Accuracy may be bad since you didn't explicitly set num_leaves OR 2^
max_depth > num_leaves. (num_leaves=31).
[LightGBM] [Warning] Accuracy may be bad since you didn't explicitly set num_leaves OR 2^
max_depth > num_leaves. (num_leaves=31).
[LightGBM] [Warning] Accuracy may be bad since you didn't explicitly set num_leaves OR 2^
max_depth > num_leaves. (num_leaves=31).
```

```
[LightGBM] [Info] Number of positive: 22350, number of negative: 83272
[LightGBM] [Info] Auto-choosing row-wise multi-threading, the overhead of testing was 0.0
01479 seconds.
You can set `force_row_wise=true` to remove the overhead.
And if memory is not enough, you can set `force_col_wise=true`.
[LightGBM] [Info] Total Bins 859
[LightGBM] [Info] Number of data points in the train set: 105622, number of used features
: 11
[LightGBM] [Info] [binary:BoostFromScore]: pavg=0.211604 -> initscore=-1.315286
[LightGBM] [Info] Start training from score -1.315286
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] Accuracy may be bad since you didn't explicitly set num_leaves OR 2^
max_depth > num_leaves. (num_leaves=31).
[LightGBM] [Warning] Accuracy may be bad since you didn't explicitly set num_leaves OR 2^
max_depth > num_leaves. (num_leaves=31).
[LightGBM] [Warning] Accuracy may be bad since you didn't explicitly set num_leaves OR 2^
max_depth > num_leaves. (num_leaves=31).
[LightGBM] [Info] Number of positive: 22350, number of negative: 83272
[LightGBM] [Info] Auto-choosing row-wise multi-threading, the overhead of testing was 0.0
01139 seconds.
You can set `force_row_wise=true` to remove the overhead.
And if memory is not enough, you can set `force_col_wise=true`.
[LightGBM] [Info] Total Bins 857
[LightGBM] [Info] Number of data points in the train set: 105622, number of used features
: 11
[LightGBM] [Info] [binary:BoostFromScore]: pavg=0.211604 -> initscore=-1.315286
[LightGBM] [Info] Start training from score -1.315286
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
```

```
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] Accuracy may be bad since you didn't explicitly set num_leaves OR 2^
max_depth > num_leaves. (num_leaves=31).
[LightGBM] [Warning] Accuracy may be bad since you didn't explicitly set num_leaves OR 2^
max_depth > num_leaves. (num_leaves=31).
[LightGBM] [Warning] Accuracy may be bad since you didn't explicitly set num_leaves OR 2^
max_depth > num_leaves. (num_leaves=31).
[LightGBM] [Info] Number of positive: 22349, number of negative: 83272
[LightGBM] [Info] Auto-choosing row-wise multi-threading, the overhead of testing was 0.0
01091 seconds.
You can set `force_row_wise=true` to remove the overhead.
And if memory is not enough, you can set `force_col_wise=true`.
[LightGBM] [Info] Total Bins 858
[LightGBM] [Info] Number of data points in the train set: 105621, number of used features
: 11
[LightGBM] [Info] [binary:BoostFromScore]: pavg=0.211596 -> initscore=-1.315331
[LightGBM] [Info] Start training from score -1.315331
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
```

```
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
```

```
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] Accuracy may be bad since you didn't explicitly set num_leaves OR 2^
max_depth > num_leaves. (num_leaves=31).
[LightGBM] [Warning] Accuracy may be bad since you didn't explicitly set num_leaves OR 2^
max_depth > num_leaves. (num_leaves=31).
[LightGBM] [Warning] Accuracy may be bad since you didn't explicitly set num_leaves OR 2^
max_depth > num_leaves. (num_leaves=31).
[LightGBM] [Info] Number of positive: 22349, number of negative: 83272
[LightGBM] [Info] Auto-choosing row-wise multi-threading, the overhead of testing was 0.0
00924 seconds.
You can set `force_row_wise=true` to remove the overhead.
And if memory is not enough, you can set `force_col_wise=true`.
[LightGBM] [Info] Total Bins 857
[LightGBM] [Info] Number of data points in the train set: 105621, number of used features
: 11
[LightGBM] [Info] [binary:BoostFromScore]: pavg=0.211596 -> initscore=-1.315331
[LightGBM] [Info] Start training from score -1.315331
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
```

```
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] Accuracy may be bad since you didn't explicitly set num_leaves OR 2^
max_depth > num_leaves. (num_leaves=31).
```

```
[LightGBM] [Warning] Accuracy may be bad since you didn't explicitly set num_leaves OR 2^
max_depth > num_leaves. (num_leaves=31).
[LightGBM] [Warning] Accuracy may be bad since you didn't explicitly set num_leaves OR 2^
max_depth > num_leaves. (num_leaves=31).
[LightGBM] [Info] Number of positive: 22350, number of negative: 83272
[LightGBM] [Info] Auto-choosing row-wise multi-threading, the overhead of testing was 0.0
01258 seconds.
You can set `force_row_wise=true` to remove the overhead.
And if memory is not enough, you can set `force_col_wise=true`.
[LightGBM] [Info] Total Bins 859
[LightGBM] [Info] Number of data points in the train set: 105622, number of used features
: 11
[LightGBM] [Info] [binary:BoostFromScore]: pavg=0.211604 -> initscore=-1.315286
[LightGBM] [Info] Start training from score -1.315286
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
```

```
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] Accuracy may be bad since you didn't explicitly set num_leaves OR 2^
max_depth > num_leaves. (num_leaves=31).
[LightGBM] [Warning] Accuracy may be bad since you didn't explicitly set num_leaves OR 2^
max_depth > num_leaves. (num_leaves=31).
[LightGBM] [Warning] Accuracy may be bad since you didn't explicitly set num_leaves OR 2^
max_depth > num_leaves. (num_leaves=31).
[LightGBM] [Info] Number of positive: 22350, number of negative: 83272
[LightGBM] [Info] Auto-choosing row-wise multi-threading, the overhead of testing was 0.0
01854 seconds.
You can set `force_row_wise=true` to remove the overhead.
And if memory is not enough, you can set `force_col_wise=true`.
[LightGBM] [Info] Total Bins 859
[LightGBM] [Info] Number of data points in the train set: 105622, number of used features
: 11
[LightGBM] [Info] [binary:BoostFromScore]: pavg=0.211604 -> initscore=-1.315286
[LightGBM] [Info] Start training from score -1.315286
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
```

```
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
```

```
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] Accuracy may be bad since you didn't explicitly set num_leaves OR 2^
max_depth > num_leaves. (num_leaves=31).
[LightGBM] [Warning] Accuracy may be bad since you didn't explicitly set num_leaves OR 2^
max_depth > num_leaves. (num_leaves=31).
[LightGBM] [Warning] Accuracy may be bad since you didn't explicitly set num_leaves OR 2^
max_depth > num_leaves. (num_leaves=31).
[LightGBM] [Info] Number of positive: 22350, number of negative: 83272
[LightGBM] [Info] Auto-choosing col-wise multi-threading, the overhead of testing was 0.0
11514 seconds.
You can set `force_col_wise=true` to remove the overhead.
[LightGBM] [Info] Total Bins 857
[LightGBM] [Info] Number of data points in the train set: 105622, number of used features
: 11
[LightGBM] [Info] [binary:BoostFromScore]: pavg=0.211604 -> initscore=-1.315286
[LightGBM] [Info] Start training from score -1.315286
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
```

```
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
```

```
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] Accuracy may be bad since you didn't explicitly set num_leaves OR 2^
max_depth > num_leaves. (num_leaves=31).
[LightGBM] [Warning] Accuracy may be bad since you didn't explicitly set num_leaves OR 2^
max_depth > num_leaves. (num_leaves=31).
[LightGBM] [Warning] Accuracy may be bad since you didn't explicitly set num_leaves OR 2^
max_depth > num_leaves. (num_leaves=31).
[LightGBM] [Info] Number of positive: 22349, number of negative: 83272
[LightGBM] [Info] Auto-choosing row-wise multi-threading, the overhead of testing was 0.0
01583 seconds.
You can set `force_row_wise=true` to remove the overhead.
And if memory is not enough, you can set `force_col_wise=true`.
[LightGBM] [Info] Total Bins 858
[LightGBM] [Info] Number of data points in the train set: 105621, number of used features
: 11
[LightGBM] [Info] [binary:BoostFromScore]: pavg=0.211596 -> initscore=-1.315331
[LightGBM] [Info] Start training from score -1.315331
[LightGBM] [Warning] Accuracy may be bad since you didn't explicitly set num_leaves OR 2^
max_depth > num_leaves. (num_leaves=31).
[LightGBM] [Warning] Accuracy may be bad since you didn't explicitly set num_leaves OR 2^
max_depth > num_leaves. (num_leaves=31).
[LightGBM] [Warning] Accuracy may be bad since you didn't explicitly set num_leaves OR 2^
max_depth > num_leaves. (num_leaves=31).
[LightGBM] [Info] Number of positive: 22349, number of negative: 83272
[LightGBM] [Info] Auto-choosing row-wise multi-threading, the overhead of testing was 0.0
01131 seconds.
You can set `force_row_wise=true` to remove the overhead.
And if memory is not enough, you can set `force_col_wise=true`.
[LightGBM] [Info] Total Bins 857
[LightGBM] [Info] Number of data points in the train set: 105621, number of used features
: 11
[LightGBM] [Info] [binary:BoostFromScore]: pavg=0.211596 -> initscore=-1.315331
[LightGBM] [Info] Start training from score -1.315331
[LightGBM] [Warning] Accuracy may be bad since you didn't explicitly set num_leaves OR 2^
max_depth > num_leaves. (num_leaves=31).
[LightGBM] [Warning] Accuracy may be bad since you didn't explicitly set num_leaves OR 2^
max_depth > num_leaves. (num_leaves=31).
[LightGBM] [Warning] Accuracy may be bad since you didn't explicitly set num_leaves OR 2^
max_depth > num_leaves. (num_leaves=31).
[LightGBM] [Info] Number of positive: 22350, number of negative: 83272
[LightGBM] [Info] Auto-choosing row-wise multi-threading, the overhead of testing was 0.0
01058 seconds.
You can set `force_row_wise=true` to remove the overhead.
And if memory is not enough, you can set `force_col_wise=true`.
[LightGBM] [Info] Total Bins 859
[LightGBM] [Info] Number of data points in the train set: 105622, number of used features
: 11
[LightGBM] [Info] [binary:BoostFromScore]: pavg=0.211604 -> initscore=-1.315286
[LightGBM] [Info] Start training from score -1.315286
[LightGBM] [Warning] Accuracy may be bad since you didn't explicitly set num_leaves OR 2^
max_depth > num_leaves. (num_leaves=31).
```

```
[LightGBM] [Warning] Accuracy may be bad since you didn't explicitly set num_leaves OR 2^
max_depth > num_leaves. (num_leaves=31).
[LightGBM] [Warning] Accuracy may be bad since you didn't explicitly set num_leaves OR 2^
max_depth > num_leaves. (num_leaves=31).
[LightGBM] [Info] Number of positive: 22350, number of negative: 83272
[LightGBM] [Info] Auto-choosing row-wise multi-threading, the overhead of testing was 0.0
01333 seconds.
You can set `force_row_wise=true` to remove the overhead.
And if memory is not enough, you can set `force_col_wise=true`.
[LightGBM] [Info] Total Bins 859
[LightGBM] [Info] Number of data points in the train set: 105622, number of used features
: 11
[LightGBM] [Info] [binary:BoostFromScore]: pavg=0.211604 -> initscore=-1.315286
[LightGBM] [Info] Start training from score -1.315286
[LightGBM] [Warning] Accuracy may be bad since you didn't explicitly set num_leaves OR 2^
max_depth > num_leaves. (num_leaves=31).
[LightGBM] [Warning] Accuracy may be bad since you didn't explicitly set num_leaves OR 2^
max_depth > num_leaves. (num_leaves=31).
[LightGBM] [Warning] Accuracy may be bad since you didn't explicitly set num_leaves OR 2^
max_depth > num_leaves. (num_leaves=31).
[LightGBM] [Info] Number of positive: 22350, number of negative: 83272
[LightGBM] [Info] Auto-choosing row-wise multi-threading, the overhead of testing was 0.0
01334 seconds.
You can set `force_row_wise=true` to remove the overhead.
And if memory is not enough, you can set `force_col_wise=true`.
[LightGBM] [Info] Total Bins 857
[LightGBM] [Info] Number of data points in the train set: 105622, number of used features
: 11
[LightGBM] [Info] [binary:BoostFromScore]: pavg=0.211604 -> initscore=-1.315286
[LightGBM] [Info] Start training from score -1.315286
[LightGBM] [Warning] Accuracy may be bad since you didn't explicitly set num_leaves OR 2^
max_depth > num_leaves. (num_leaves=31).
[LightGBM] [Warning] Accuracy may be bad since you didn't explicitly set num_leaves OR 2^
max_depth > num_leaves. (num_leaves=31).
[LightGBM] [Warning] Accuracy may be bad since you didn't explicitly set num_leaves OR 2^
max_depth > num_leaves. (num_leaves=31).
[LightGBM] [Info] Number of positive: 22349, number of negative: 83272
[LightGBM] [Info] Auto-choosing row-wise multi-threading, the overhead of testing was 0.0
02406 seconds.
You can set `force_row_wise=true` to remove the overhead.
And if memory is not enough, you can set `force_col_wise=true`.
[LightGBM] [Info] Total Bins 858
[LightGBM] [Info] Number of data points in the train set: 105621, number of used features
: 11
[LightGBM] [Info] [binary:BoostFromScore]: pavg=0.211596 -> initscore=-1.315331
[LightGBM] [Info] Start training from score -1.315331
[LightGBM] [Warning] Accuracy may be bad since you didn't explicitly set num_leaves OR 2^
max_depth > num_leaves. (num_leaves=31).
[LightGBM] [Warning] Accuracy may be bad since you didn't explicitly set num_leaves OR 2^
max_depth > num_leaves. (num_leaves=31).
[LightGBM] [Warning] Accuracy may be bad since you didn't explicitly set num_leaves OR 2^
max_depth > num_leaves. (num_leaves=31).
[LightGBM] [Info] Number of positive: 22349, number of negative: 83272
[LightGBM] [Info] Auto-choosing row-wise multi-threading, the overhead of testing was 0.0
03500 seconds.
You can set `force_row_wise=true` to remove the overhead.
And if memory is not enough, you can set `force_col_wise=true`.
[LightGBM] [Info] Total Bins 857
[LightGBM] [Info] Number of data points in the train set: 105621, number of used features
: 11
[LightGBM] [Info] [binary:BoostFromScore]: pavg=0.211596 -> initscore=-1.315331
[LightGBM] [Info] Start training from score -1.315331
[LightGBM] [Warning] Accuracy may be bad since you didn't explicitly set num_leaves OR 2^
max_depth > num_leaves. (num_leaves=31).
[LightGBM] [Warning] Accuracy may be bad since you didn't explicitly set num_leaves OR 2^
max_depth > num_leaves. (num_leaves=31).
[LightGBM] [Warning] Accuracy may be bad since you didn't explicitly set num_leaves OR 2^
max_depth > num_leaves. (num_leaves=31).
[LightGBM] [Info] Number of positive: 22350, number of negative: 83272
[LightGBM] [Info] Auto-choosing row-wise multi-threading, the overhead of testing was 0.0
01300 seconds.
You can set `force_row_wise=true` to remove the overhead.
```

```
And if memory is not enough, you can set `force_col_wise=true`.
[LightGBM] [Info] Total Bins 859
[LightGBM] [Info] Number of data points in the train set: 105622, number of used features
: 11
[LightGBM] [Info] [binary:BoostFromScore]: pavg=0.211604 -> initscore=-1.315286
[LightGBM] [Info] Start training from score -1.315286
[LightGBM] [Warning] Accuracy may be bad since you didn't explicitly set num_leaves OR 2^
max_depth > num_leaves. (num_leaves=31).
[LightGBM] [Warning] Accuracy may be bad since you didn't explicitly set num_leaves OR 2^
max_depth > num_leaves. (num_leaves=31).
[LightGBM] [Warning] Accuracy may be bad since you didn't explicitly set num_leaves OR 2^
max_depth > num_leaves. (num_leaves=31).
[LightGBM] [Info] Number of positive: 22350, number of negative: 83272
[LightGBM] [Info] Auto-choosing row-wise multi-threading, the overhead of testing was 0.0
01284 seconds.
You can set `force_row_wise=true` to remove the overhead.
And if memory is not enough, you can set `force_col_wise=true`.
[LightGBM] [Info] Total Bins 859
[LightGBM] [Info] Number of data points in the train set: 105622, number of used features
: 11
[LightGBM] [Info] [binary:BoostFromScore]: pavg=0.211604 -> initscore=-1.315286
[LightGBM] [Info] Start training from score -1.315286
[LightGBM] [Warning] Accuracy may be bad since you didn't explicitly set num_leaves OR 2^
max_depth > num_leaves. (num_leaves=31).
[LightGBM] [Warning] Accuracy may be bad since you didn't explicitly set num_leaves OR 2^
max_depth > num_leaves. (num_leaves=31).
[LightGBM] [Warning] Accuracy may be bad since you didn't explicitly set num_leaves OR 2^
max_depth > num_leaves. (num_leaves=31).
[LightGBM] [Info] Number of positive: 22350, number of negative: 83272
[LightGBM] [Info] Auto-choosing row-wise multi-threading, the overhead of testing was 0.0
01658 seconds.
You can set `force_row_wise=true` to remove the overhead.
And if memory is not enough, you can set `force_col_wise=true`.
[LightGBM] [Info] Total Bins 857
[LightGBM] [Info] Number of data points in the train set: 105622, number of used features
: 11
[LightGBM] [Info] [binary:BoostFromScore]: pavg=0.211604 -> initscore=-1.315286
[LightGBM] [Info] Start training from score -1.315286
[LightGBM] [Warning] Accuracy may be bad since you didn't explicitly set num_leaves OR 2^
max_depth > num_leaves. (num_leaves=31).
[LightGBM] [Warning] Accuracy may be bad since you didn't explicitly set num_leaves OR 2^
max_depth > num_leaves. (num_leaves=31).
[LightGBM] [Warning] Accuracy may be bad since you didn't explicitly set num_leaves OR 2^
max_depth > num_leaves. (num_leaves=31).
[LightGBM] [Info] Number of positive: 22349, number of negative: 83272
[LightGBM] [Info] Auto-choosing row-wise multi-threading, the overhead of testing was 0.0
01069 seconds.
You can set `force_row_wise=true` to remove the overhead.
And if memory is not enough, you can set `force_col_wise=true`.
[LightGBM] [Info] Total Bins 858
[LightGBM] [Info] Number of data points in the train set: 105621, number of used features
: 11
[LightGBM] [Info] [binary:BoostFromScore]: pavg=0.211596 -> initscore=-1.315331
[LightGBM] [Info] Start training from score -1.315331
[LightGBM] [Warning] Accuracy may be bad since you didn't explicitly set num_leaves OR 2^
max_depth > num_leaves. (num_leaves=31).
[LightGBM] [Warning] Accuracy may be bad since you didn't explicitly set num_leaves OR 2^
max_depth > num_leaves. (num_leaves=31).
[LightGBM] [Warning] Accuracy may be bad since you didn't explicitly set num_leaves OR 2^
max_depth > num_leaves. (num_leaves=31).
[LightGBM] [Info] Number of positive: 22349, number of negative: 83272
[LightGBM] [Info] Auto-choosing row-wise multi-threading, the overhead of testing was 0.0
01052 seconds.
You can set `force_row_wise=true` to remove the overhead.
And if memory is not enough, you can set `force_col_wise=true`.
[LightGBM] [Info] Total Bins 857
[LightGBM] [Info] Number of data points in the train set: 105621, number of used features
: 11
[LightGBM] [Info] [binary:BoostFromScore]: pavg=0.211596 -> initscore=-1.315331
[LightGBM] [Info] Start training from score -1.315331
[LightGBM] [Warning] Accuracy may be bad since you didn't explicitly set num_leaves OR 2^
max_depth > num_leaves. (num_leaves=31).
```

```
[LightGBM] [Warning] Accuracy may be bad since you didn't explicitly set num_leaves OR 2^
max_depth > num_leaves. (num_leaves=31).
[LightGBM] [Warning] Accuracy may be bad since you didn't explicitly set num_leaves OR 2^
max_depth > num_leaves. (num_leaves=31).
[LightGBM] [Info] Number of positive: 22350, number of negative: 83272
[LightGBM] [Info] Auto-choosing col-wise multi-threading, the overhead of testing was 0.0
12068 seconds.
You can set `force_col_wise=true` to remove the overhead.
[LightGBM] [Info] Total Bins 859
[LightGBM] [Info] Number of data points in the train set: 105622, number of used features
: 11
[LightGBM] [Info] [binary:BoostFromScore]: pavg=0.211604 -> initscore=-1.315286
[LightGBM] [Info] Start training from score -1.315286
[LightGBM] [Warning] Accuracy may be bad since you didn't explicitly set num_leaves OR 2^
max_depth > num_leaves. (num_leaves=31).
[LightGBM] [Warning] Accuracy may be bad since you didn't explicitly set num_leaves OR 2^
max_depth > num_leaves. (num_leaves=31).
[LightGBM] [Warning] Accuracy may be bad since you didn't explicitly set num_leaves OR 2^
max_depth > num_leaves. (num_leaves=31).
[LightGBM] [Info] Number of positive: 22350, number of negative: 83272
[LightGBM] [Info] Auto-choosing row-wise multi-threading, the overhead of testing was 0.0
01338 seconds.
You can set `force_row_wise=true` to remove the overhead.
And if memory is not enough, you can set `force_col_wise=true`.
[LightGBM] [Info] Total Bins 859
[LightGBM] [Info] Number of data points in the train set: 105622, number of used features
: 11
[LightGBM] [Info] [binary:BoostFromScore]: pavg=0.211604 -> initscore=-1.315286
[LightGBM] [Info] Start training from score -1.315286
[LightGBM] [Warning] Accuracy may be bad since you didn't explicitly set num_leaves OR 2^
max_depth > num_leaves. (num_leaves=31).
[LightGBM] [Warning] Accuracy may be bad since you didn't explicitly set num_leaves OR 2^
max_depth > num_leaves. (num_leaves=31).
[LightGBM] [Warning] Accuracy may be bad since you didn't explicitly set num_leaves OR 2^
max_depth > num_leaves. (num_leaves=31).
[LightGBM] [Info] Number of positive: 22350, number of negative: 83272
[LightGBM] [Info] Auto-choosing row-wise multi-threading, the overhead of testing was 0.0
01247 seconds.
You can set `force_row_wise=true` to remove the overhead.
And if memory is not enough, you can set `force_col_wise=true`.
[LightGBM] [Info] Total Bins 857
[LightGBM] [Info] Number of data points in the train set: 105622, number of used features
: 11
[LightGBM] [Info] [binary:BoostFromScore]: pavg=0.211604 -> initscore=-1.315286
[LightGBM] [Info] Start training from score -1.315286
[LightGBM] [Warning] Accuracy may be bad since you didn't explicitly set num_leaves OR 2^
max_depth > num_leaves. (num_leaves=31).
[LightGBM] [Info] Number of positive: 22349, number of negative: 83272
[LightGBM] [Info] Auto-choosing row-wise multi-threading, the overhead of testing was 0.0
01192 seconds.
You can set `force_row_wise=true` to remove the overhead.
And if memory is not enough, you can set `force_col_wise=true`.
[LightGBM] [Info] Total Bins 858
[LightGBM] [Info] Number of data points in the train set: 105621, number of used features
: 11
[LightGBM] [Info] [binary:BoostFromScore]: pavg=0.211596 -> initscore=-1.315331
[LightGBM] [Info] Start training from score -1.315331
[LightGBM] [Info] Number of positive: 22349, number of negative: 83272
[LightGBM] [Info] Auto-choosing row-wise multi-threading, the overhead of testing was 0.0
01299 seconds.
You can set `force_row_wise=true` to remove the overhead.
And if memory is not enough, you can set `force_col_wise=true`.
[LightGBM] [Info] Total Bins 857
[LightGBM] [Info] Number of data points in the train set: 105621, number of used features
: 11
[LightGBM] [Info] [binary:BoostFromScore]: pavg=0.211596 -> initscore=-1.315331
[LightGBM] [Info] Start training from score -1.315331
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Info] Number of positive: 22350, number of negative: 83272
[LightGBM] [Info] Auto-choosing row-wise multi-threading, the overhead of testing was 0.0
01257 seconds.
```

```
You can set `force_row_wise=true` to remove the overhead.
And if memory is not enough, you can set `force_col_wise=true`.
[LightGBM] [Info] Total Bins 859
[LightGBM] [Info] Number of data points in the train set: 105622, number of used features
: 11
[LightGBM] [Info] [binary:BoostFromScore]: pavg=0.211604 -> initscore=-1.315286
[LightGBM] [Info] Start training from score -1.315286
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Info] Number of positive: 22350, number of negative: 83272
[LightGBM] [Info] Auto-choosing row-wise multi-threading, the overhead of testing was 0.0
01262 seconds.
You can set `force_row_wise=true` to remove the overhead.
And if memory is not enough, you can set `force_col_wise=true`.
[LightGBM] [Info] Total Bins 859
[LightGBM] [Info] Number of data points in the train set: 105622, number of used features
: 11
[LightGBM] [Info] [binary:BoostFromScore]: pavg=0.211604 -> initscore=-1.315286
[LightGBM] [Info] Start training from score -1.315286
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Info] Number of positive: 22350, number of negative: 83272
[LightGBM] [Info] Auto-choosing row-wise multi-threading, the overhead of testing was 0.0
01359 seconds.
You can set `force_row_wise=true` to remove the overhead.
And if memory is not enough, you can set `force_col_wise=true`.
[LightGBM] [Info] Total Bins 857
[LightGBM] [Info] Number of data points in the train set: 105622, number of used features
: 11
[LightGBM] [Info] [binary:BoostFromScore]: pavg=0.211604 -> initscore=-1.315286
[LightGBM] [Info] Start training from score -1.315286
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Info] Number of positive: 22349, number of negative: 83272
[LightGBM] [Info] Auto-choosing row-wise multi-threading, the overhead of testing was 0.0
01546 seconds.
You can set `force_row_wise=true` to remove the overhead.
And if memory is not enough, you can set `force_col_wise=true`.
[LightGBM] [Info] Total Bins 858
[LightGBM] [Info] Number of data points in the train set: 105621, number of used features
: 11
[LightGBM] [Info] [binary:BoostFromScore]: pavg=0.211596 -> initscore=-1.315331
[LightGBM] [Info] Start training from score -1.315331
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Info] Number of positive: 22349, number of negative: 83272
[LightGBM] [Info] Auto-choosing row-wise multi-threading, the overhead of testing was 0.0
01100 seconds.
You can set `force_row_wise=true` to remove the overhead.
And if memory is not enough, you can set `force_col_wise=true`.
[LightGBM] [Info] Total Bins 857
[LightGBM] [Info] Number of data points in the train set: 105621, number of used features
: 11
[LightGBM] [Info] [binary:BoostFromScore]: pavg=0.211596 -> initscore=-1.315331
[LightGBM] [Info] Start training from score -1.315331
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Info] Number of positive: 22350, number of negative: 83272
[LightGBM] [Info] Auto-choosing row-wise multi-threading, the overhead of testing was 0.0
01252 seconds.
You can set `force_row_wise=true` to remove the overhead.
And if memory is not enough, you can set `force_col_wise=true`.
[LightGBM] [Info] Total Bins 859
```

```
[LightGBM] [Info] Number of data points in the train set: 105622, number of used features
: 11
[LightGBM] [Info] [binary:BoostFromScore]: pavg=0.211604 -> initscore=-1.315286
[LightGBM] [Info] Start training from score -1.315286
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Info] Number of positive: 22350, number of negative: 83272
[LightGBM] [Info] Auto-choosing row-wise multi-threading, the overhead of testing was 0.0
01530 seconds.
You can set `force_row_wise=true` to remove the overhead.
And if memory is not enough, you can set `force_col_wise=true`.
[LightGBM] [Info] Total Bins 859
[LightGBM] [Info] Number of data points in the train set: 105622, number of used features
: 11
[LightGBM] [Info] [binary:BoostFromScore]: pavg=0.211604 -> initscore=-1.315286
[LightGBM] [Info] Start training from score -1.315286
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Info] Number of positive: 22350, number of negative: 83272
[LightGBM] [Info] Auto-choosing row-wise multi-threading, the overhead of testing was 0.0
01874 seconds.
You can set `force_row_wise=true` to remove the overhead.
And if memory is not enough, you can set `force_col_wise=true`.
[LightGBM] [Info] Total Bins 857
[LightGBM] [Info] Number of data points in the train set: 105622, number of used features
: 11
[LightGBM] [Info] [binary:BoostFromScore]: pavg=0.211604 -> initscore=-1.315286
[LightGBM] [Info] Start training from score -1.315286
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Info] Number of positive: 22349, number of negative: 83272
[LightGBM] [Info] Auto-choosing row-wise multi-threading, the overhead of testing was 0.0
01124 seconds.
You can set `force_row_wise=true` to remove the overhead.
And if memory is not enough, you can set `force_col_wise=true`.
[LightGBM] [Info] Total Bins 858
[LightGBM] [Info] Number of data points in the train set: 105621, number of used features
: 11
[LightGBM] [Info] [binary:BoostFromScore]: pavg=0.211596 -> initscore=-1.315331
[LightGBM] [Info] Start training from score -1.315331
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Info] Number of positive: 22349, number of negative: 83272
[LightGBM] [Info] Auto-choosing row-wise multi-threading, the overhead of testing was 0.0
01214 seconds.
```

```
You can set `force_row_wise=true` to remove the overhead.
And if memory is not enough, you can set `force_col_wise=true`.
[LightGBM] [Info] Total Bins 857
[LightGBM] [Info] Number of data points in the train set: 105621, number of used features
: 11
[LightGBM] [Info] [binary:BoostFromScore]: pavg=0.211596 -> initscore=-1.315331
[LightGBM] [Info] Start training from score -1.315331
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Info] Number of positive: 22350, number of negative: 83272
[LightGBM] [Info] Auto-choosing row-wise multi-threading, the overhead of testing was 0.0
01232 seconds.
You can set `force_row_wise=true` to remove the overhead.
And if memory is not enough, you can set `force_col_wise=true`.
[LightGBM] [Info] Total Bins 859
[LightGBM] [Info] Number of data points in the train set: 105622, number of used features
: 11
[LightGBM] [Info] [binary:BoostFromScore]: pavg=0.211604 -> initscore=-1.315286
[LightGBM] [Info] Start training from score -1.315286
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Info] Number of positive: 22350, number of negative: 83272
[LightGBM] [Info] Auto-choosing row-wise multi-threading, the overhead of testing was 0.0
01310 seconds.
You can set `force_row_wise=true` to remove the overhead.
And if memory is not enough, you can set `force_col_wise=true`.
[LightGBM] [Info] Total Bins 859
[LightGBM] [Info] Number of data points in the train set: 105622, number of used features
: 11
[LightGBM] [Info] [binary:BoostFromScore]: pavg=0.211604 -> initscore=-1.315286
[LightGBM] [Info] Start training from score -1.315286
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
```

```
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Info] Number of positive: 22350, number of negative: 83272
[LightGBM] [Info] Auto-choosing row-wise multi-threading, the overhead of testing was 0.0
01293 seconds.
You can set `force_row_wise=true` to remove the overhead.
And if memory is not enough, you can set `force_col_wise=true`.
[LightGBM] [Info] Total Bins 857
[LightGBM] [Info] Number of data points in the train set: 105622, number of used features
: 11
[LightGBM] [Info] [binary:BoostFromScore]: pavg=0.211604 -> initscore=-1.315286
[LightGBM] [Info] Start training from score -1.315286
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] Accuracy may be bad since you didn't explicitly set num_leaves OR 2^
max_depth > num_leaves. (num_leaves=31).
[LightGBM] [Warning] Accuracy may be bad since you didn't explicitly set num_leaves OR 2^
max_depth > num_leaves. (num_leaves=31).
[LightGBM] [Info] Number of positive: 22349, number of negative: 83272
[LightGBM] [Info] Auto-choosing row-wise multi-threading, the overhead of testing was 0.0
01971 seconds.
You can set `force_row_wise=true` to remove the overhead.
And if memory is not enough, you can set `force_col_wise=true`.
[LightGBM] [Info] Total Bins 858
[LightGBM] [Info] Number of data points in the train set: 105621, number of used features
: 11
[LightGBM] [Info] [binary:BoostFromScore]: pavg=0.211596 -> initscore=-1.315331
[LightGBM] [Info] Start training from score -1.315331
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] Accuracy may be bad since you didn't explicitly set num_leaves OR 2^
max_depth > num_leaves. (num_leaves=31).
[LightGBM] [Warning] Accuracy may be bad since you didn't explicitly set num_leaves OR 2^
max_depth > num_leaves. (num_leaves=31).
[LightGBM] [Warning] Accuracy may be bad since you didn't explicitly set num_leaves OR 2^
max_depth > num_leaves. (num_leaves=31).
[LightGBM] [Info] Number of positive: 22349, number of negative: 83272
[LightGBM] [Info] Auto-choosing row-wise multi-threading, the overhead of testing was 0.0
00918 seconds.
You can set `force_row_wise=true` to remove the overhead.
```

```
And if memory is not enough, you can set `force_col_wise=true`.
[LightGBM] [Info] Total Bins 857
[LightGBM] [Info] Number of data points in the train set: 105621, number of used features
: 11
[LightGBM] [Info] [binary:BoostFromScore]: pavg=0.211596 -> initscore=-1.315331
[LightGBM] [Info] Start training from score -1.315331
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] Accuracy may be bad since you didn't explicitly set num_leaves OR 2^
max_depth > num_leaves. (num_leaves=31).
[LightGBM] [Warning] Accuracy may be bad since you didn't explicitly set num_leaves OR 2^
max_depth > num_leaves. (num_leaves=31).
[LightGBM] [Warning] Accuracy may be bad since you didn't explicitly set num_leaves OR 2^
max_depth > num_leaves. (num_leaves=31).
[LightGBM] [Info] Number of positive: 22350, number of negative: 83272
[LightGBM] [Info] Auto-choosing row-wise multi-threading, the overhead of testing was 0.0
01379 seconds.
You can set `force_row_wise=true` to remove the overhead.
And if memory is not enough, you can set `force_col_wise=true`.
[LightGBM] [Info] Total Bins 859
[LightGBM] [Info] Number of data points in the train set: 105622, number of used features
: 11
[LightGBM] [Info] [binary:BoostFromScore]: pavg=0.211604 -> initscore=-1.315286
[LightGBM] [Info] Start training from score -1.315286
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] Accuracy may be bad since you didn't explicitly set num_leaves OR 2^
max_depth > num_leaves. (num_leaves=31).
[LightGBM] [Warning] Accuracy may be bad since you didn't explicitly set num_leaves OR 2^
max_depth > num_leaves. (num_leaves=31).
[LightGBM] [Warning] Accuracy may be bad since you didn't explicitly set num_leaves OR 2^
max_depth > num_leaves. (num_leaves=31).
[LightGBM] [Info] Number of positive: 22350, number of negative: 83272
[LightGBM] [Info] Auto-choosing row-wise multi-threading, the overhead of testing was 0.0
01320 seconds.
You can set `force_row_wise=true` to remove the overhead.
```

```
And if memory is not enough, you can set `force_col_wise=true`.
[LightGBM] [Info] Total Bins 859
[LightGBM] [Info] Number of data points in the train set: 105622, number of used features
: 11
[LightGBM] [Info] [binary:BoostFromScore]: pavg=0.211604 -> initscore=-1.315286
[LightGBM] [Info] Start training from score -1.315286
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] Accuracy may be bad since you didn't explicitly set num_leaves OR 2^
max_depth > num_leaves. (num_leaves=31).
[LightGBM] [Warning] Accuracy may be bad since you didn't explicitly set num_leaves OR 2^
max_depth > num_leaves. (num_leaves=31).
[LightGBM] [Warning] Accuracy may be bad since you didn't explicitly set num_leaves OR 2^
max_depth > num_leaves. (num_leaves=31).
[LightGBM] [Info] Number of positive: 22350, number of negative: 83272
[LightGBM] [Info] Auto-choosing row-wise multi-threading, the overhead of testing was 0.0
01219 seconds.
You can set `force_row_wise=true` to remove the overhead.
And if memory is not enough, you can set `force_col_wise=true`.
[LightGBM] [Info] Total Bins 857
[LightGBM] [Info] Number of data points in the train set: 105622, number of used features
: 11
[LightGBM] [Info] [binary:BoostFromScore]: pavg=0.211604 -> initscore=-1.315286
[LightGBM] [Info] Start training from score -1.315286
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] Accuracy may be bad since you didn't explicitly set num_leaves OR 2^
max_depth > num_leaves. (num_leaves=31).
[LightGBM] [Warning] Accuracy may be bad since you didn't explicitly set num_leaves OR 2^
max_depth > num_leaves. (num_leaves=31).
[LightGBM] [Warning] Accuracy may be bad since you didn't explicitly set num_leaves OR 2^
max_depth > num_leaves. (num_leaves=31).
[LightGBM] [Info] Number of positive: 22349, number of negative: 83272
[LightGBM] [Info] Auto-choosing row-wise multi-threading, the overhead of testing was 0.0
01062 seconds.
You can set `force_row_wise=true` to remove the overhead.
And if memory is not enough, you can set `force_col_wise=true`.
[LightGBM] [Info] Total Bins 858
```

```
[LightGBM] [Info] Number of data points in the train set: 105621, number of used features
: 11
[LightGBM] [Info] [binary:BoostFromScore]: pavg=0.211596 -> initscore=-1.315331
[LightGBM] [Info] Start training from score -1.315331
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] Accuracy may be bad since you didn't explicitly set num_leaves OR 2^
max_depth > num_leaves. (num_leaves=31).
[LightGBM] [Warning] Accuracy may be bad since you didn't explicitly set num_leaves OR 2^
max_depth > num_leaves. (num_leaves=31).
[LightGBM] [Warning] Accuracy may be bad since you didn't explicitly set num_leaves OR 2^
max_depth > num_leaves. (num_leaves=31).
[LightGBM] [Info] Number of positive: 22349, number of negative: 83272
[LightGBM] [Info] Auto-choosing row-wise multi-threading, the overhead of testing was 0.0
```

```
01151 seconds.
You can set `force_row_wise=true` to remove the overhead.
And if memory is not enough, you can set `force_col_wise=true`.
[LightGBM] [Info] Total Bins 857
[LightGBM] [Info] Number of data points in the train set: 105621, number of used features
: 11
[LightGBM] [Info] [binary:BoostFromScore]: pavg=0.211596 -> initscore=-1.315331
[LightGBM] [Info] Start training from score -1.315331
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] Accuracy may be bad since you didn't explicitly set num_leaves OR 2^
max_depth > num_leaves. (num_leaves=31).
[LightGBM] [Warning] Accuracy may be bad since you didn't explicitly set num_leaves OR 2^
max_depth > num_leaves. (num_leaves=31).
```

```
[LightGBM] [Warning] Accuracy may be bad since you didn't explicitly set num_leaves OR 2^
max_depth > num_leaves. (num_leaves=31).
[LightGBM] [Info] Number of positive: 22350, number of negative: 83272
[LightGBM] [Info] Auto-choosing row-wise multi-threading, the overhead of testing was 0.0
01635 seconds.
You can set `force_row_wise=true` to remove the overhead.
And if memory is not enough, you can set `force_col_wise=true`.
[LightGBM] [Info] Total Bins 859
[LightGBM] [Info] Number of data points in the train set: 105622, number of used features
: 11
[LightGBM] [Info] [binary:BoostFromScore]: pavg=0.211604 -> initscore=-1.315286
[LightGBM] [Info] Start training from score -1.315286
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] Accuracy may be bad since you didn't explicitly set num_leaves OR 2^
max_depth > num_leaves. (num_leaves=31).
[LightGBM] [Warning] Accuracy may be bad since you didn't explicitly set num_leaves OR 2^
max_depth > num_leaves. (num_leaves=31).
[LightGBM] [Warning] Accuracy may be bad since you didn't explicitly set num_leaves OR 2^
```

```
max_depth > num_leaves. (num_leaves=31).
[LightGBM] [Info] Number of positive: 22350, number of negative: 83272
[LightGBM] [Info] Auto-choosing row-wise multi-threading, the overhead of testing was 0.0
01512 seconds.
You can set `force_row_wise=true` to remove the overhead.
And if memory is not enough, you can set `force_col_wise=true`.
[LightGBM] [Info] Total Bins 859
[LightGBM] [Info] Number of data points in the train set: 105622, number of used features
: 11
[LightGBM] [Info] [binary:BoostFromScore]: pavg=0.211604 -> initscore=-1.315286
[LightGBM] [Info] Start training from score -1.315286
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] Accuracy may be bad since you didn't explicitly set num_leaves OR 2^
max_depth > num_leaves. (num_leaves=31).
[LightGBM] [Warning] Accuracy may be bad since you didn't explicitly set num_leaves OR 2^
max_depth > num_leaves. (num_leaves=31).
[LightGBM] [Warning] Accuracy may be bad since you didn't explicitly set num_leaves OR 2^
max_depth > num_leaves. (num_leaves=31).
[LightGBM] [Info] Number of positive: 22350, number of negative: 83272
```

```
[LightGBM] [Info] Auto-choosing row-wise multi-threading, the overhead of testing was 0.0
01276 seconds.
You can set `force_row_wise=true` to remove the overhead.
And if memory is not enough, you can set `force_col_wise=true`.
[LightGBM] [Info] Total Bins 857
[LightGBM] [Info] Number of data points in the train set: 105622, number of used features
: 11
[LightGBM] [Info] [binary:BoostFromScore]: pavg=0.211604 -> initscore=-1.315286
[LightGBM] [Info] Start training from score -1.315286
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] Accuracy may be bad since you didn't explicitly set num_leaves OR 2^
max_depth > num_leaves. (num_leaves=31).
[LightGBM] [Warning] Accuracy may be bad since you didn't explicitly set num_leaves OR 2^
max_depth > num_leaves. (num_leaves=31).
[LightGBM] [Warning] Accuracy may be bad since you didn't explicitly set num_leaves OR 2^
max_depth > num_leaves. (num_leaves=31).
[LightGBM] [Info] Number of positive: 22349, number of negative: 83272
```

```
[LightGBM] [Info] Auto-choosing row-wise multi-threading, the overhead of testing was 0.0
01243 seconds.
You can set `force_row_wise=true` to remove the overhead.
And if memory is not enough, you can set `force_col_wise=true`.
[LightGBM] [Info] Total Bins 858
[LightGBM] [Info] Number of data points in the train set: 105621, number of used features
: 11
[LightGBM] [Info] [binary:BoostFromScore]: pavg=0.211596 -> initscore=-1.315331
[LightGBM] [Info] Start training from score -1.315331
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
```

```
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] Accuracy may be bad since you didn't explicitly set num_leaves OR 2^
max_depth > num_leaves. (num_leaves=31).
[LightGBM] [Warning] Accuracy may be bad since you didn't explicitly set num_leaves OR 2^
max_depth > num_leaves. (num_leaves=31).
[LightGBM] [Warning] Accuracy may be bad since you didn't explicitly set num_leaves OR 2^
max_depth > num_leaves. (num_leaves=31).
[LightGBM] [Info] Number of positive: 22349, number of negative: 83272
```

```
[LightGBM] [Info] Auto-choosing col-wise multi-threading, the overhead of testing was 0.0
11590 seconds.
You can set `force_col_wise=true` to remove the overhead.
[LightGBM] [Info] Total Bins 857
[LightGBM] [Info] Number of data points in the train set: 105621, number of used features
: 11
[LightGBM] [Info] [binary:BoostFromScore]: pavg=0.211596 -> initscore=-1.315331
[LightGBM] [Info] Start training from score -1.315331
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
```

```
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
```

```
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] Accuracy may be bad since you didn't explicitly set num_leaves OR 2^
max_depth > num_leaves. (num_leaves=31).
[LightGBM] [Warning] Accuracy may be bad since you didn't explicitly set num_leaves OR 2^
max_depth > num_leaves. (num_leaves=31).
[LightGBM] [Warning] Accuracy may be bad since you didn't explicitly set num_leaves OR 2^
max_depth > num_leaves. (num_leaves=31).
[LightGBM] [Info] Number of positive: 22350, number of negative: 83272
[LightGBM] [Info] Auto-choosing row-wise multi-threading, the overhead of testing was 0.0
01310 seconds.
You can set `force_row_wise=true` to remove the overhead.
And if memory is not enough, you can set `force_col_wise=true`.
[LightGBM] [Info] Total Bins 859
[LightGBM] [Info] Number of data points in the train set: 105622, number of used features
: 11
[LightGBM] [Info] [binary:BoostFromScore]: pavg=0.211604 -> initscore=-1.315286
[LightGBM] [Info] Start training from score -1.315286
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
```

```
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] Accuracy may be bad since you didn't explicitly set num_leaves OR 2^
max_depth > num_leaves. (num_leaves=31).
```

```
[LightGBM] [Warning] Accuracy may be bad since you didn't explicitly set num_leaves OR 2^
max_depth > num_leaves. (num_leaves=31).
[LightGBM] [Warning] Accuracy may be bad since you didn't explicitly set num_leaves OR 2^
max_depth > num_leaves. (num_leaves=31).
[LightGBM] [Info] Number of positive: 22350, number of negative: 83272
[LightGBM] [Info] Auto-choosing row-wise multi-threading, the overhead of testing was 0.0
01377 seconds.
You can set `force_row_wise=true` to remove the overhead.
And if memory is not enough, you can set `force_col_wise=true`.
[LightGBM] [Info] Total Bins 859
[LightGBM] [Info] Number of data points in the train set: 105622, number of used features
: 11
[LightGBM] [Info] [binary:BoostFromScore]: pavg=0.211604 -> initscore=-1.315286
[LightGBM] [Info] Start training from score -1.315286
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
```

```
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
```

```
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] Accuracy may be bad since you didn't explicitly set num_leaves OR 2^
max_depth > num_leaves. (num_leaves=31).
[LightGBM] [Warning] Accuracy may be bad since you didn't explicitly set num_leaves OR 2^
max_depth > num_leaves. (num_leaves=31).
[LightGBM] [Warning] Accuracy may be bad since you didn't explicitly set num_leaves OR 2^
max_depth > num_leaves. (num_leaves=31).
[LightGBM] [Info] Number of positive: 22350, number of negative: 83272
[LightGBM] [Info] Auto-choosing row-wise multi-threading, the overhead of testing was 0.0
01704 seconds.
You can set `force_row_wise=true` to remove the overhead.
And if memory is not enough, you can set `force_col_wise=true`.
[LightGBM] [Info] Total Bins 857
[LightGBM] [Info] Number of data points in the train set: 105622, number of used features
: 11
[LightGBM] [Info] [binary:BoostFromScore]: pavg=0.211604 -> initscore=-1.315286
[LightGBM] [Info] Start training from score -1.315286
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
```

```
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
```

```
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
[LightGBM] [Warning] Accuracy may be bad since you didn't explicitly set num_leaves OR 2^
max_depth > num_leaves. (num_leaves=31).
[LightGBM] [Warning] Accuracy may be bad since you didn't explicitly set num_leaves OR 2^
max_depth > num_leaves. (num_leaves=31).
[LightGBM] [Warning] Accuracy may be bad since you didn't explicitly set num_leaves OR 2^
max_depth > num_leaves. (num_leaves=31).
[LightGBM] [Info] Number of positive: 22349, number of negative: 83272
[LightGBM] [Info] Auto-choosing row-wise multi-threading, the overhead of testing was 0.0
01150 seconds.
You can set `force_row_wise=true` to remove the overhead.
And if memory is not enough, you can set `force_col_wise=true`.
[LightGBM] [Info] Total Bins 858
[LightGBM] [Info] Number of data points in the train set: 105621, number of used features
: 11
[LightGBM] [Info] [binary:BoostFromScore]: pavg=0.211596 -> initscore=-1.315331
[LightGBM] [Info] Start training from score -1.315331
[LightGBM] [Warning] Accuracy may be bad since you didn't explicitly set num_leaves OR 2^
max_depth > num_leaves. (num_leaves=31).
[LightGBM] [Warning] Accuracy may be bad since you didn't explicitly set num_leaves OR 2^
max_depth > num_leaves. (num_leaves=31).
[LightGBM] [Warning] Accuracy may be bad since you didn't explicitly set num_leaves OR 2^
max_depth > num_leaves. (num_leaves=31).
[LightGBM] [Info] Number of positive: 22349, number of negative: 83272
[LightGBM] [Info] Auto-choosing row-wise multi-threading, the overhead of testing was 0.0
01293 seconds.
You can set `force_row_wise=true` to remove the overhead.
And if memory is not enough, you can set `force_col_wise=true`.
[LightGBM] [Info] Total Bins 857
[LightGBM] [Info] Number of data points in the train set: 105621, number of used features
: 11
[LightGBM] [Info] [binary:BoostFromScore]: pavg=0.211596 -> initscore=-1.315331
[LightGBM] [Info] Start training from score -1.315331
[LightGBM] [Warning] Accuracy may be bad since you didn't explicitly set num_leaves OR 2^
max_depth > num_leaves. (num_leaves=31).
[LightGBM] [Warning] Accuracy may be bad since you didn't explicitly set num_leaves OR 2^
max_depth > num_leaves. (num_leaves=31).
[LightGBM] [Warning] Accuracy may be bad since you didn't explicitly set num_leaves OR 2^
max_depth > num_leaves. (num_leaves=31).
[LightGBM] [Info] Number of positive: 22350, number of negative: 83272
[LightGBM] [Info] Auto-choosing row-wise multi-threading, the overhead of testing was 0.0
01316 seconds.
You can set `force_row_wise=true` to remove the overhead.
And if memory is not enough, you can set `force_col_wise=true`.
[LightGBM] [Info] Total Bins 859
[LightGBM] [Info] Number of data points in the train set: 105622, number of used features
: 11
[LightGBM] [Info] [binary:BoostFromScore]: pavg=0.211604 -> initscore=-1.315286
[LightGBM] [Info] Start training from score -1.315286
[LightGBM] [Warning] Accuracy may be bad since you didn't explicitly set num_leaves OR 2^
max_depth > num_leaves. (num_leaves=31).
[LightGBM] [Warning] Accuracy may be bad since you didn't explicitly set num_leaves OR 2^
max_depth > num_leaves. (num_leaves=31).
[LightGBM] [Warning] Accuracy may be bad since you didn't explicitly set num_leaves OR 2^
max_depth > num_leaves. (num_leaves=31).
[LightGBM] [Info] Number of positive: 22350, number of negative: 83272
[LightGBM] [Info] Auto-choosing row-wise multi-threading, the overhead of testing was 0.0
```

```
01816 seconds.
You can set `force_row_wise=true` to remove the overhead.
And if memory is not enough, you can set `force_col_wise=true`.
[LightGBM] [Info] Total Bins 859
[LightGBM] [Info] Number of data points in the train set: 105622, number of used features
: 11
[LightGBM] [Info] [binary:BoostFromScore]: pavg=0.211604 -> initscore=-1.315286
[LightGBM] [Info] Start training from score -1.315286
[LightGBM] [Warning] Accuracy may be bad since you didn't explicitly set num_leaves OR 2^
max_depth > num_leaves. (num_leaves=31).
[LightGBM] [Warning] Accuracy may be bad since you didn't explicitly set num_leaves OR 2^
max_depth > num_leaves. (num_leaves=31).
[LightGBM] [Warning] Accuracy may be bad since you didn't explicitly set num_leaves OR 2^
max_depth > num_leaves. (num_leaves=31).
[LightGBM] [Info] Number of positive: 22350, number of negative: 83272
[LightGBM] [Info] Auto-choosing row-wise multi-threading, the overhead of testing was 0.0
01304 seconds.
You can set `force_row_wise=true` to remove the overhead.
And if memory is not enough, you can set `force_col_wise=true`.
[LightGBM] [Info] Total Bins 857
[LightGBM] [Info] Number of data points in the train set: 105622, number of used features
: 11
[LightGBM] [Info] [binary:BoostFromScore]: pavg=0.211604 -> initscore=-1.315286
[LightGBM] [Info] Start training from score -1.315286
[LightGBM] [Warning] Accuracy may be bad since you didn't explicitly set num_leaves OR 2^
max_depth > num_leaves. (num_leaves=31).
[LightGBM] [Warning] Accuracy may be bad since you didn't explicitly set num_leaves OR 2^
max_depth > num_leaves. (num_leaves=31).
[LightGBM] [Warning] Accuracy may be bad since you didn't explicitly set num_leaves OR 2^
max_depth > num_leaves. (num_leaves=31).
[LightGBM] [Info] Number of positive: 22349, number of negative: 83272
[LightGBM] [Info] Auto-choosing col-wise multi-threading, the overhead of testing was 0.0
09654 seconds.
You can set `force_col_wise=true` to remove the overhead.
[LightGBM] [Info] Total Bins 858
[LightGBM] [Info] Number of data points in the train set: 105621, number of used features
: 11
[LightGBM] [Info] [binary:BoostFromScore]: pavg=0.211596 -> initscore=-1.315331
[LightGBM] [Info] Start training from score -1.315331
[LightGBM] [Warning] Accuracy may be bad since you didn't explicitly set num_leaves OR 2^
max_depth > num_leaves. (num_leaves=31).
[LightGBM] [Warning] Accuracy may be bad since you didn't explicitly set num_leaves OR 2^
max_depth > num_leaves. (num_leaves=31).
[LightGBM] [Warning] Accuracy may be bad since you didn't explicitly set num_leaves OR 2^
max_depth > num_leaves. (num_leaves=31).
[LightGBM] [Info] Number of positive: 22349, number of negative: 83272
[LightGBM] [Info] Auto-choosing row-wise multi-threading, the overhead of testing was 0.0
01308 seconds.
You can set `force_row_wise=true` to remove the overhead.
And if memory is not enough, you can set `force_col_wise=true`.
[LightGBM] [Info] Total Bins 857
[LightGBM] [Info] Number of data points in the train set: 105621, number of used features
: 11
[LightGBM] [Info] [binary:BoostFromScore]: pavg=0.211596 -> initscore=-1.315331
[LightGBM] [Info] Start training from score -1.315331
[LightGBM] [Warning] Accuracy may be bad since you didn't explicitly set num_leaves OR 2^
max_depth > num_leaves. (num_leaves=31).
[LightGBM] [Warning] Accuracy may be bad since you didn't explicitly set num_leaves OR 2^
max_depth > num_leaves. (num_leaves=31).
[LightGBM] [Warning] Accuracy may be bad since you didn't explicitly set num_leaves OR 2^
max_depth > num_leaves. (num_leaves=31).
[LightGBM] [Info] Number of positive: 22350, number of negative: 83272
[LightGBM] [Info] Auto-choosing row-wise multi-threading, the overhead of testing was 0.0
01368 seconds.
You can set `force_row_wise=true` to remove the overhead.
And if memory is not enough, you can set `force_col_wise=true`.
[LightGBM] [Info] Total Bins 859
[LightGBM] [Info] Number of data points in the train set: 105622, number of used features
: 11
[LightGBM] [Info] [binary:BoostFromScore]: pavg=0.211604 -> initscore=-1.315286
[LightGBM] [Info] Start training from score -1.315286
[LightGBM] [Warning] Accuracy may be bad since you didn't explicitly set num_leaves OR 2^
```

```
max_depth > num_leaves. (num_leaves=31).
[LightGBM] [Warning] Accuracy may be bad since you didn't explicitly set num_leaves OR 2^
max_depth > num_leaves. (num_leaves=31).
[LightGBM] [Warning] Accuracy may be bad since you didn't explicitly set num_leaves OR 2^
max_depth > num_leaves. (num_leaves=31).
[LightGBM] [Info] Number of positive: 22350, number of negative: 83272
[LightGBM] [Info] Auto-choosing row-wise multi-threading, the overhead of testing was 0.0
01220 seconds.
You can set `force_row_wise=true` to remove the overhead.
And if memory is not enough, you can set `force_col_wise=true`.
[LightGBM] [Info] Total Bins 859
[LightGBM] [Info] Number of data points in the train set: 105622, number of used features
: 11
[LightGBM] [Info] [binary:BoostFromScore]: pavg=0.211604 -> initscore=-1.315286
[LightGBM] [Info] Start training from score -1.315286
[LightGBM] [Warning] Accuracy may be bad since you didn't explicitly set num_leaves OR 2^
max_depth > num_leaves. (num_leaves=31).
[LightGBM] [Warning] Accuracy may be bad since you didn't explicitly set num_leaves OR 2^
max_depth > num_leaves. (num_leaves=31).
[LightGBM] [Warning] Accuracy may be bad since you didn't explicitly set num_leaves OR 2^
max_depth > num_leaves. (num_leaves=31).
[LightGBM] [Info] Number of positive: 22350, number of negative: 83272
[LightGBM] [Info] Auto-choosing row-wise multi-threading, the overhead of testing was 0.0
01530 seconds.
You can set `force_row_wise=true` to remove the overhead.
And if memory is not enough, you can set `force_col_wise=true`.
[LightGBM] [Info] Total Bins 857
[LightGBM] [Info] Number of data points in the train set: 105622, number of used features
: 11
[LightGBM] [Info] [binary:BoostFromScore]: pavg=0.211604 -> initscore=-1.315286
[LightGBM] [Info] Start training from score -1.315286
[LightGBM] [Warning] Accuracy may be bad since you didn't explicitly set num_leaves OR 2^
max_depth > num_leaves. (num_leaves=31).
[LightGBM] [Warning] Accuracy may be bad since you didn't explicitly set num_leaves OR 2^
max_depth > num_leaves. (num_leaves=31).
[LightGBM] [Warning] Accuracy may be bad since you didn't explicitly set num_leaves OR 2^
max_depth > num_leaves. (num_leaves=31).
[LightGBM] [Info] Number of positive: 22349, number of negative: 83272
[LightGBM] [Info] Auto-choosing row-wise multi-threading, the overhead of testing was 0.0
01235 seconds.
You can set `force_row_wise=true` to remove the overhead.
And if memory is not enough, you can set `force_col_wise=true`.
[LightGBM] [Info] Total Bins 858
[LightGBM] [Info] Number of data points in the train set: 105621, number of used features
: 11
[LightGBM] [Info] [binary:BoostFromScore]: pavg=0.211596 -> initscore=-1.315331
[LightGBM] [Info] Start training from score -1.315331
[LightGBM] [Warning] Accuracy may be bad since you didn't explicitly set num_leaves OR 2^
max_depth > num_leaves. (num_leaves=31).
[LightGBM] [Warning] Accuracy may be bad since you didn't explicitly set num_leaves OR 2^
max_depth > num_leaves. (num_leaves=31).
[LightGBM] [Warning] Accuracy may be bad since you didn't explicitly set num_leaves OR 2^
max_depth > num_leaves. (num_leaves=31).
[LightGBM] [Info] Number of positive: 22349, number of negative: 83272
[LightGBM] [Info] Auto-choosing row-wise multi-threading, the overhead of testing was 0.0
01501 seconds.
You can set `force_row_wise=true` to remove the overhead.
And if memory is not enough, you can set `force_col_wise=true`.
[LightGBM] [Info] Total Bins 857
[LightGBM] [Info] Number of data points in the train set: 105621, number of used features
: 11
[LightGBM] [Info] [binary:BoostFromScore]: pavg=0.211596 -> initscore=-1.315331
[LightGBM] [Info] Start training from score -1.315331
[LightGBM] [Warning] Accuracy may be bad since you didn't explicitly set num_leaves OR 2^
max_depth > num_leaves. (num_leaves=31).
[LightGBM] [Warning] Accuracy may be bad since you didn't explicitly set num_leaves OR 2^
max_depth > num_leaves. (num_leaves=31).
[LightGBM] [Warning] Accuracy may be bad since you didn't explicitly set num_leaves OR 2^
max_depth > num_leaves. (num_leaves=31).
[LightGBM] [Info] Number of positive: 22350, number of negative: 83272
[LightGBM] [Info] Auto-choosing row-wise multi-threading, the overhead of testing was 0.0
01285 seconds.
```

```
You can set `force_row_wise=true` to remove the overhead.
And if memory is not enough, you can set `force_col_wise=true`.
[LightGBM] [Info] Total Bins 859
[LightGBM] [Info] Number of data points in the train set: 105622, number of used features
: 11
[LightGBM] [Info] [binary:BoostFromScore]: pavg=0.211604 -> initscore=-1.315286
[LightGBM] [Info] Start training from score -1.315286
[LightGBM] [Warning] Accuracy may be bad since you didn't explicitly set num_leaves OR 2^
max_depth > num_leaves. (num_leaves=31).
[LightGBM] [Warning] Accuracy may be bad since you didn't explicitly set num_leaves OR 2^
max_depth > num_leaves. (num_leaves=31).
[LightGBM] [Warning] Accuracy may be bad since you didn't explicitly set num_leaves OR 2^
max_depth > num_leaves. (num_leaves=31).
[LightGBM] [Info] Number of positive: 22350, number of negative: 83272
[LightGBM] [Info] Auto-choosing row-wise multi-threading, the overhead of testing was 0.0
01302 seconds.
You can set `force_row_wise=true` to remove the overhead.
And if memory is not enough, you can set `force_col_wise=true`.
[LightGBM] [Info] Total Bins 859
[LightGBM] [Info] Number of data points in the train set: 105622, number of used features
: 11
[LightGBM] [Info] [binary:BoostFromScore]: pavg=0.211604 -> initscore=-1.315286
[LightGBM] [Info] Start training from score -1.315286
[LightGBM] [Warning] Accuracy may be bad since you didn't explicitly set num_leaves OR 2^
max_depth > num_leaves. (num_leaves=31).
[LightGBM] [Warning] Accuracy may be bad since you didn't explicitly set num_leaves OR 2^
max_depth > num_leaves. (num_leaves=31).
[LightGBM] [Warning] Accuracy may be bad since you didn't explicitly set num_leaves OR 2^
max_depth > num_leaves. (num_leaves=31).
[LightGBM] [Info] Number of positive: 22350, number of negative: 83272
[LightGBM] [Info] Auto-choosing row-wise multi-threading, the overhead of testing was 0.0
00975 seconds.
You can set `force_row_wise=true` to remove the overhead.
And if memory is not enough, you can set `force_col_wise=true`.
[LightGBM] [Info] Total Bins 857
[LightGBM] [Info] Number of data points in the train set: 105622, number of used features
: 11
[LightGBM] [Info] [binary:BoostFromScore]: pavg=0.211604 -> initscore=-1.315286
[LightGBM] [Info] Start training from score -1.315286
[LightGBM] [Warning] Accuracy may be bad since you didn't explicitly set num_leaves OR 2^
max_depth > num_leaves. (num_leaves=31).
[LightGBM] [Info] Number of positive: 27937, number of negative: 104090
[LightGBM] [Info] Auto-choosing row-wise multi-threading, the overhead of testing was 0.0
01511 seconds.
You can set `force_row_wise=true` to remove the overhead.
And if memory is not enough, you can set `force_col_wise=true`.
[LightGBM] [Info] Total Bins 859
[LightGBM] [Info] Number of data points in the train set: 132027, number of used features
: 11
[LightGBM] [Info] [binary:BoostFromScore]: pavg=0.211601 -> initscore=-1.315304
[LightGBM] [Info] Start training from score -1.315304
```

In [216]:

```python
# Gradient Boosting Model
grad_boost = GradientBoostingClassifier(
    n_estimators=100, learning_rate=0.1, max_depth=4, min_samples_leaf=5, subsample=0.8,
random_state=1
)
grad_boost.fit(X_train, y_train)
y_true = y_test
y_pred_prob_grad_boost = grad_boost.predict_proba(X_test)[:, 1]
# Calculate ROC-AUC score
roc_auc_grad_boost = roc_auc_score(y_true, y_pred_prob_grad_boost)

y_pred_grad_boost = grad_boost.predict(X_test)
grad_boost_accuracy = accuracy_score(y_test, y_pred_grad_boost)
grad_boost_precision = precision_score(y_test, y_pred_grad_boost)
print(f"ROC-AUC Score for Gradient Boosting: {roc_auc_grad_boost:.4f}")
```

```
ROC-AUC Score for Gradient Boosting: 0.8899
```

In [217]:

```
# Histogram-Based Gradient Boosting Model
hist_grad_boost = HistGradientBoostingClassifier(
    max_iter=100, max_depth=4, random_state=10
)
hist_grad_boost.fit(X_train, y_train)
y_pred_hist_grad_boost = hist_grad_boost.predict(X_test)
hist_grad_accuracy = accuracy_score(y_test, y_pred_hist_grad_boost)
hist_grad_precision = precision_score(y_test, y_pred_hist_grad_boost)
```

In [251]:

```
# Initialize an empty DataFrame to store results
models = pd.DataFrame(columns=['Model', 'Accuracy', 'Precision'])

# List of models and their corresponding metrics

model_list = [logreg,rf,perceptron,sgd,dt,gnb,mlp,xgb_model,knn,lgb_model,grad_boost,hist
_grad_boost]
model_names = ['Logistic Regression', 'Random Forest', 'Perceptron', 'SGDClassifier', 'D
ecision Tree', 'GaussianNB', 'MLPClassifier', 'XGBoost', 'KNN', 'LightGBM','Gradient-Boo
sting','HistGradient-Boosting']
accuracy_list = [logreg_accuracy, rf_accuracy, perceptron_accuracy, sgd_accuracy, dt_acc
uracy, gnb_accuracy, mlp_accuracy, xgb_accuracy, knn_accuracy, lgb_accuracy,grad_boost_a
ccuracy,hist_grad_accuracy]
precision_list = [logreg_precision, rf_precision, perceptron_precision, sgd_precision, d
t_precision, gnb_precision, mlp_precision, xgb_precision, knn_precision, lgb_precision,gr
ad_boost_precision,hist_grad_precision]

# Populate the DataFrame
models['Model'] = model_names
models['object'] = model_list
models['Accuracy'] = accuracy_list
models['Precision'] = precision_list
```

In [219]:

```
models.sort_values(by='Accuracy', ascending=False).style.background_gradient(
        cmap='coolwarm').set_properties(**{
            'font-family': 'Times New Roman',
            'color': 'LigntGreen',
            'font-size': '15px'
        })
```

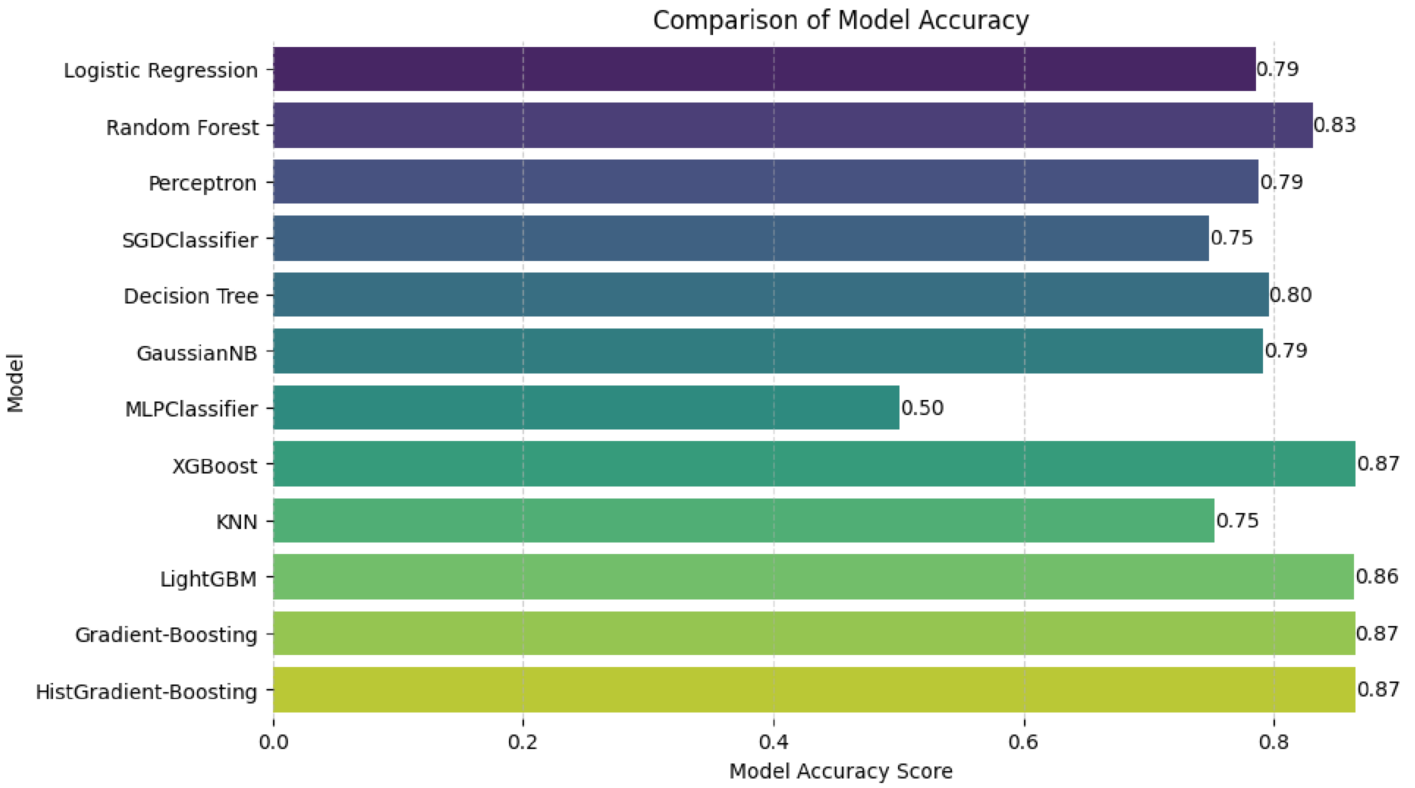
Out[219]:

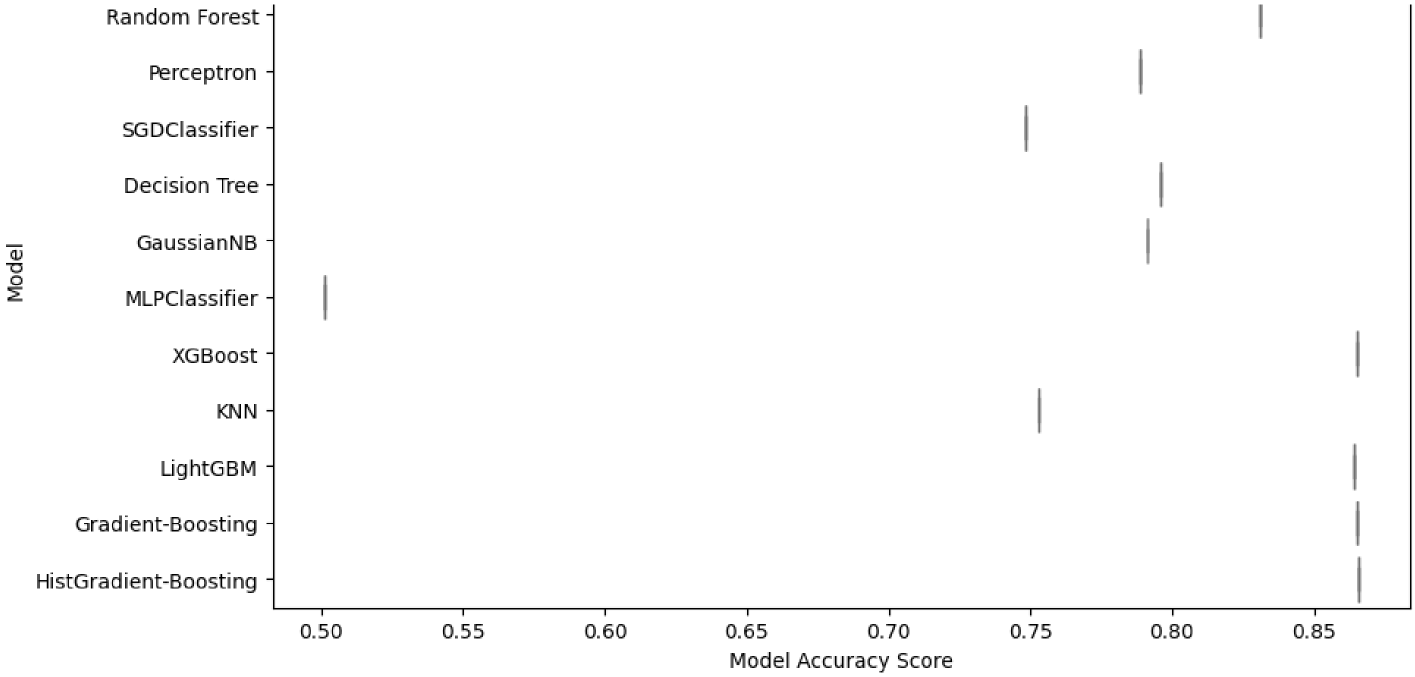
| | Model | Accuracy | Precision | object |
|---|---|---|---|---|
| **11** | HistGradient-Boosting | 0.865513 | 0.749951 | HistGradientBoostingClassifier(max_depth=4, random_state=10) |
| **7** | XGBoost | 0.865392 | 0.747999 | XGBClassifier(base_score=None, booster=None, callbacks=None, colsample_bylevel=None, colsample_bynode=None, colsample_bytree=0.3, device=None, early_stopping_rounds=None, enable_categorical=False, eval_metric='auc', feature_types=None, gamma=1.0, grow_policy=None, importance_type=None, interaction_constraints=None, learning_rate=0.05, max_bin=None, max_cat_threshold=None, max_cat_to_onehot=None, max_delta_step=None, max_depth=10, max_leaves=None, min_child_weight=None, missing=nan, monotone_constraints=None, multi_strategy=None, n_estimators=2048, n_jobs=-1, num_parallel_tree=None, random_state=42, ...) |
| **10** | Gradient-Boosting | 0.865059 | 0.746013 | GradientBoostingClassifier(max_depth=4, min_samples_leaf=5, random_state=1, subsample=0.8) |
| **9** | LightGBM | 0.864241 | 0.754422 | LGBMClassifier(max_depth=3, random_state=42) |
| **1** | Random Forest | 0.830945 | 0.829268 | RandomForestClassifier(max_depth=3, min_samples_leaf=3, n_jobs=-1, random_state=10) |

|  | Model | Accuracy | Precision | object |
|---|---|---|---|---|
|  | Forest |  |  | random_state=10) |
| 4 | Decision Tree | 0.795861 | 0.516882 | DecisionTreeClassifier(random_state=42) |
| 5 | GaussianNB | 0.791408 | 0.519313 | GaussianNB() |
| 2 | Perceptron | 0.788409 | 0.000000 | Perceptron() |
| 0 | Logistic Regression | 0.785258 | 0.471271 | LogisticRegression() |
| 8 | KNN | 0.752871 | 0.282536 | KNeighborsClassifier() |
| 3 | SGDClassifier | 0.748538 | 0.298283 | SGDClassifier() |
| 6 | MLPClassifier | 0.501227 | 0.184054 | MLPClassifier() |

In [220]:

```
# Bar Plot
plt.figure(figsize=(10, 6))
bar_colors = sns.color_palette('viridis', len(models))
bar_plot = sns.barplot(x='Accuracy', y='Model', data=models, palette=bar_colors)

for index, value in enumerate(models['Accuracy']):
    bar_plot.text(value, index, f'{value:.2f}', ha='left', va='center', fontsize=10, col
or='black')

plt.title('Comparison of Model Accuracy')
plt.xlabel('Model Accuracy Score')
plt.ylabel('Model')
plt.grid(axis='x', linestyle='--', alpha=0.6)
sns.despine(left=True, bottom=True)

# Box Plot
plt.figure(figsize=(10, 6))
sns.boxplot(x='Accuracy', y='Model', data=models, palette='pastel')
plt.title('Distribution of Model Accuracy')
plt.xlabel('Model Accuracy Score')
plt.ylabel('Model')
plt.show()
```





**Ensemble Design Considerations:-**

- Diversity: Ensure diverse base models with different algorithms and characteristics.
- Weighting: Assign weights based on individual model performance.
- Stacking or Boosting: Choose between stacking or boosting for combining predictions.

In [252]:

```
filtered_models = models[models['Accuracy'] >= 0.85]
filtered_models
```

Out[252]:

| | Model | Accuracy | Precision | object |
|---|---|---|---|---|
| 7 | XGBoost | 0.865392 | 0.747999 | XGBClassifier(base_score=None, booster=None, c... |
| 9 | LightGBM | 0.864241 | 0.754422 | LGBMClassifier(max_depth=3, random_state=42) |
| 10 | Gradient-Boosting | 0.865059 | 0.746013 | ([DecisionTreeRegressor(criterion='friedman_ms... |
| 11 | HistGradient-Boosting | 0.865513 | 0.749951 | HistGradientBoostingClassifier(max_depth=4, ra... |

**Advanced Model Comparison:-**

**After establishing the baseline, advanced models aim to outperform it, with metrics like accuracy, precision, recall, and ROC curve area used for evaluation.**

In [222]:

```python
def baseline_modeling(X, Y, model, model_name, skf):
    cv_results = cross_val_score(model, X, Y, scoring='roc_auc', cv=skf, n_jobs=-1)
    print(f"The average 10-folds of ROC-AUC score of the {model_name} is {cv_results.mean()}")

# Define cross-validation strategy
skf = RepeatedStratifiedKFold(n_splits=10, n_repeats=1, random_state=42)
```

In [223]:

```python
# Iterate through the models and perform baseline modeling
for model_name, model in zip(filtered_models['Model'], models['object']):
    baseline_modeling(X, Y, model, model_name, skf)
```

```
The average 10-folds of ROC-AUC score of the XGBoost is 0.71389095219676
The average 10-folds of ROC-AUC score of the LightGBM is 0.8649378691437668
The average 10-folds of ROC-AUC score of the Gradient-Boosting is 0.4857878591197028
The average 10-folds of ROC-AUC score of the HistGradient-Boosting is 0.5380081569077516
```

In [253]:

```python
model_performance = pd.DataFrame()
model_performance['Model'] = filtered_models['Model']
model_performance['10-folds oof ROC-AUC'] = [cross_val_score(model, X, Y, scoring='roc_auc', cv=skf, n_jobs=-1).mean() for model in filtered_models['object']]

print(f"The following table shows the performance of the considered models: \n\n{model_performance}")
```

```
The following table shows the performance of the considered models:

                    Model  10-folds oof ROC-AUC
7                 XGBoost              0.888206
9                LightGBM              0.888502
10      Gradient-Boosting              0.889307
11  HistGradient-Boosting              0.889244
```

In [225]:

```python
def plot_roc_curve(X, y, model, model_name):
    """
    Plot ROC curve for a given model.

    Parameters:
    - X: Features of the dataset
    - y: Target variable of the dataset
    - model: Model object with predict_proba method
    - model_name: Name of the model for labeling the plot
    """
    if not hasattr(model, 'predict_proba'):
        print(f"{model_name} does not have 'predict_proba' method. Skipping ROC curve plot.")
        return

    fpr, tpr, thresholds = roc_curve(y, model.predict_proba(X)[:, 1])
    roc_auc = auc(fpr, tpr)

    plt.figure(figsize=(8, 6))
    plt.plot(fpr, tpr, color='darkorange', lw=2, label=f'{model_name} (AUC = {roc_auc:.2f})')
    plt.plot([0, 1], [0, 1], color='navy', lw=2, linestyle='--')
    plt.xlabel('False Positive Rate')
    plt.ylabel('True Positive Rate')
    plt.title('Receiver Operating Characteristic (ROC) Curve')
    plt.legend(loc='lower right')
    plt.show()

# Example usage:
# Replace 'your_model' and 'Your Model Name' with your actual model and name
```

In [226]:

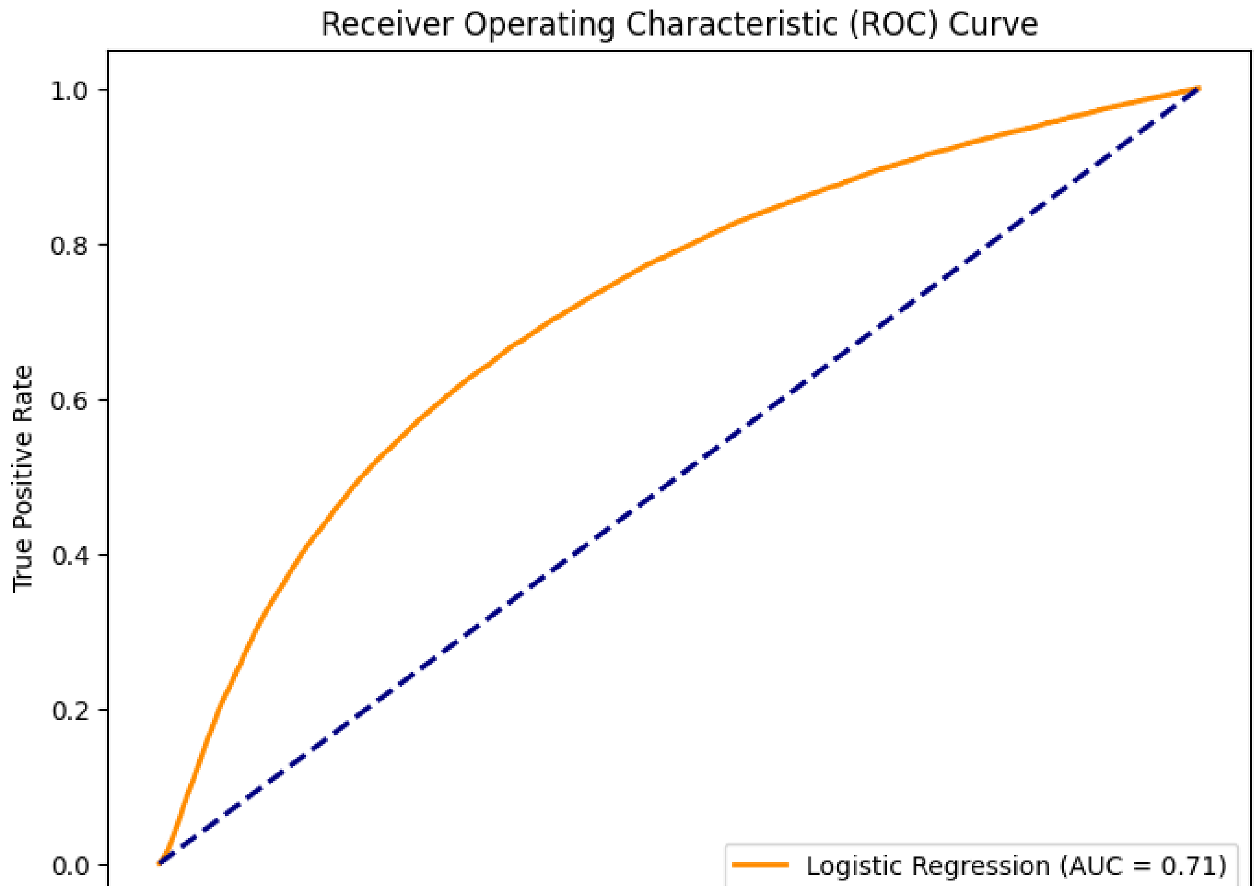
```
models
```

Out[226]:

| | Model | Accuracy | Precision | object |
|---|---|---|---|---|
| 0 | Logistic Regression | 0.785258 | 0.471271 | LogisticRegression() |
| 1 | Random Forest | 0.830945 | 0.829268 | (DecisionTreeClassifier(max_depth=3, max_featu... |
| 2 | Perceptron | 0.788409 | 0.000000 | Perceptron() |
| 3 | SGDClassifier | 0.748538 | 0.298283 | SGDClassifier() |
| 4 | Decision Tree | 0.795861 | 0.516882 | DecisionTreeClassifier(random_state=42) |
| 5 | GaussianNB | 0.791408 | 0.519313 | GaussianNB() |
| 6 | MLPClassifier | 0.501227 | 0.184054 | MLPClassifier() |
| 7 | XGBoost | 0.865392 | 0.747999 | XGBClassifier(base_score=None, booster=None, c... |
| 8 | KNN | 0.752871 | 0.282536 | KNeighborsClassifier() |
| 9 | LightGBM | 0.864241 | 0.754422 | LGBMClassifier(max_depth=3, random_state=42) |
| 10 | Gradient-Boosting | 0.865059 | 0.746013 | ([DecisionTreeRegressor(criterion='friedman_ms... |
| 11 | HistGradient-Boosting | 0.865513 | 0.749951 | HistGradientBoostingClassifier(max_depth=4, ra... |

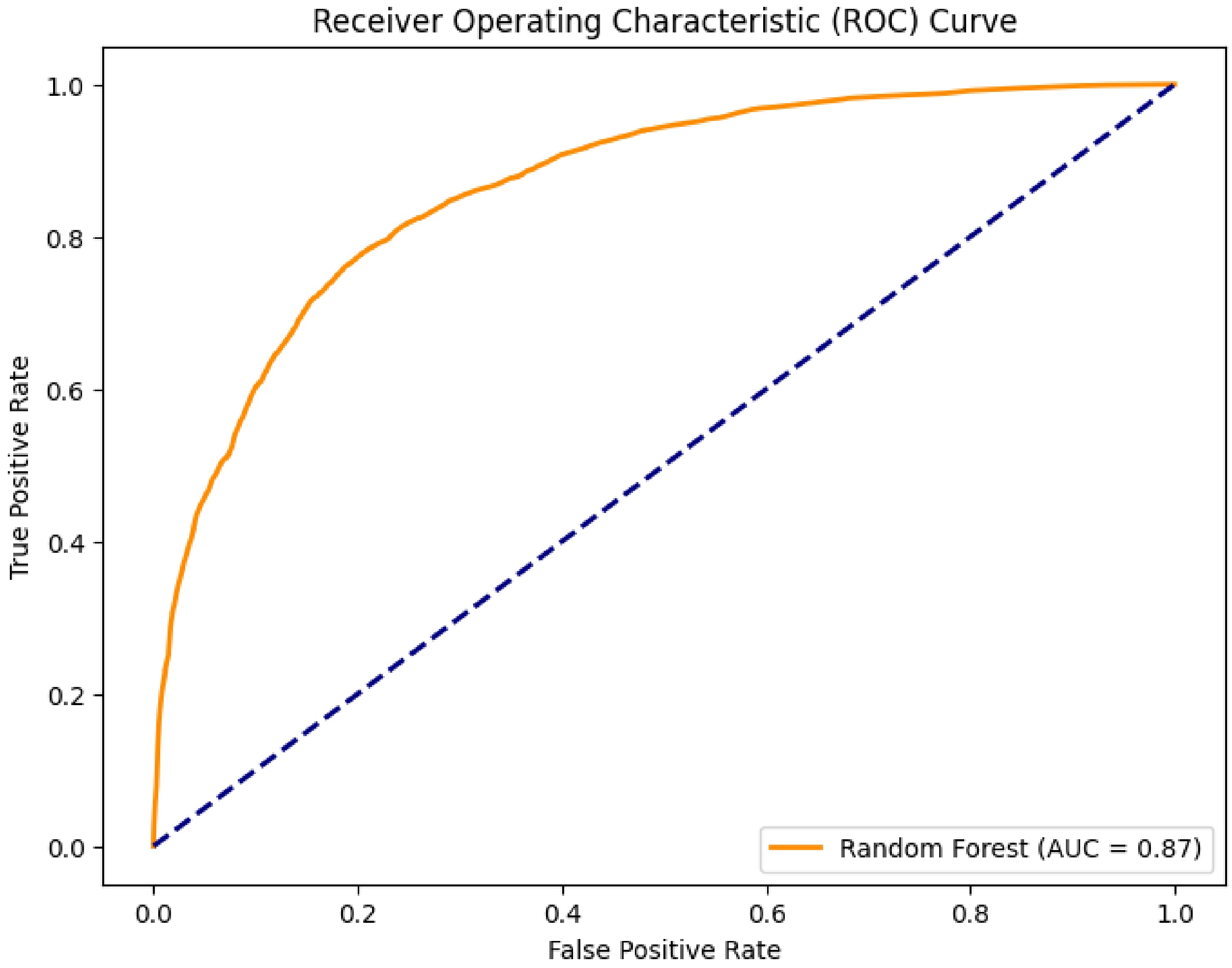
In [227]:

```
plot_roc_curve(X, Y, logreg, 'Logistic Regression')
```



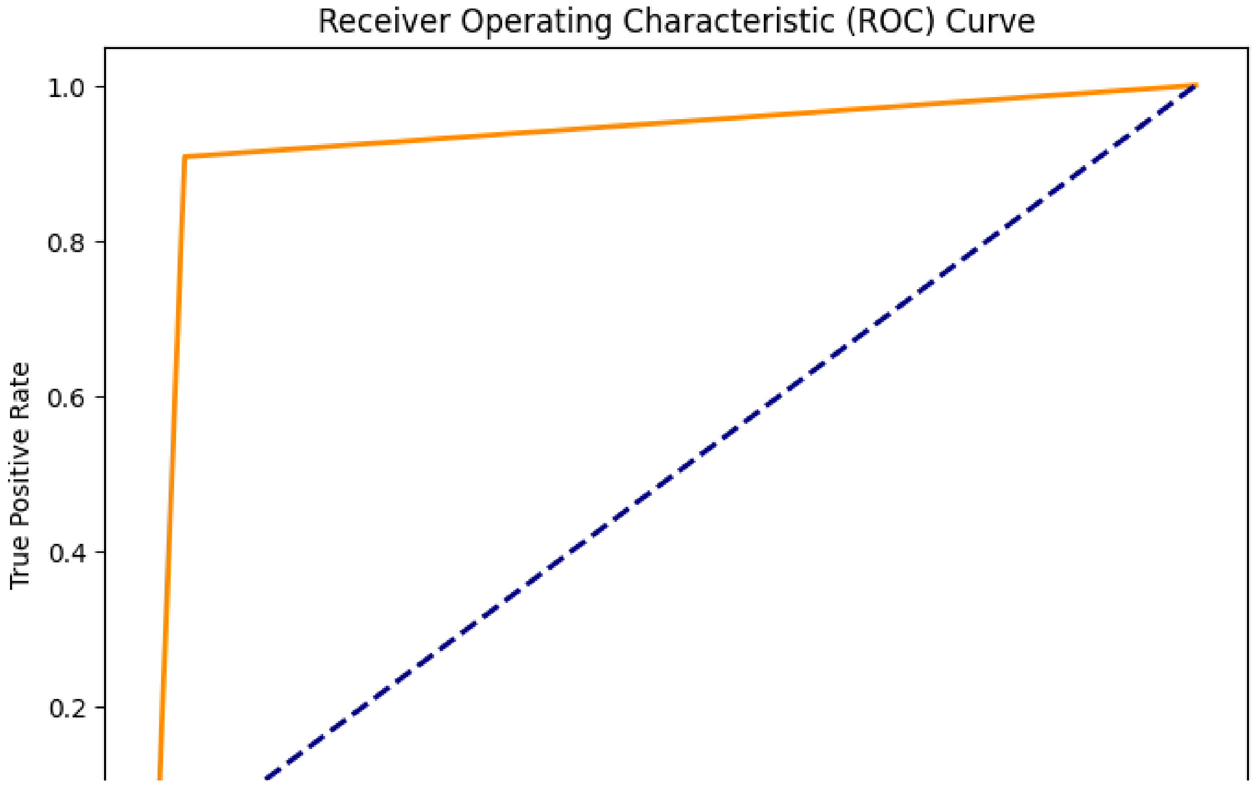
In [228]:

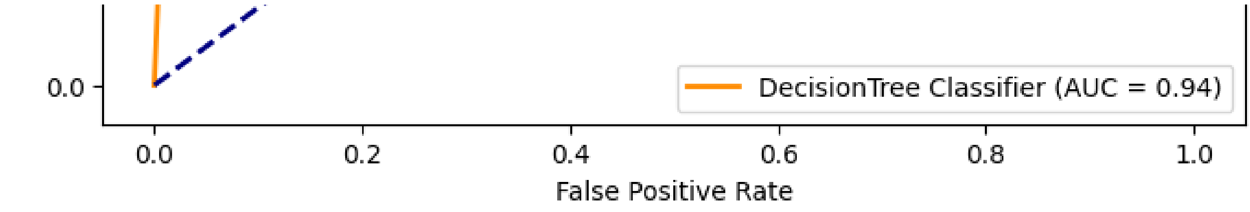
```
plot_roc_curve(X, Y, rf, 'Random Forest')
```



In [229]:

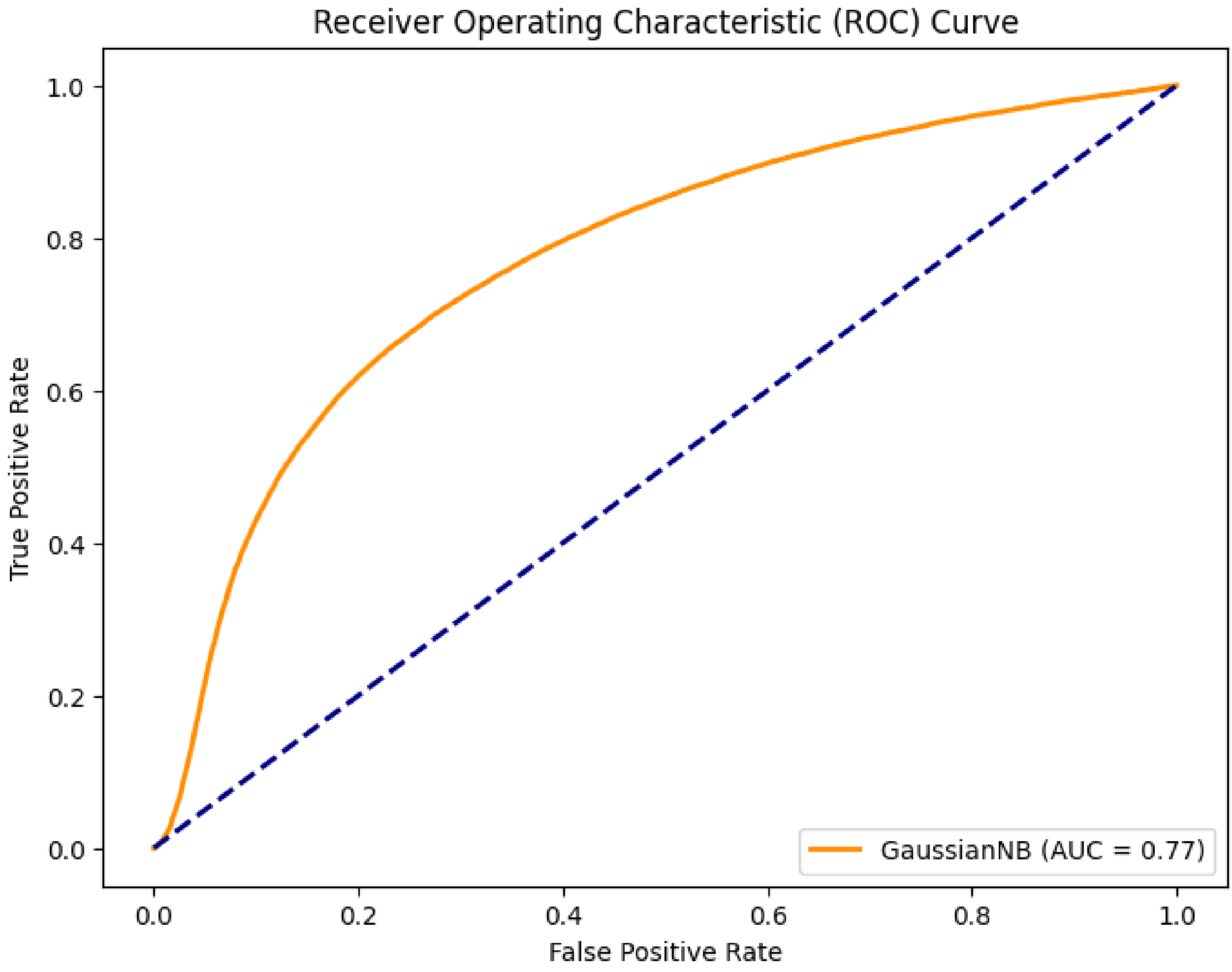
```
plot_roc_curve(X, Y, dt, 'DecisionTree Classifier')
```





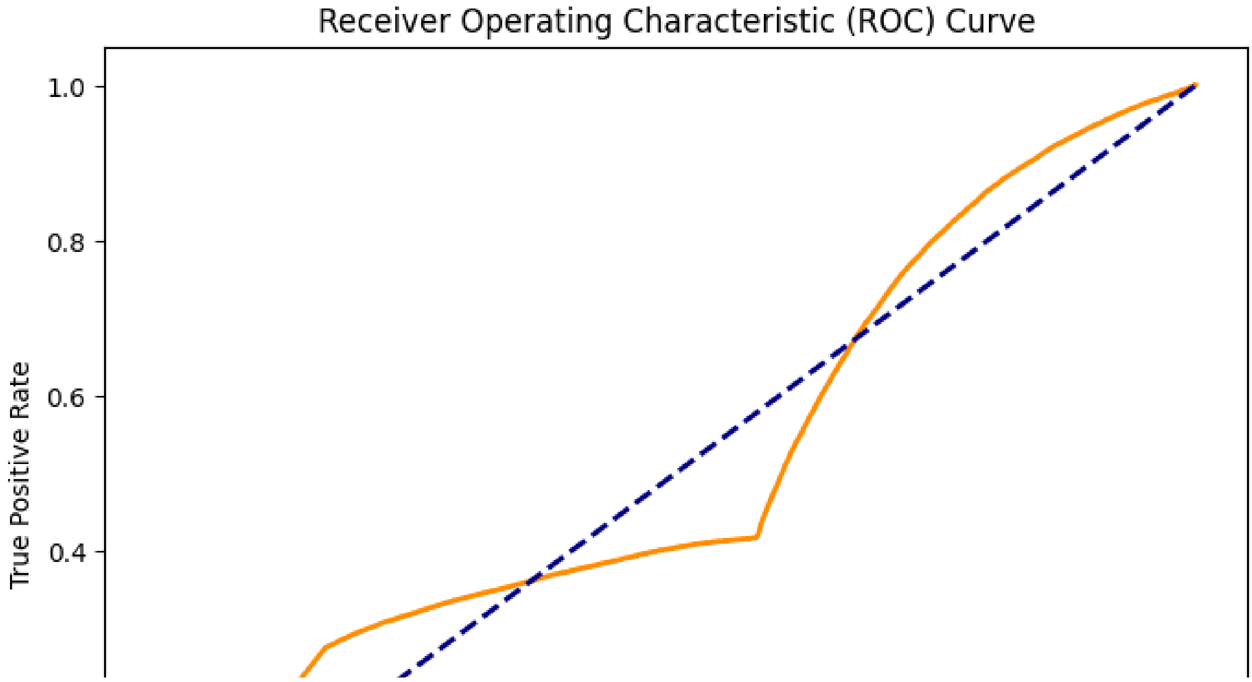
In [230]:

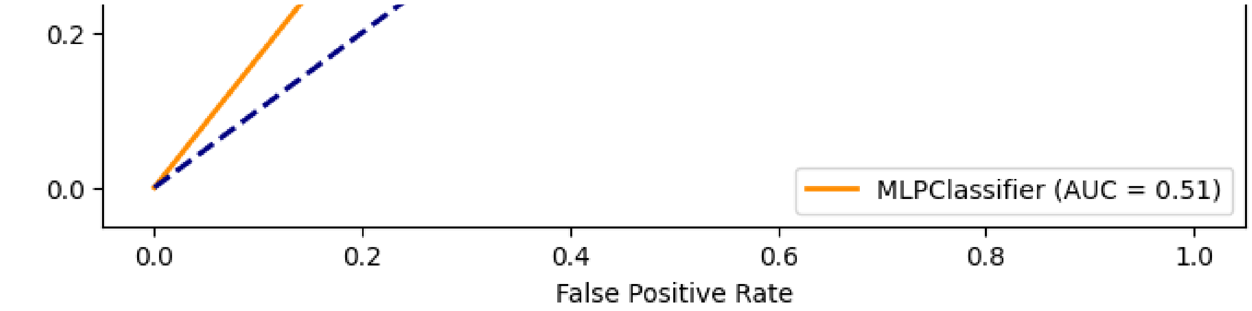
```
plot_roc_curve(X, Y, gnb, 'GaussianNB')
```



In [231]:

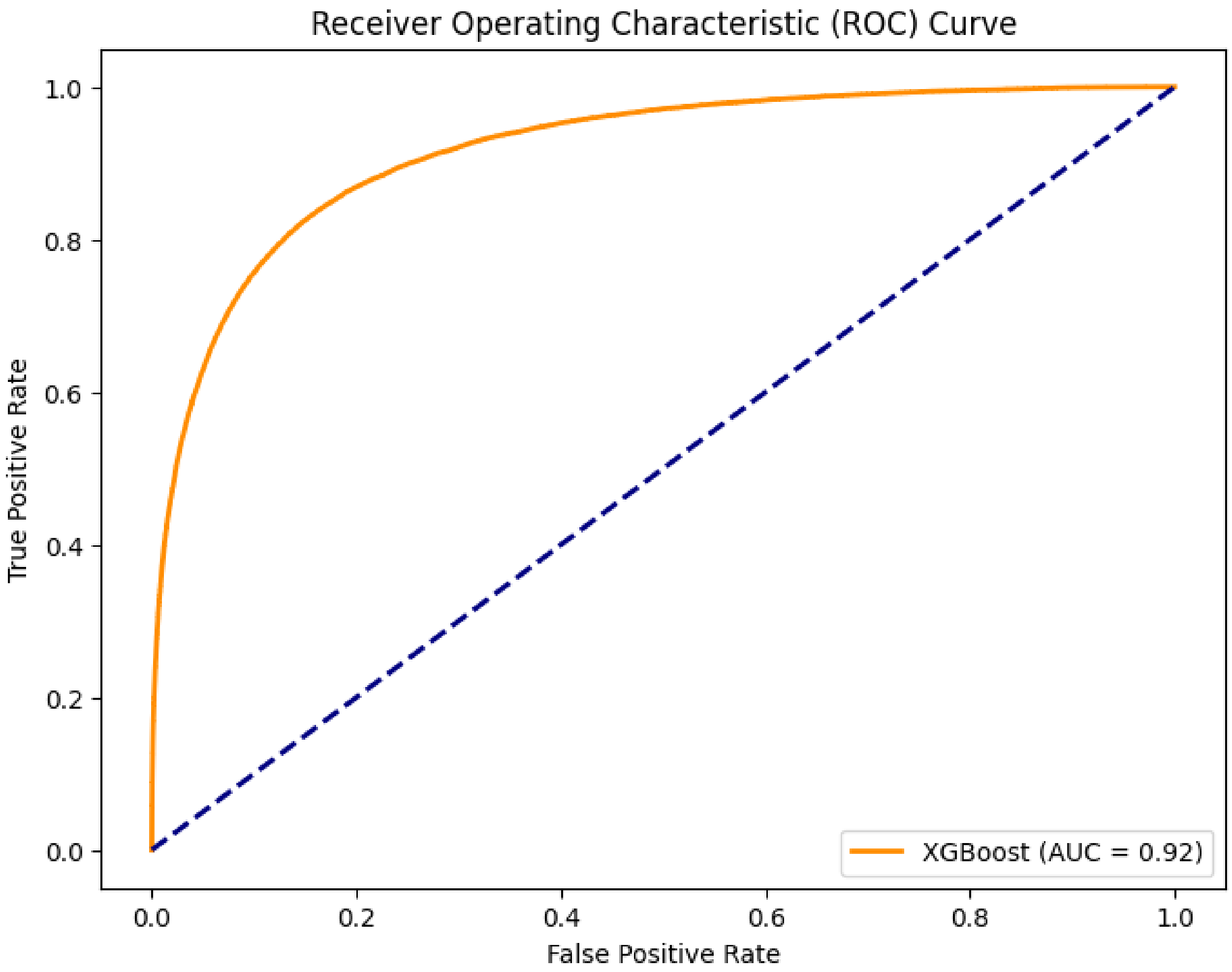
```
plot_roc_curve(X, Y, mlp, 'MLPClassifier')
```





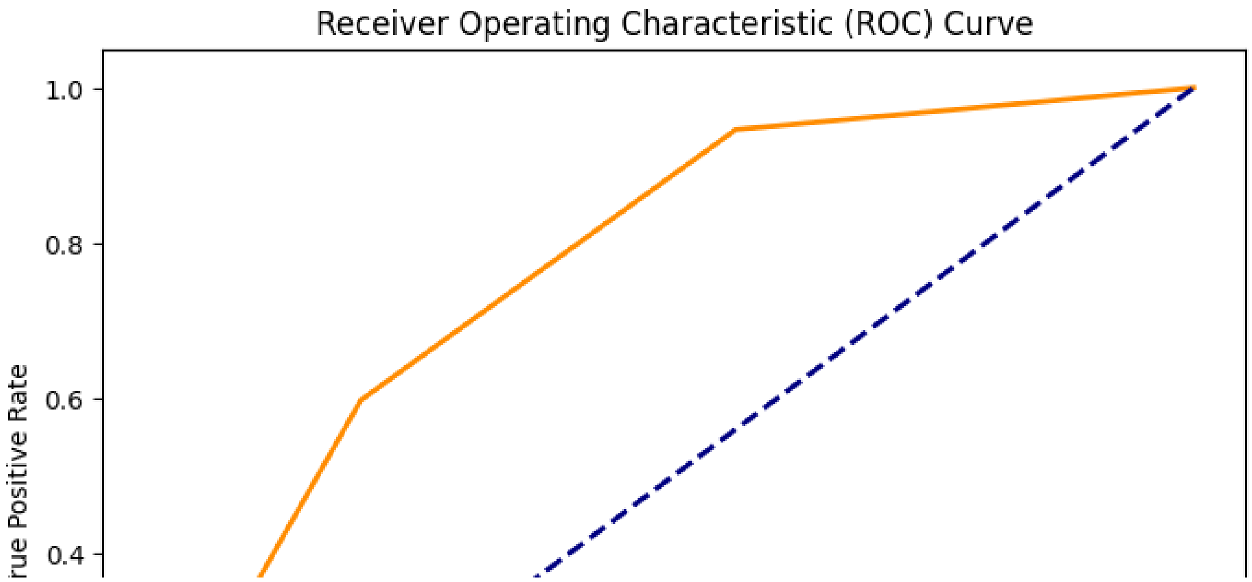
In [232]:

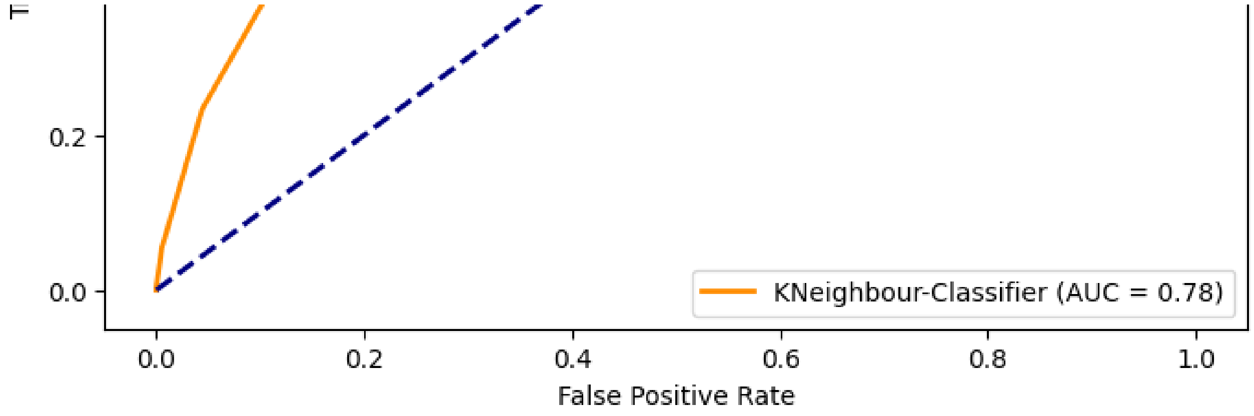
```
plot_roc_curve(X, Y, xgb_model, 'XGBoost')
```



In [233]:

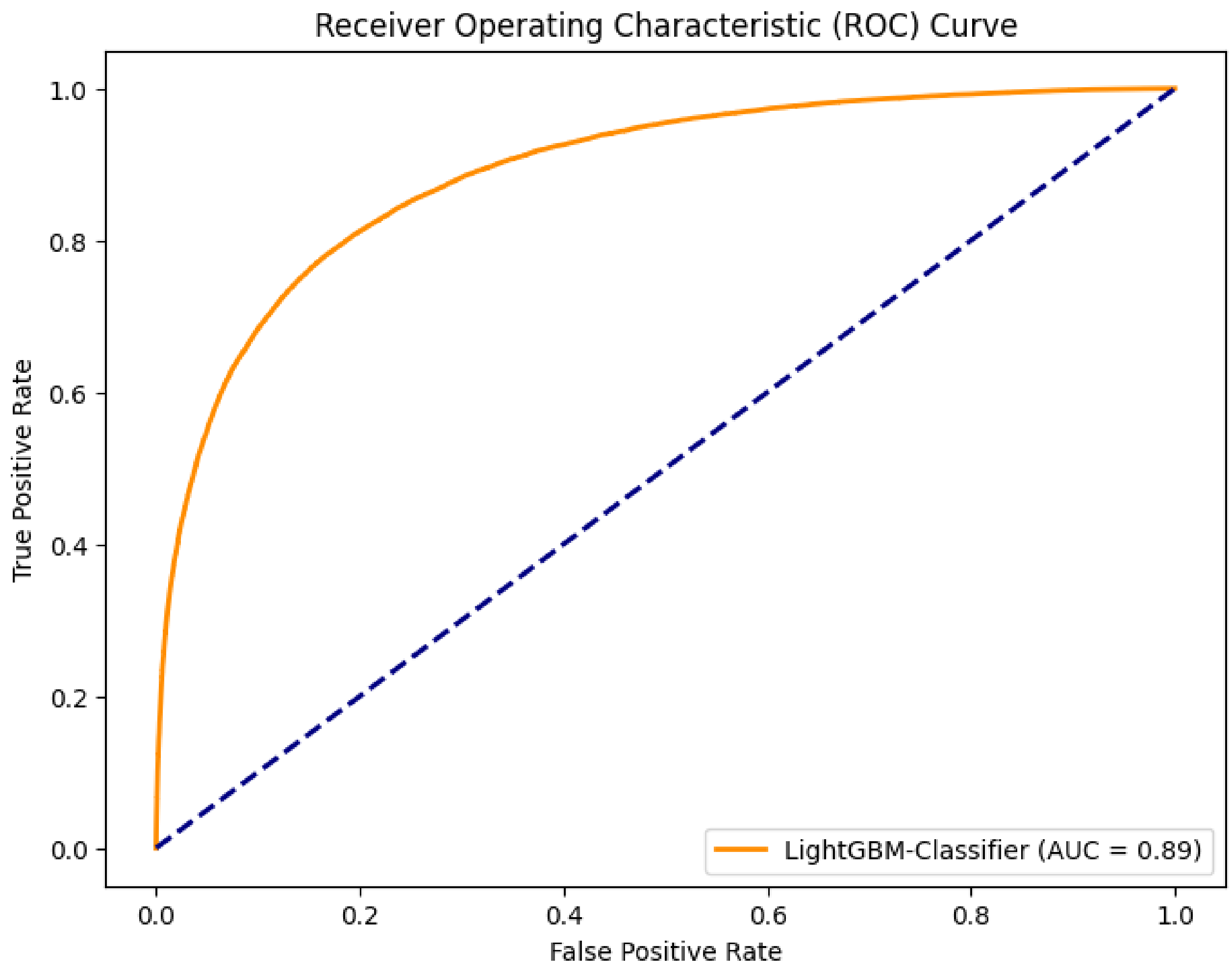
```
plot_roc_curve(X, Y, knn, 'KNeighbour-Classifier')
```





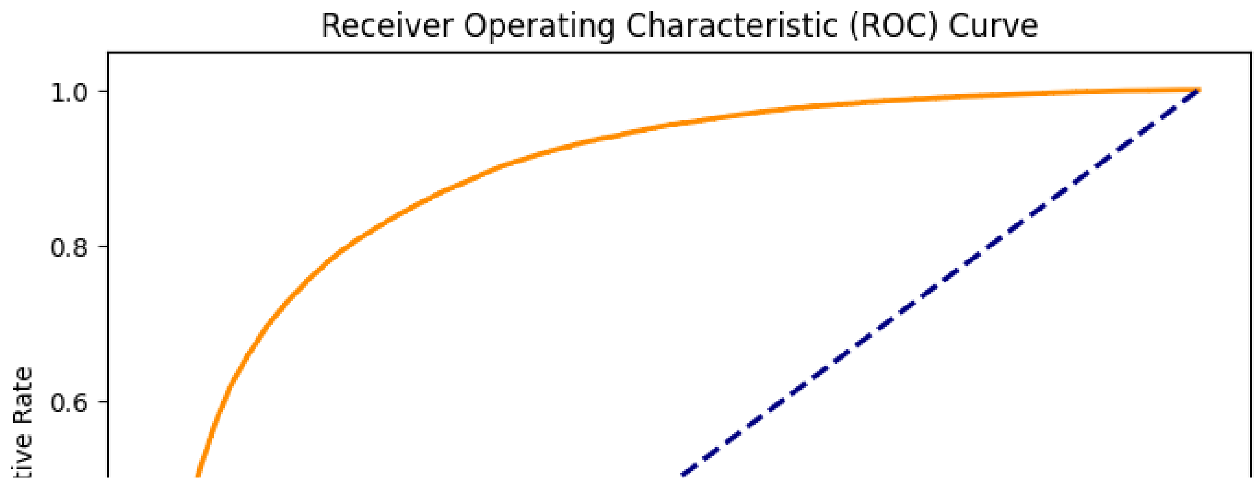
In [234]:

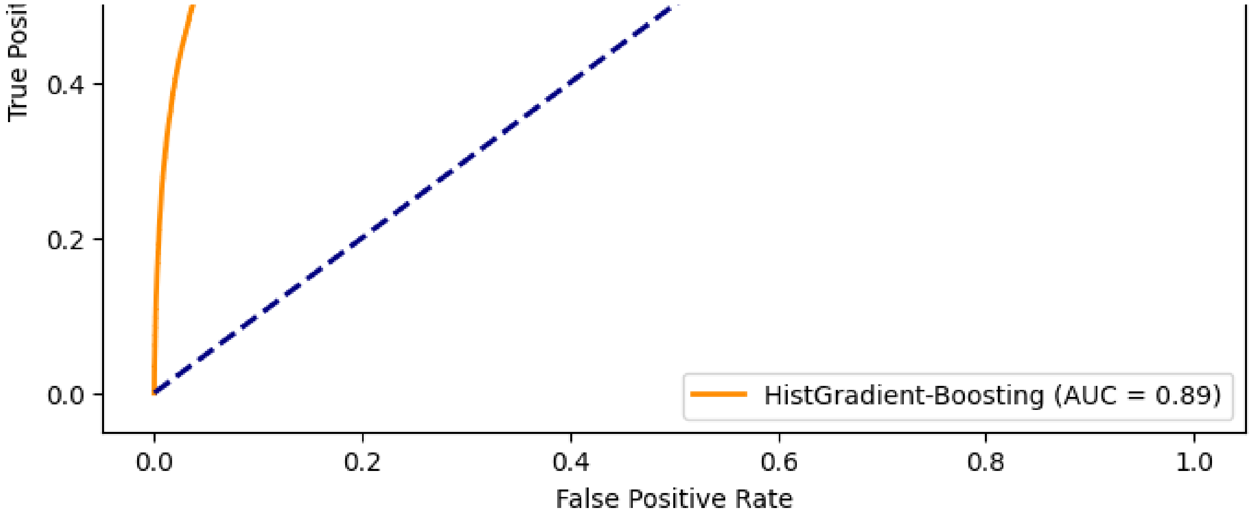
```
plot_roc_curve(X, Y, lgb_model, 'LightGBM-Classifier')
```



In [235]:

```
plot_roc_curve(X, Y, hist_grad_boost, 'HistGradient-Boosting')
```




True Posi
0.4
0.2
0.0
HistGradient-Boosting (AUC = 0.89)
0.0
0.2
0.4
0.6
0.8
1.0
False Positive Rate

Evaluation and Tuning

1. **Performance Metrics:**
   - **Ensemble models are evaluated using appropriate performance metrics, such as accuracy, precision, recall, F1-score, or area under the ROC curve (AUC-ROC).**
2. **Hyperparameter Tuning:**
   - **Fine-tuning hyperparameters is essential for optimizing ensemble model performance. Techniques like grid search or random search can be employed.**

```
In [254]:
```

```
filtered_models
```

Out[254]:

|  | Model | Accuracy | Precision | object |
|---|---|---|---|---|
| 7 | XGBoost | 0.865392 | 0.747999 | XGBClassifier(base_score=None, booster=None, c... |
| 9 | LightGBM | 0.864241 | 0.754422 | LGBMClassifier(max_depth=3, random_state=42) |
| 10 | Gradient-Boosting | 0.865059 | 0.746013 | ([DecisionTreeRegressor(criterion='friedman_ms... |
| 11 | HistGradient-Boosting | 0.865513 | 0.749951 | HistGradientBoostingClassifier(max_depth=4, ra... |

In [255]:

```
model_performance
```

Out[255]:

|  | Model | 10-folds oof ROC-AUC |
|---|---|---|
| 7 | XGBoost | 0.888206 |
| 9 | LightGBM | 0.888502 |
| 10 | Gradient-Boosting | 0.889307 |
| 11 | HistGradient-Boosting | 0.889244 |

In [261]:

```
# Initialize a list to store ensemble models
ensemble_models = []
for model, name in zip(filtered_models['object'],filtered_models['Model']):
    ensemble_models.append((name, model))
```

In [262]:

```
ensemble_models
```

Out[262]:

```
[('XGBoost',
  XGBClassifier(base_score=None, booster=None, callbacks=None,
                colsample_bylevel=None, colsample_bynode=None,
                colsample_bytree=0.3, device=None, early_stopping_rounds=None,
                enable_categorical=False, eval_metric='auc', feature_types=None,
                gamma=1.0, grow_policy=None, importance_type=None,
                interaction_constraints=None, learning_rate=0.05, max_bin=None,
                max_cat_threshold=None, max_cat_to_onehot=None,
                max_delta_step=None, max_depth=10, max_leaves=None,
                min_child_weight=None, missing=nan, monotone_constraints=None,
                multi_strategy=None, n_estimators=2048, n_jobs=-1,
                num_parallel_tree=None, random_state=42, ...)),
 ('LightGBM', LGBMClassifier(max_depth=3, random_state=42)),
 ('Gradient-Boosting',
  GradientBoostingClassifier(max_depth=4, min_samples_leaf=5, random_state=1,
                             subsample=0.8)),
 ('HistGradient-Boosting',
  HistGradientBoostingClassifier(max_depth=4, random_state=10))]
```

In [263]:

```
# Initialize Voting Classifier:-
voting_md = VotingClassifier(estimators=ensemble_models, voting='soft')
```

In [264]:

```
# Cross-Validation and Print ROC-AUC Score:
vot_cv = cross_val_score(voting_md, X, Y, cv=skf, scoring='roc_auc', n_jobs=-1)
```

```
print(f"The 10 folds oof ROC-AUC score of Voting Classifier is {vot_cv.mean()}")
```

```
The 10 folds oof ROC-AUC score of Voting Classifier is 0.890193038687492
```

In [266]:

```
# Initialize Lists for Metrics:-
roc_auc_list = []
accuracy_list = []
precision_list = []
recall_list = []
```

In [267]:

```
# Iterate Over Folds for Cross-Validation:-
for train_idx, val_idx in skf.split(X, Y):
    X_train, X_val = X.iloc[train_idx], X.iloc[val_idx]
    y_train, y_val = Y.iloc[train_idx], Y.iloc[val_idx]
```

In [276]:

```
# Fitting Ensemble Model and Evaluate Metrics:-
vot_md = voting_md.fit(X_train, y_train)

y_val_pred_proba = vot_md.predict_proba(X_val)[:, 1]
fpr, tpr, _ = roc_curve(y_val, y_val_pred_proba)
roc_auc = auc(fpr, tpr)
roc_auc_list.append(roc_auc)
```

```
[LightGBM] [Info] Number of positive: 31429, number of negative: 117102
[LightGBM] [Info] Auto-choosing col-wise multi-threading, the overhead of testing was 0.0
11983 seconds.
You can set `force_col_wise=true` to remove the overhead.
[LightGBM] [Info] Total Bins 859
[LightGBM] [Info] Number of data points in the train set: 148531, number of used features
: 11
[LightGBM] [Info] [binary:BoostFromScore]: pavg=0.211599 -> initscore=-1.315314
[LightGBM] [Info] Start training from score -1.315314
[LightGBM] [Warning] No further splits with positive gain, best gain: -inf
```

In [277]:

```
y_val_pred = vot_md.predict(X_val)
accuracy_list.append(accuracy_score(y_val, y_val_pred))
precision_list.append(precision_score(y_val, y_val_pred))
recall_list.append(recall_score(y_val, y_val_pred))
```

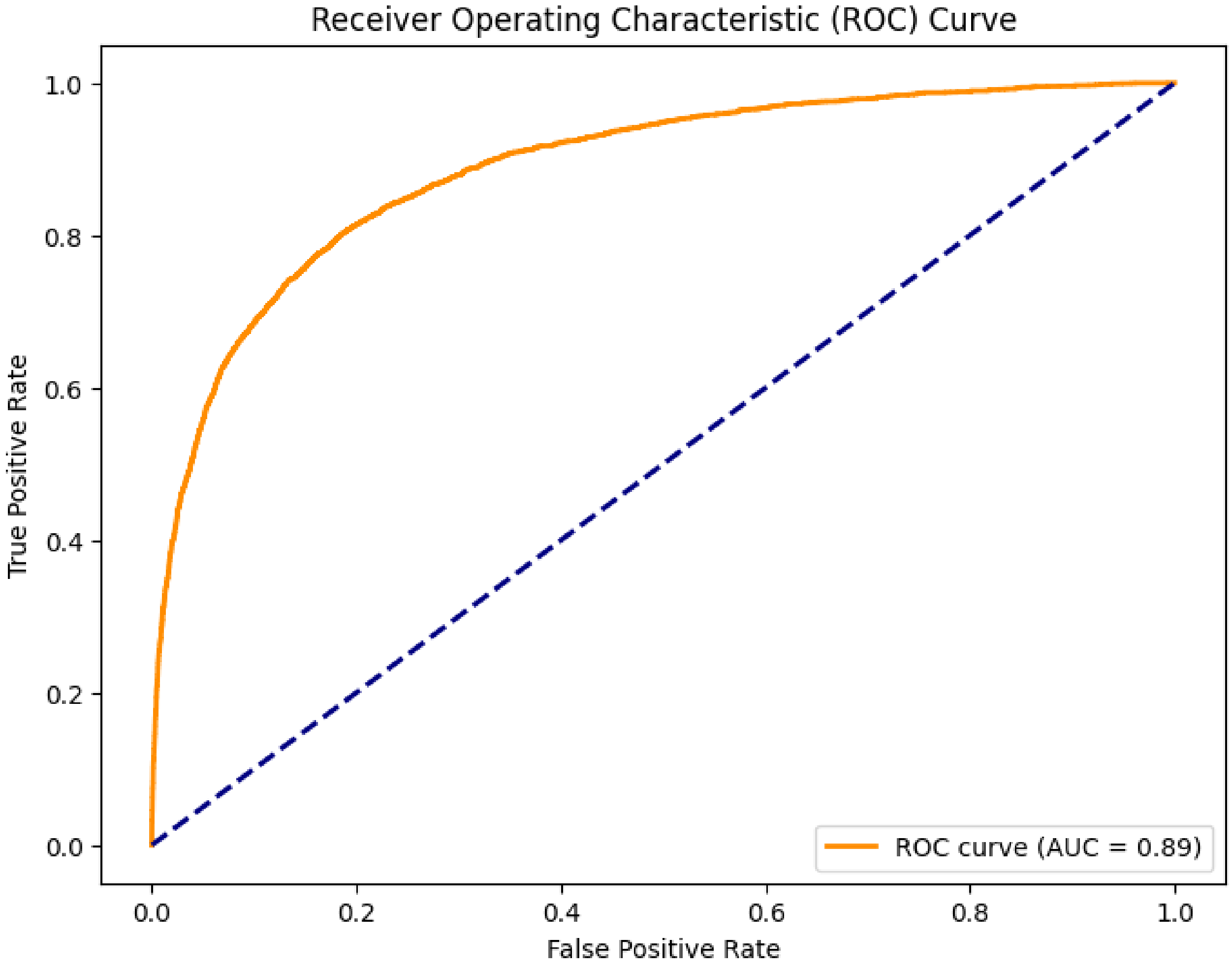
In [278]:

```
print(f"Average ROC-AUC: {np.mean(roc_auc_list)}")
print(f"Average Accuracy: {np.mean(accuracy_list)}")
print(f"Average Precision: {np.mean(precision_list)}")
print(f"Average Recall: {np.mean(recall_list)}")
```

```
Average ROC-AUC: 0.8870105769168972
Average Accuracy: 0.8666303096406714
Average Precision: 0.7564560985299961
Average Recall: 0.54524627720504
```

In [279]:

```
# Plotting ROC curve
plt.figure(figsize=(8, 6))
plt.plot(fpr, tpr, color='darkorange', lw=2, label=f'ROC curve (AUC = {np.mean(roc_auc_l
ist):.2f})')
plt.plot([0, 1], [0, 1], color='navy', lw=2, linestyle='--')
plt.xlabel('False Positive Rate')
plt.ylabel('True Positive Rate')
plt.title('Receiver Operating Characteristic (ROC) Curve')
plt.legend(loc='lower right')
plt.show()
```



In [281]:

```
# Processing the test dataset for making predictions
test_md = test.drop(columns=['id', 'CustomerId', 'Surname'], axis=1)
test_md['Gender'] = test_md['Gender'].map({'Female': 0, 'Male': 1})
test_md = pd.concat([test_md.drop(columns=['Geography'], axis=1), pd.get_dummies(test_md
['Geography'], drop_first=True, dtype=int)], axis=1)
```

In [283]:

```
vot_pred = vot_md.predict_proba(test_md)[:, 1]
submission['Exited'] = vot_pred
submission.to_csv('Advanced_ensemble_sub_2.csv', index=False)
```

In [ ]:

```

```