attrition

April 25, 2024

[1]:
```
import math, time, random, datetime

# data analysis and wrangling
import pandas as pd
import numpy as np
from pandas_profiling import ProfileReport
```

[2]:
```
# visualization
import seaborn as sns
import matplotlib.pyplot as plt
plt.style.use('seaborn-whitegrid')

#import for interactive plotting
import plotly.offline as py
py.init_notebook_mode(connected=True)
import plotly.graph_objs as go
import plotly.tools as tls
import plotly.figure_factory as ff
from plotly.subplots import make_subplots
%matplotlib inline
```

[3]:
```
# Preprocessing
from sklearn.preprocessing import OneHotEncoder, LabelEncoder, label_binarize,␣
 ↪StandardScaler
```

[4]:
```
# machine learning
from sklearn import model_selection, tree, preprocessing, metrics, linear_model
from sklearn.metrics import confusion_matrix,classification_report
from sklearn.svm import SVC, LinearSVC
from sklearn.ensemble import RandomForestClassifier, GradientBoostingClassifier
from sklearn.neighbors import KNeighborsClassifier
from sklearn.naive_bayes import GaussianNB
from sklearn.linear_model import Perceptron,SGDClassifier,LogisticRegression
from sklearn.tree import DecisionTreeClassifier
from sklearn.model_selection import train_test_split,StratifiedKFold,␣
 ↪GridSearchCV, learning_curve, cross_val_score
from catboost import CatBoostClassifier, Pool, cv
```

[5]:
```
# ignore Warnings
import warnings
warnings.filterwarnings('ignore')
```

1 Import and Inspect Data

[6]:
```
df = pd.read_csv("Data/WA_Fn-UseC_-HR-Employee-Attrition.csv")
```

[7]:
```
df.head()
```

[7]:

	Age	Attrition	BusinessTravel	DailyRate	Department	\
0	41	Yes	Travel_Rarely	1102	Sales	
1	49	No	Travel_Frequently	279	Research & Development	
2	37	Yes	Travel_Rarely	1373	Research & Development	
3	33	No	Travel_Frequently	1392	Research & Development	
4	27	No	Travel_Rarely	591	Research & Development	

	DistanceFromHome	Education	EducationField	EmployeeCount	EmployeeNumber	\
0	1	2	Life Sciences	1	1	
1	8	1	Life Sciences	1	2	
2	2	2	Other	1	4	
3	3	4	Life Sciences	1	5	
4	2	1	Medical	1	7	

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

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

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

[5 rows x 35 columns]

[8]:
```
df.shape
```

[8]:
```
(1470, 35)
```

2 Exploratory Data Analysis

[9]:
```
ProfileReport(df)
```

[9]:
```
<pandas_profiling.ProfileReport at 0x20dbfded278>
```

- Job level is strongly correlated with total working hours
- Monthly income is strongly correlated with Job level
- Monthly income is strongly correlated with total working hours
- Age is stongly correlated with monthly income

[10]:
```
# drop the unnecessary columns
df.
  ↪drop(['EmployeeNumber','Over18','StandardHours','EmployeeCount'],axis=1,inplace=True)
```

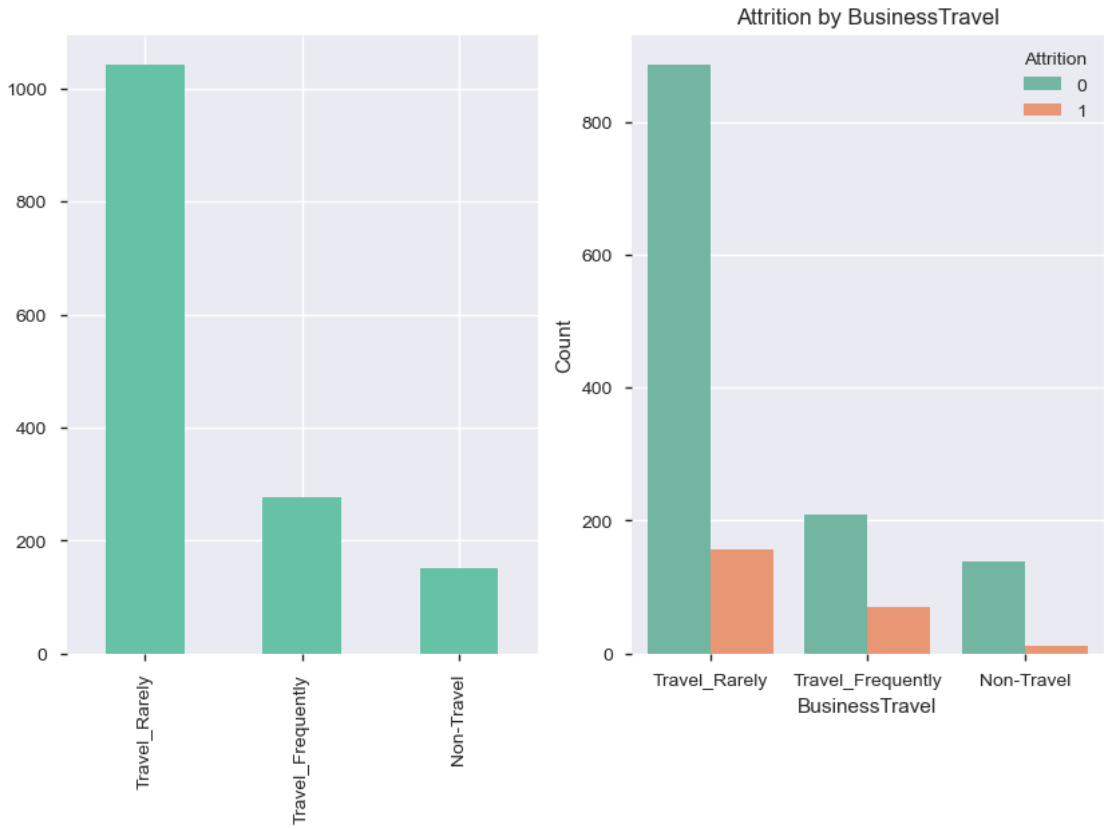
[11]:
```
df['Attrition'] = df['Attrition'].apply(lambda x:1 if x == "Yes" else 0 )
df['OverTime'] = df['OverTime'].apply(lambda x:1 if x =="Yes" else 0 )
```

[12]:
```
attrition = df[df['Attrition'] == 1]
no_attrition = df[df['Attrition']==0]
```

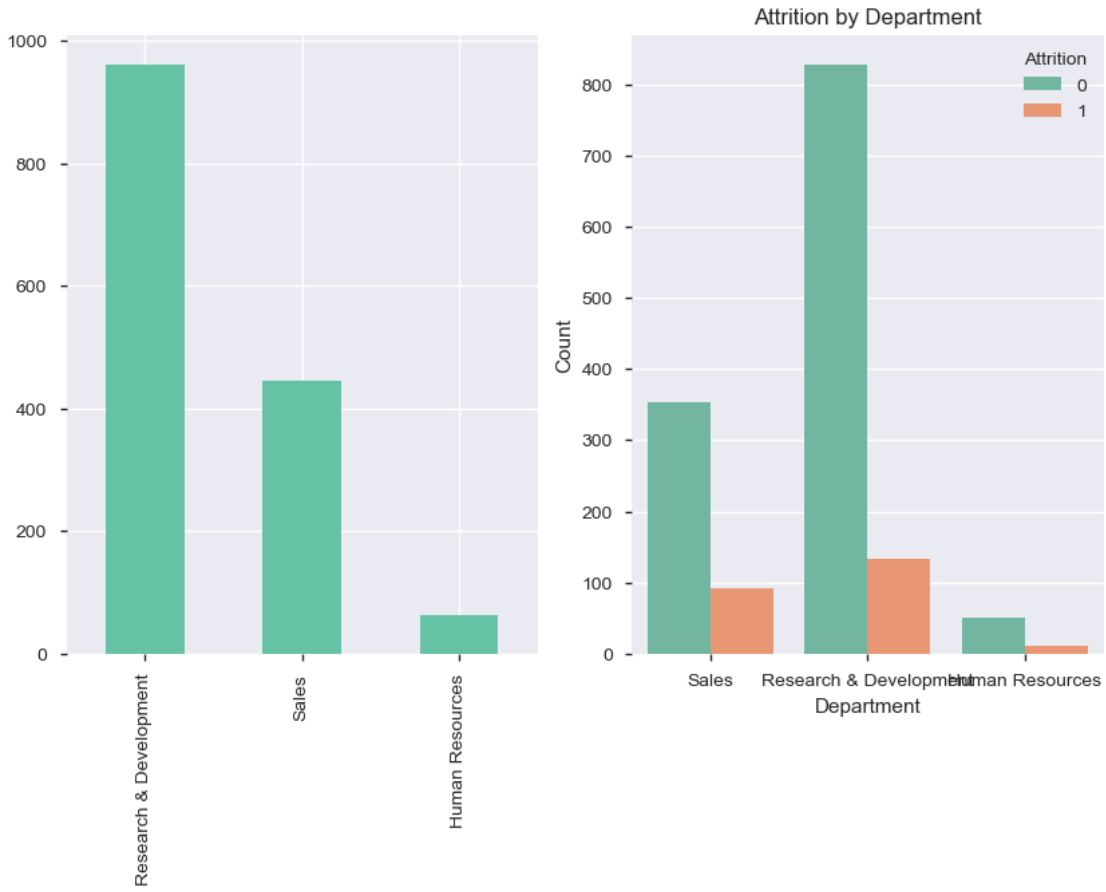
2.0.1 Visualization of Categorical Features

[13]:
```
def categorical_column_viz(col_name):

    f,ax = plt.subplots(1,2, figsize=(10,6))

    # Count Plot
    df[col_name].value_counts().plot.bar(cmap='Set2',ax=ax[0])
    ax[1].set_title(f'Number of Employee by {col_name}')
    ax[1].set_ylabel('Count')
    ax[1].set_xlabel(f'{col_name}')

    # Attrition Count per factors
    sns.countplot(col_name, hue='Attrition',data=df, ax=ax[1], palette='Set2')
    ax[1].set_title(f'Attrition by {col_name}')
    ax[1].set_xlabel(f'{col_name}')
    ax[1].set_ylabel('Count')
```

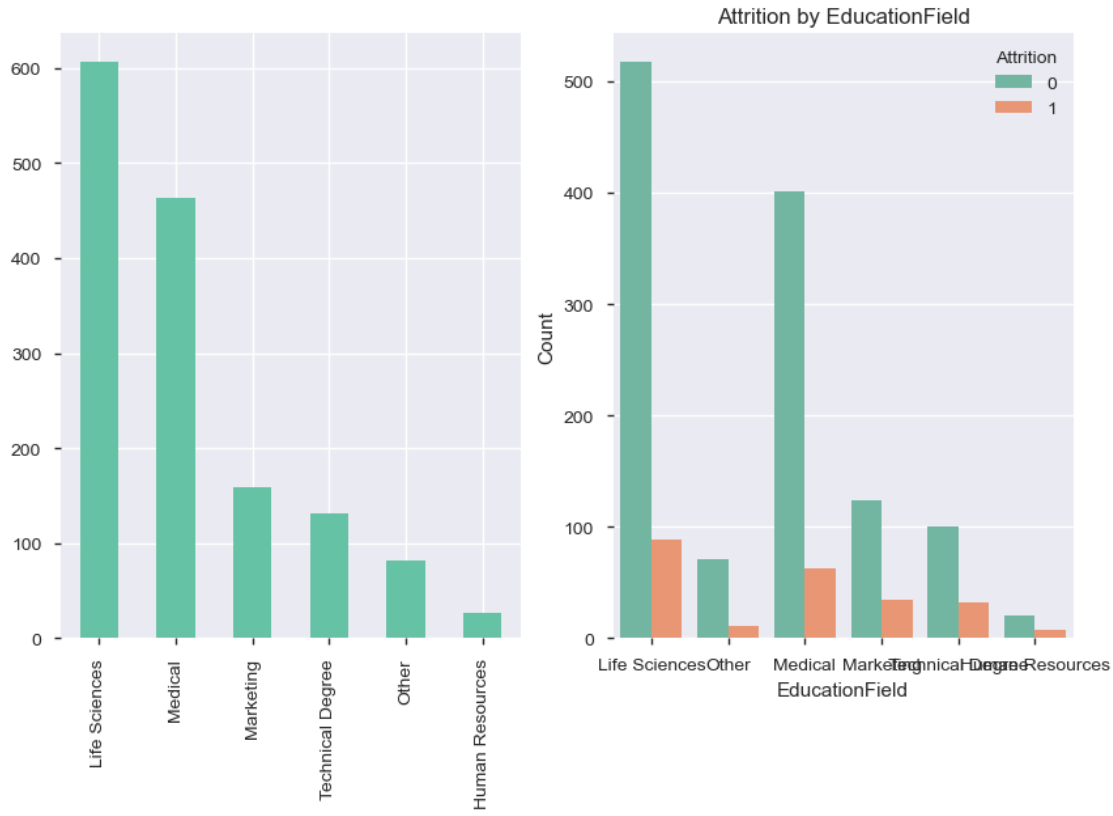
[14]:
```
categorical_column_viz('BusinessTravel')
```



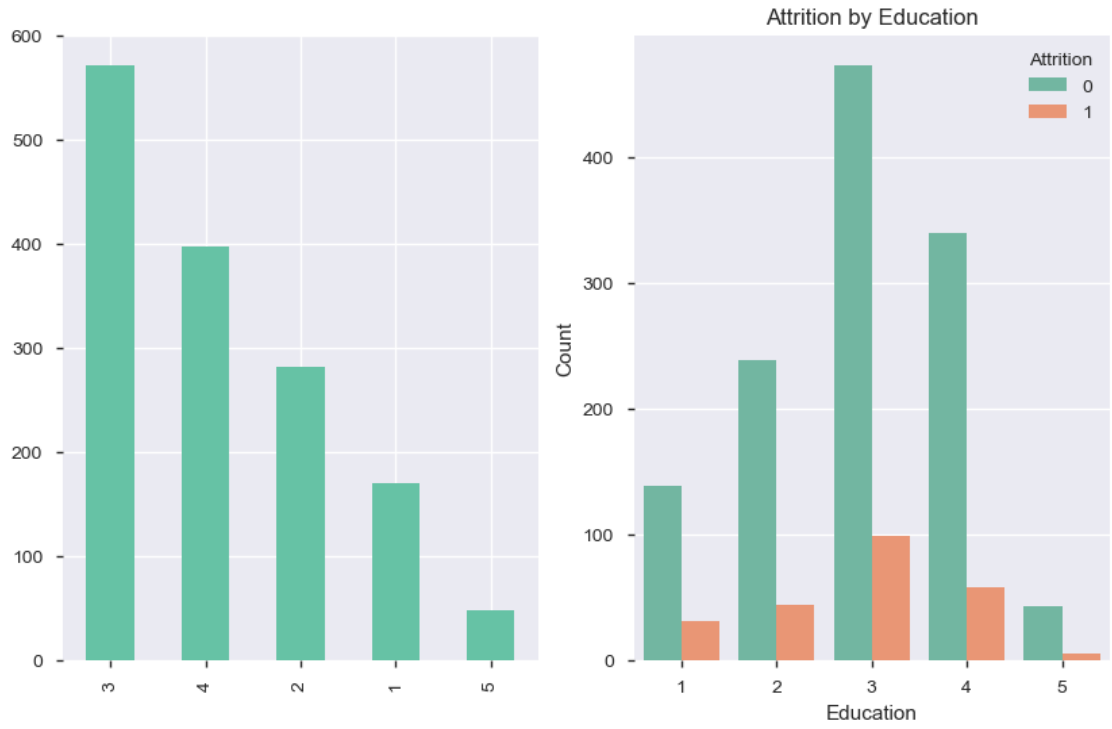
[15]:
```
categorical_column_viz('Department')
```



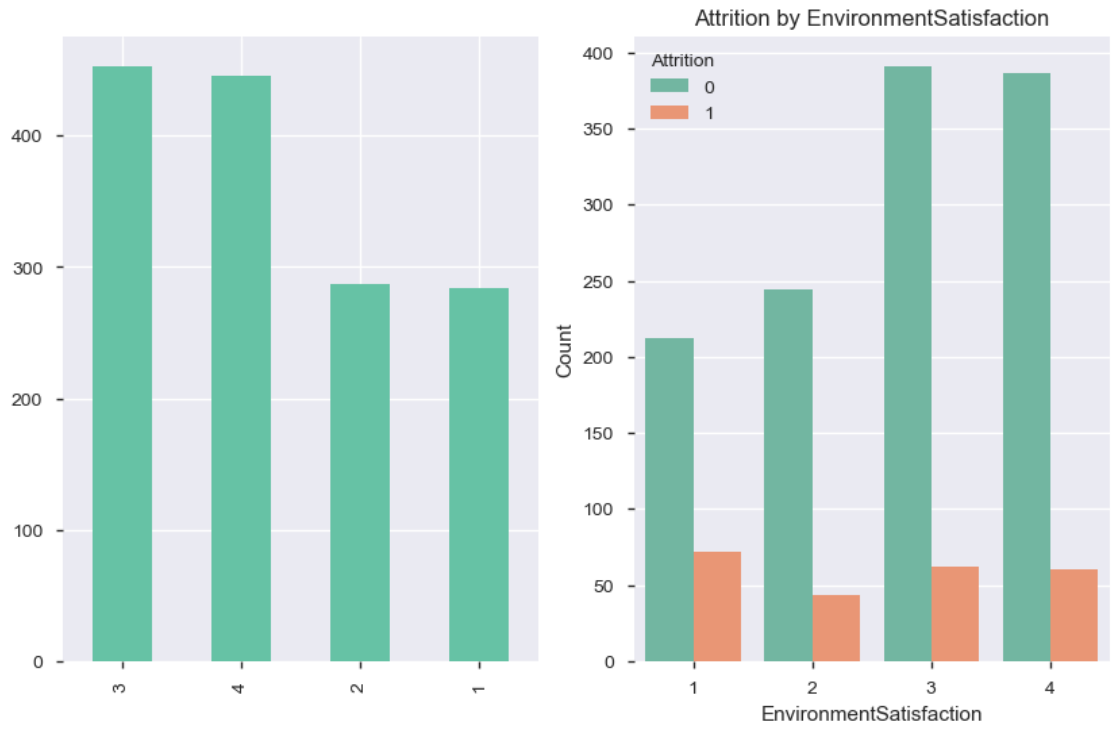
[16]:
```
categorical_column_viz('EducationField')
```



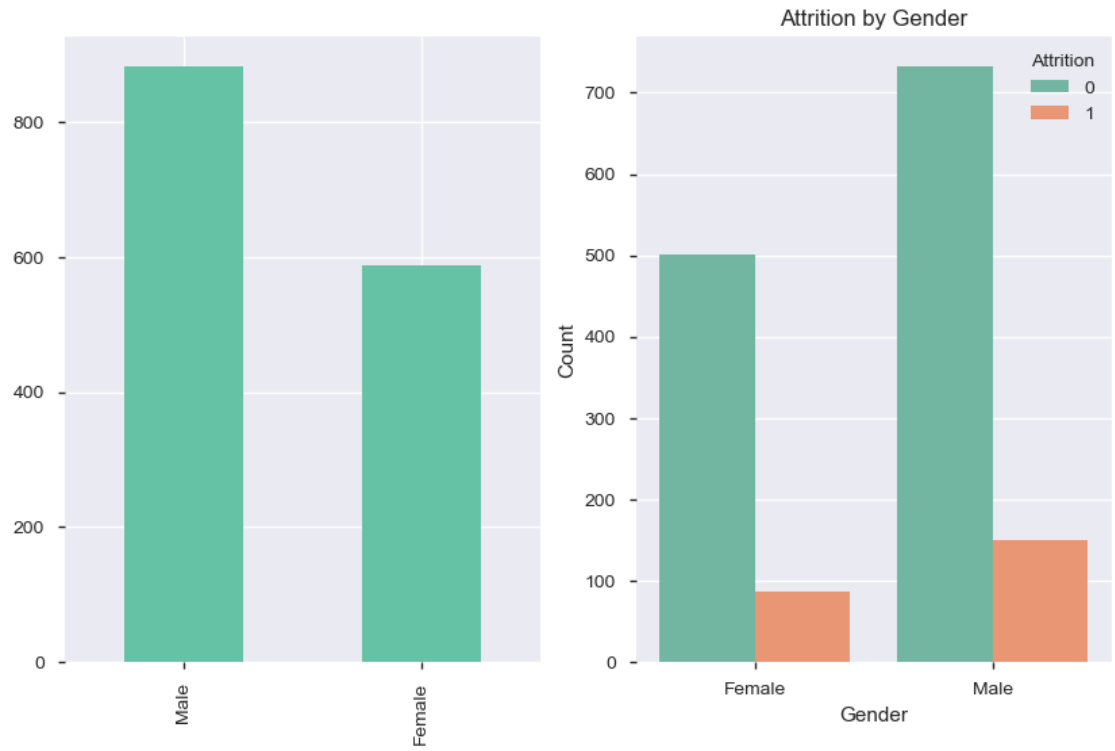
[17]:
```
categorical_column_viz('Education')
```



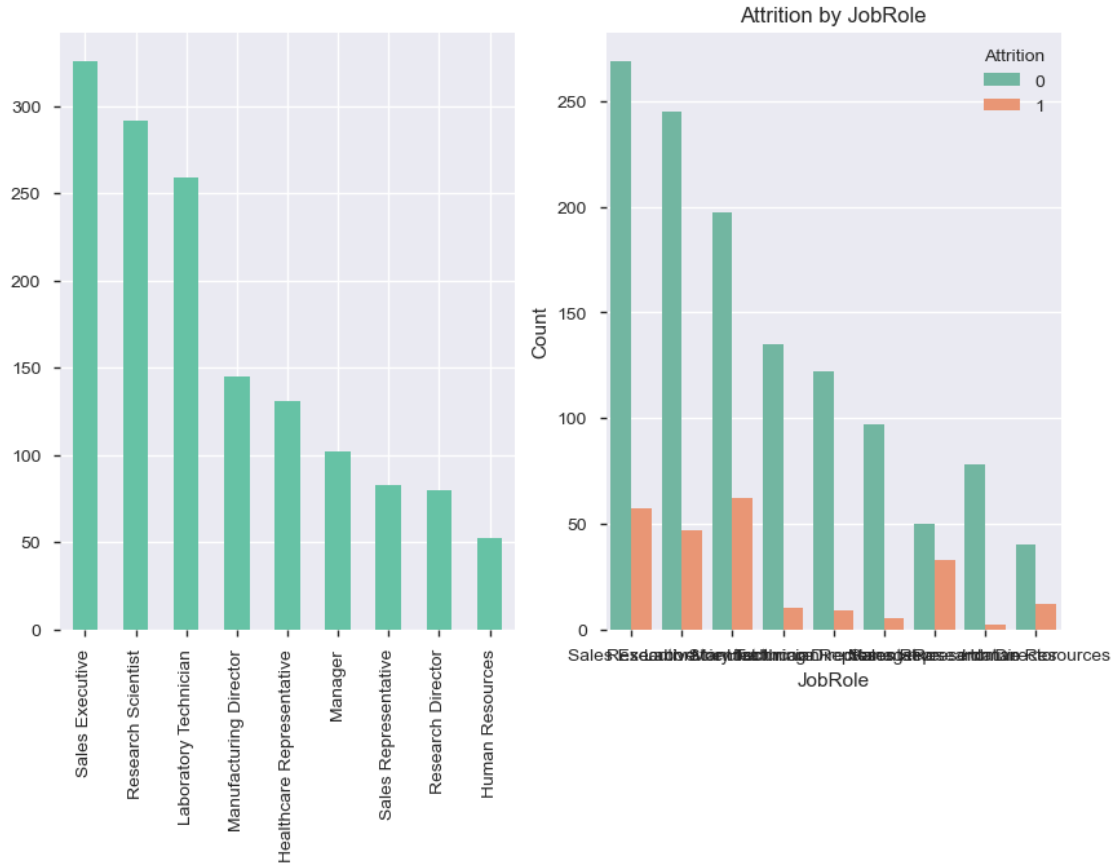
[18]:
```
categorical_column_viz('EnvironmentSatisfaction')
```



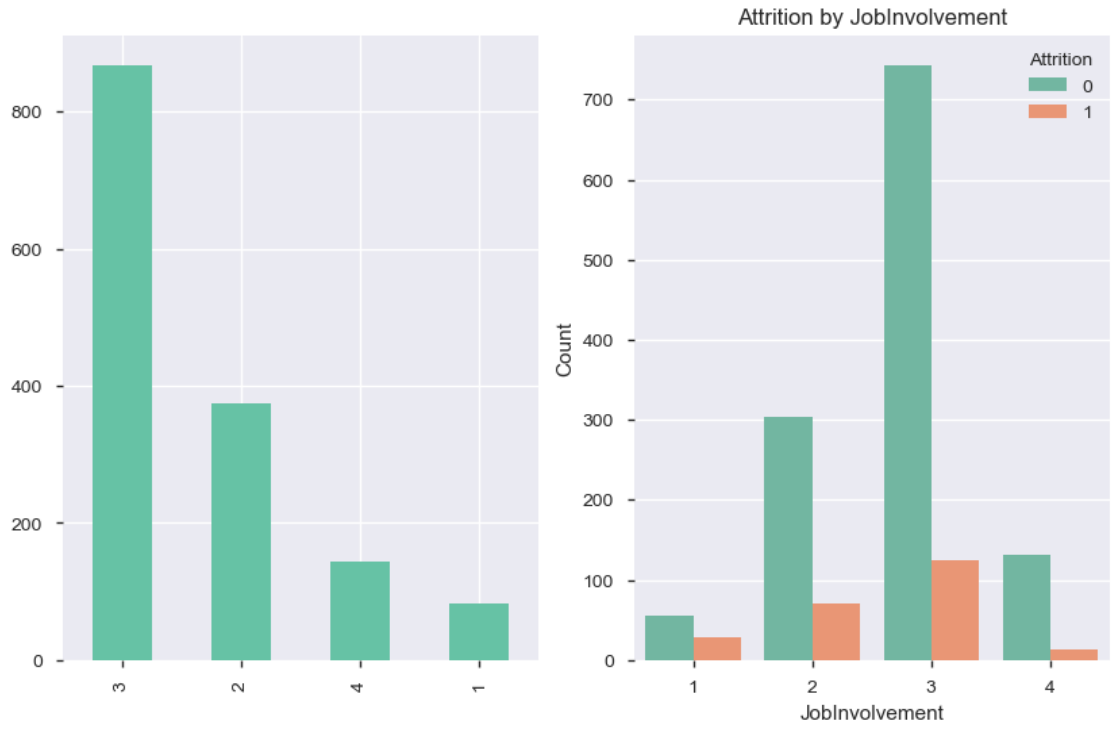
[19]:
```
categorical_column_viz('Gender')
```



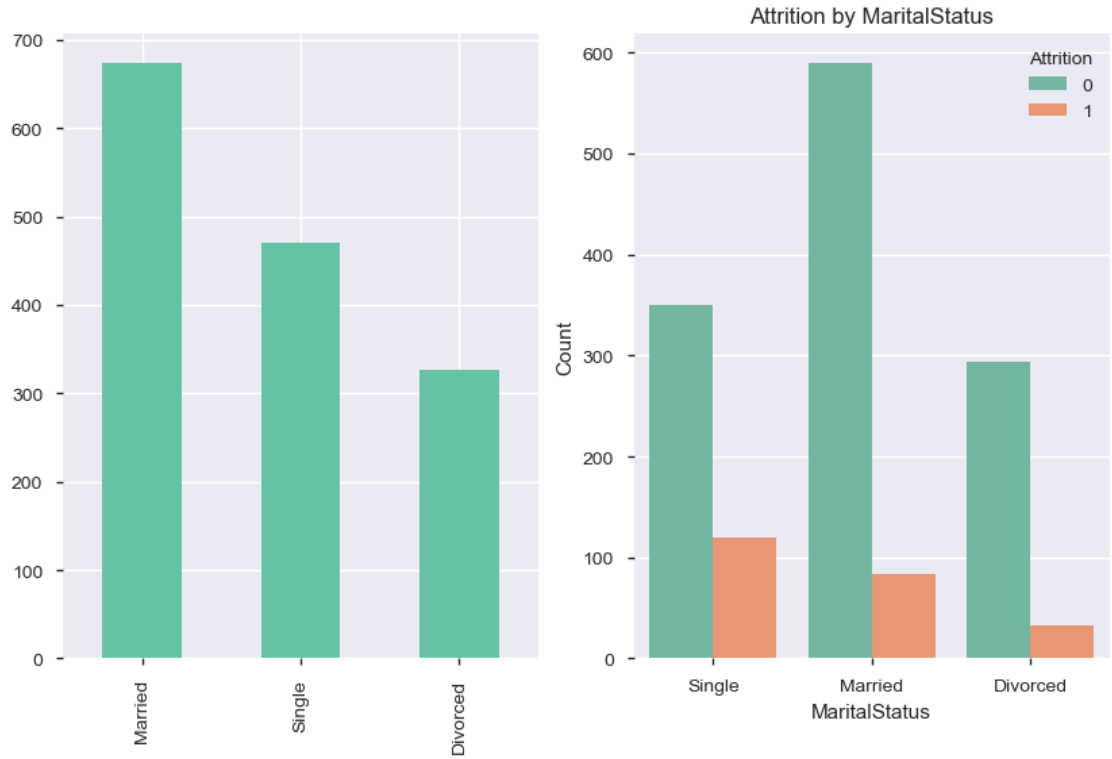
[20]:
```
categorical_column_viz('JobRole')
```



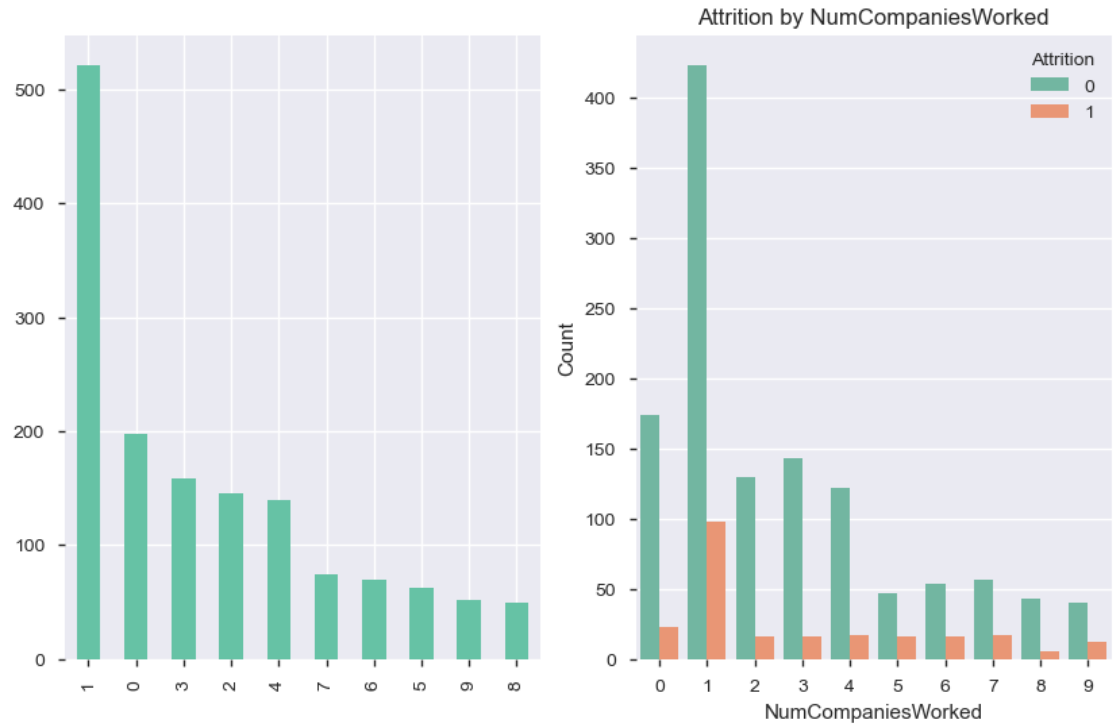
[21]:
```
categorical_column_viz('JobInvolvement')
```



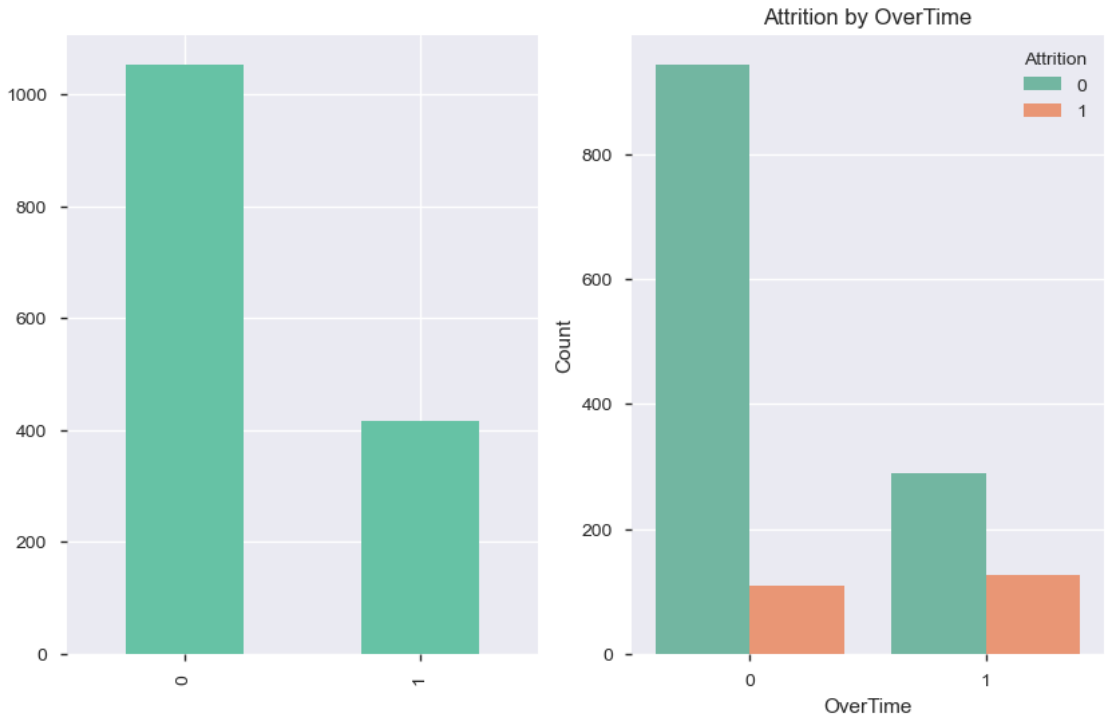
[22]:
```
categorical_column_viz('MaritalStatus')
```



[23]:
```
categorical_column_viz('NumCompaniesWorked')
```



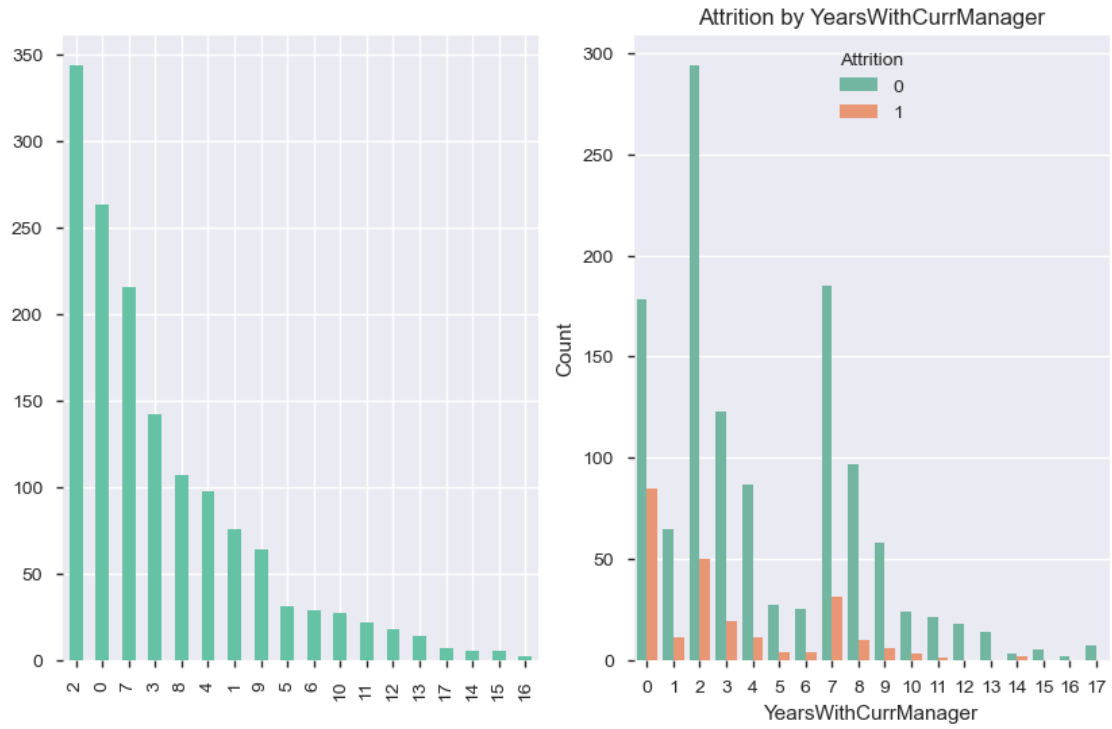
[24]:
```
categorical_column_viz('OverTime')
```



[25]:
```
categorical_column_viz('StockOptionLevel')
```

[26]:
```
categorical_column_viz('TrainingTimesLastYear')
```

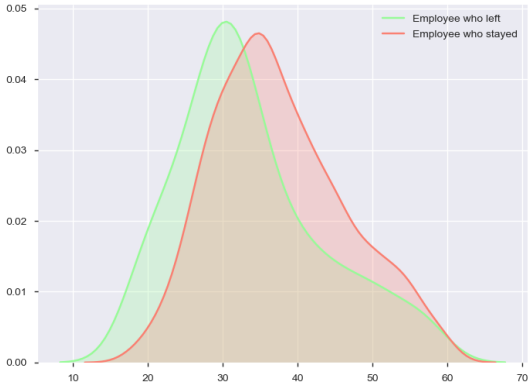
[27]:
```
categorical_column_viz('YearsWithCurrManager')
```

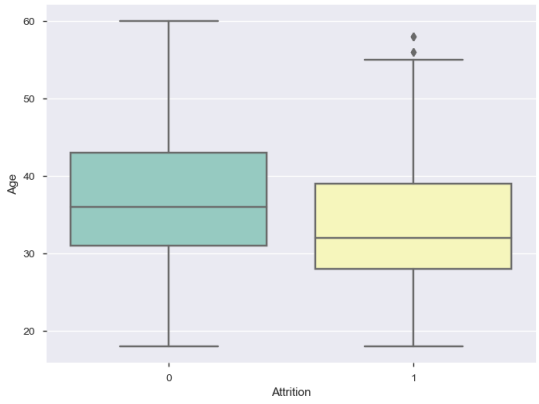


2.0.2 Visualization of Numerical Features

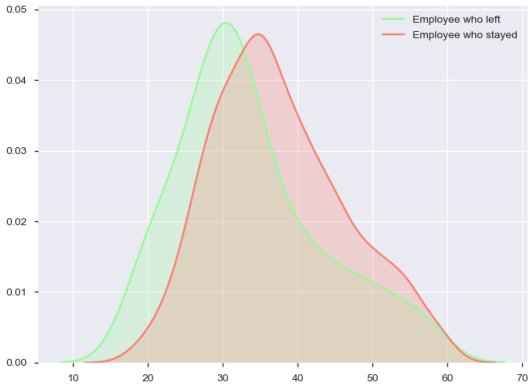
[28]:
```
def numerical_column_viz(col_name):
    f,ax = plt.subplots(1,2, figsize=(18,6))
    sns.kdeplot(attrition[col_name], label='Employee who left',ax=ax[0],␣
 ↪shade=True, color='palegreen')
    sns.kdeplot(no_attrition[col_name], label='Employee who stayed', ax=ax[0],␣
 ↪shade=True, color='salmon')

    sns.boxplot(y=col_name, x='Attrition',data=df, palette='Set3', ax=ax[1])
```

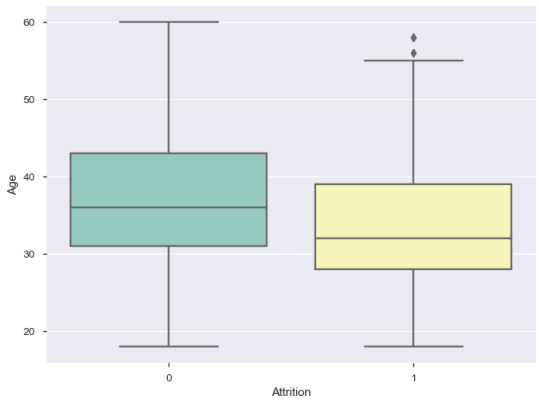
[29]:
```
numerical_column_viz("Age")
```



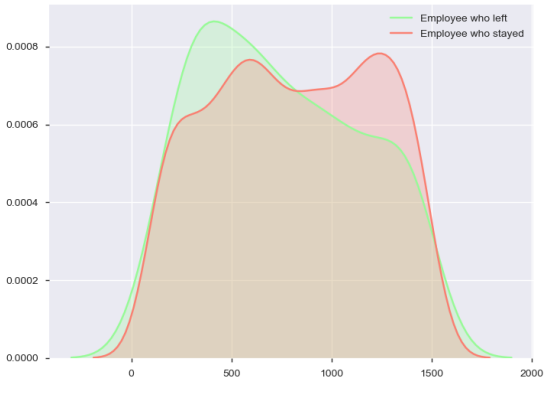


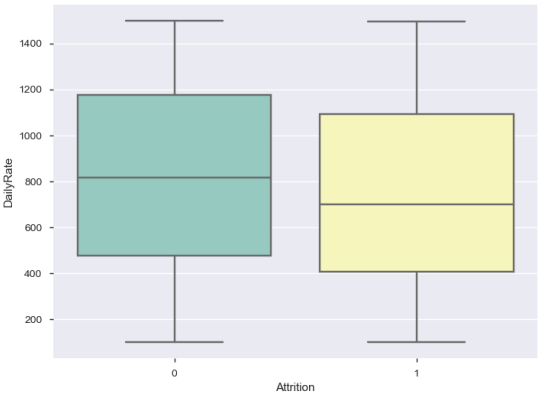
[30]:
```
numerical_column_viz("Age")
```



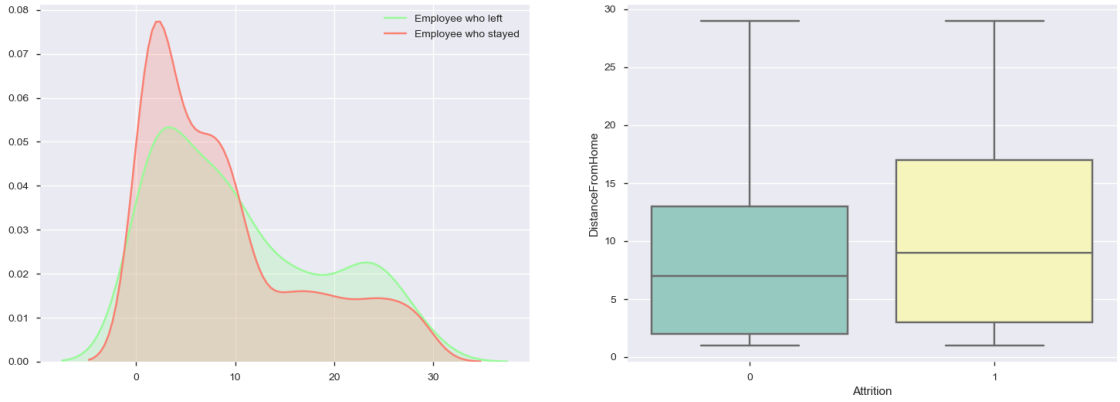


[31]:
```
numerical_column_viz("DailyRate")
```

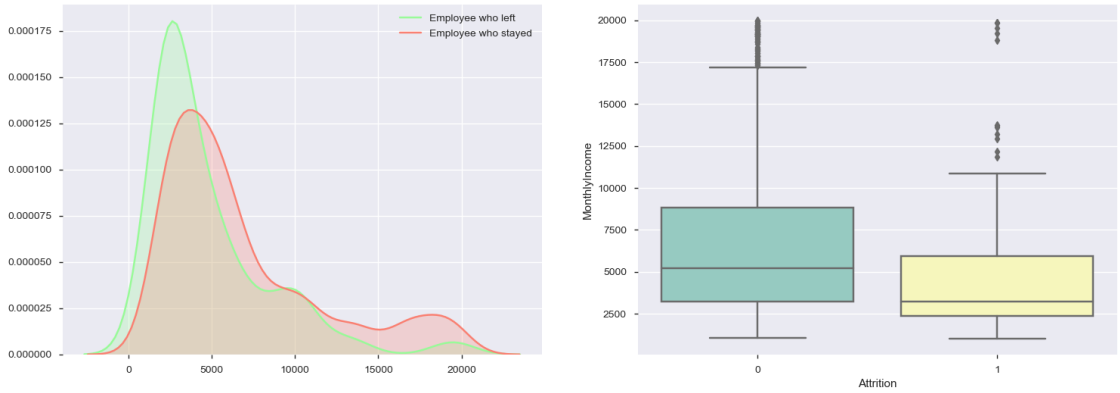




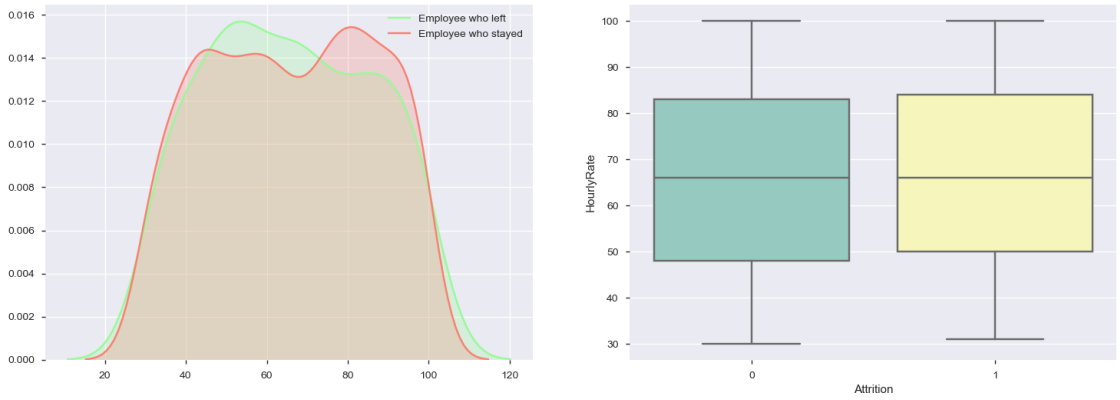
[32]:
```
numerical_column_viz("DistanceFromHome")
```



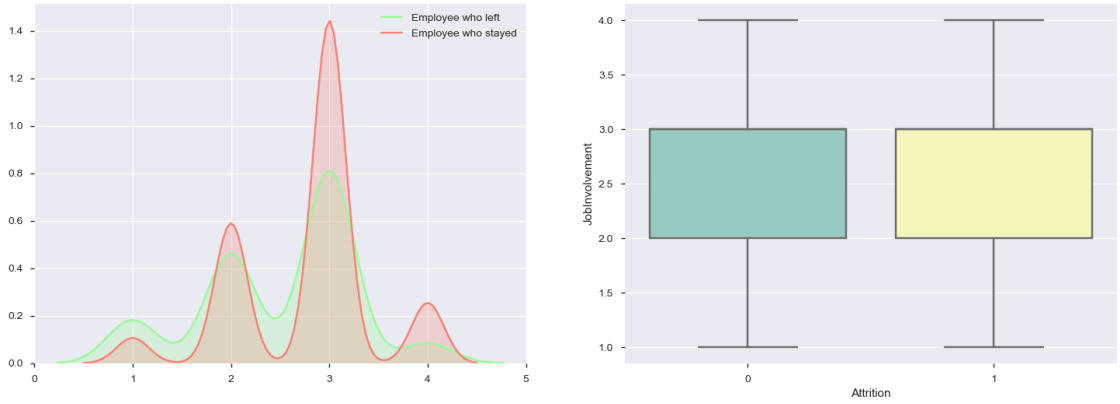
[33]:
```
numerical_column_viz("MonthlyIncome")
```



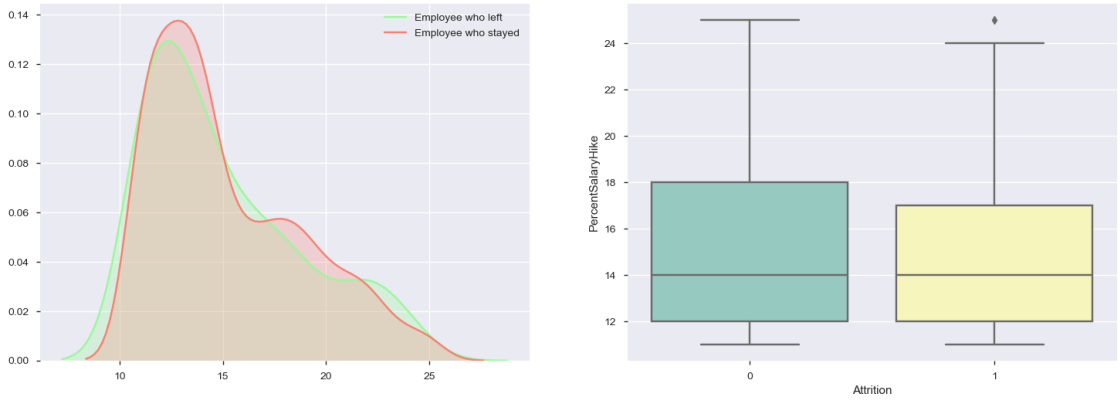
[34]:
```
numerical_column_viz("HourlyRate")
```



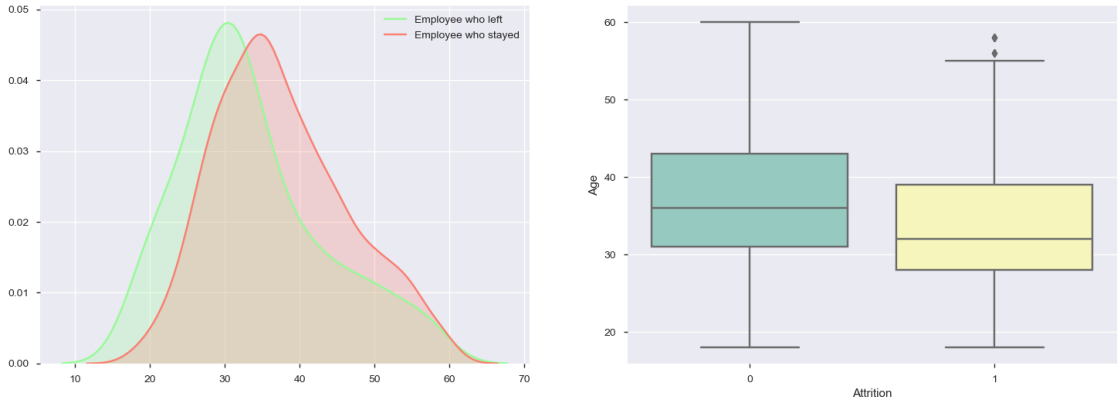
[35]:
```
numerical_column_viz("JobInvolvement")
```



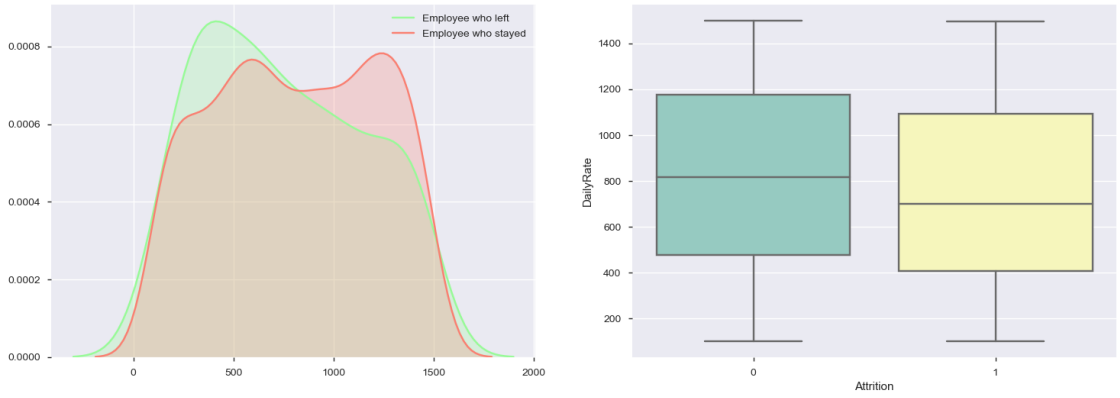
[36]:
```
numerical_column_viz("PercentSalaryHike")
```



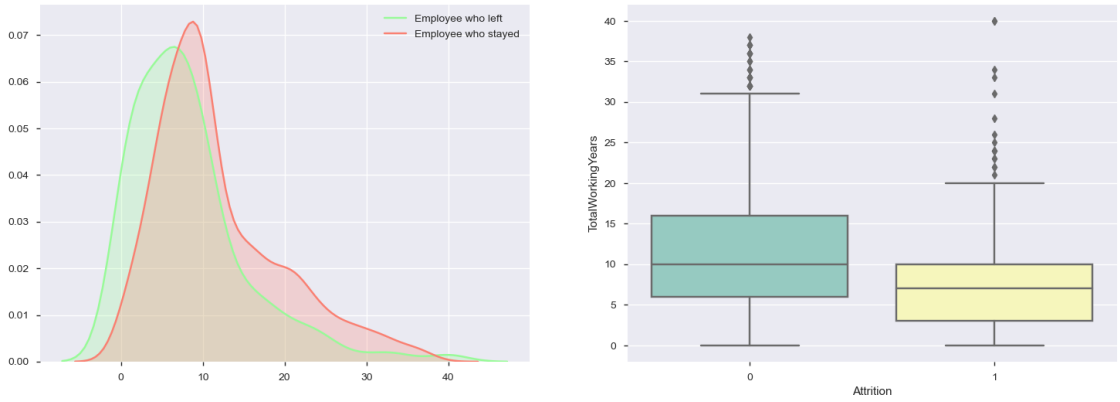
[37]:
```
numerical_column_viz("Age")
```



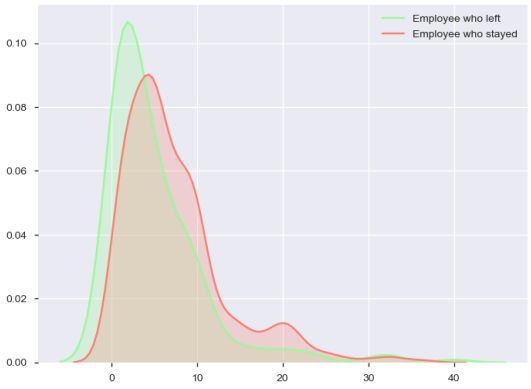
[38]:
```
numerical_column_viz("DailyRate")
```

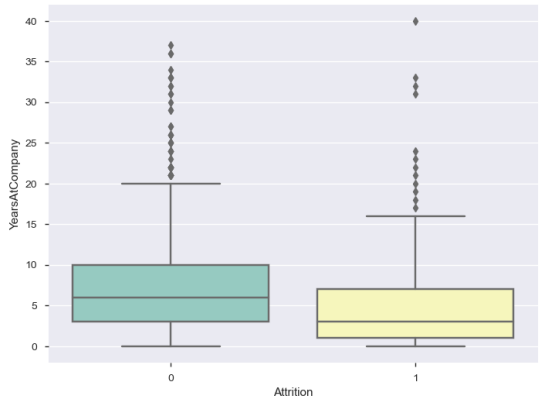


[39]:
```
numerical_column_viz("TotalWorkingYears")
```

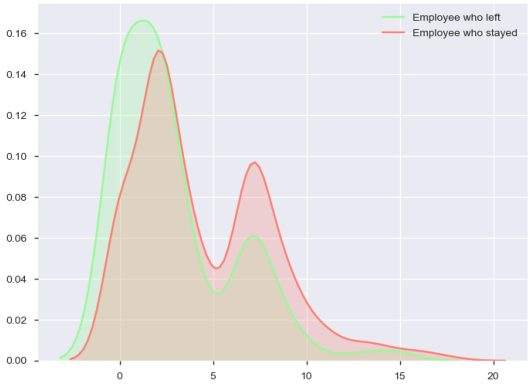


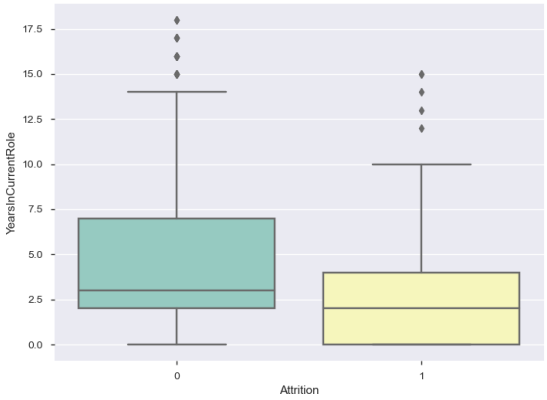
[40]:
```
numerical_column_viz("YearsAtCompany")
```



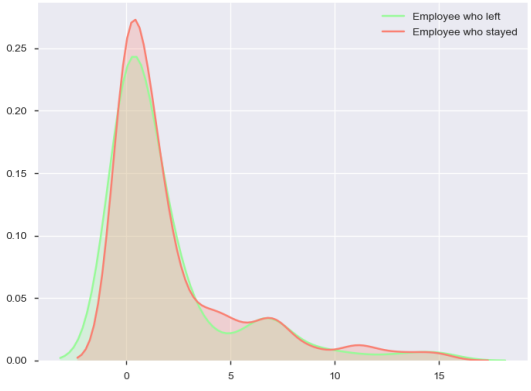


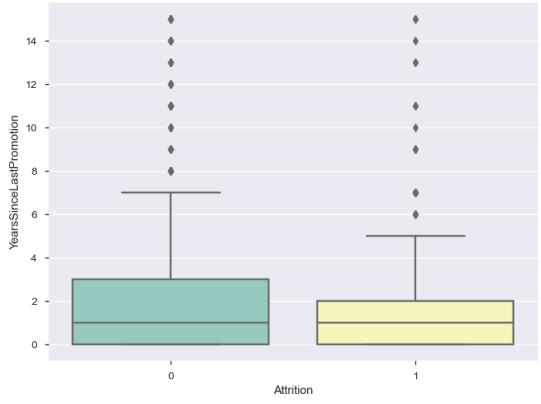
[41]:
```
numerical_column_viz("YearsInCurrentRole")
```



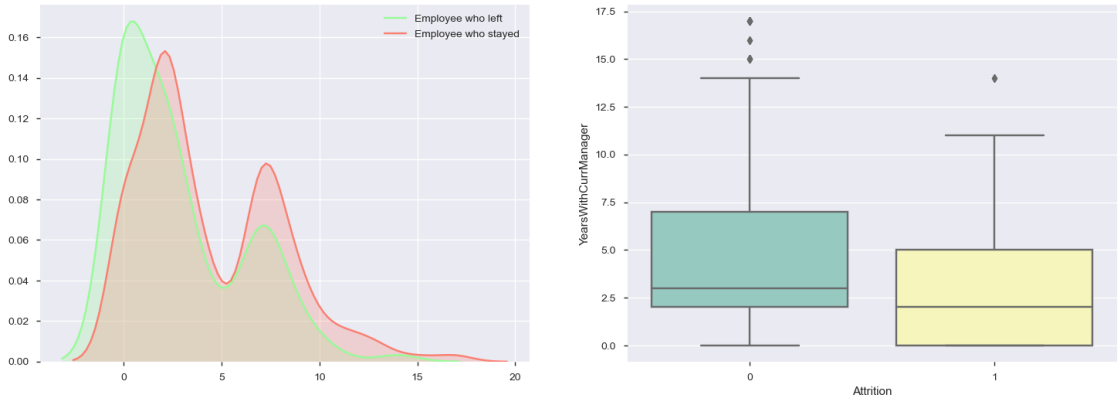


[42]:
```
numerical_column_viz("YearsSinceLastPromotion")
```





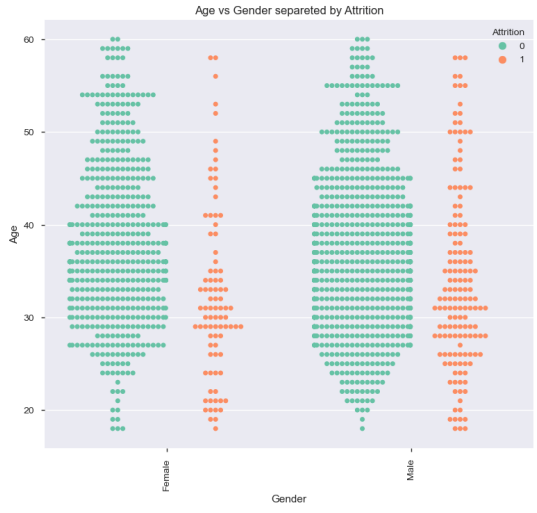
[43]:
```
numerical_column_viz("YearsWithCurrManager")
```

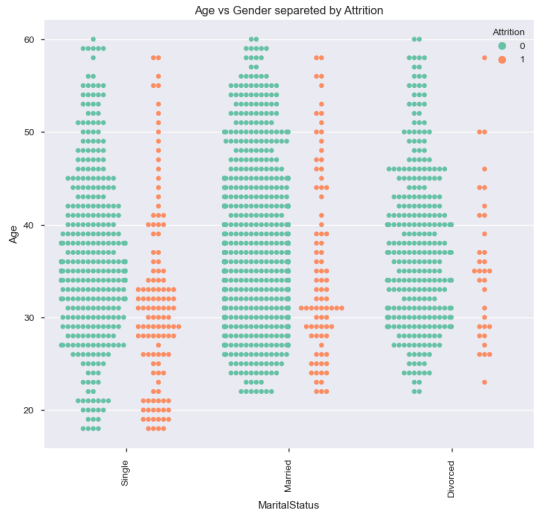


2.0.3 Visualization of Categorical vs Numericals Features

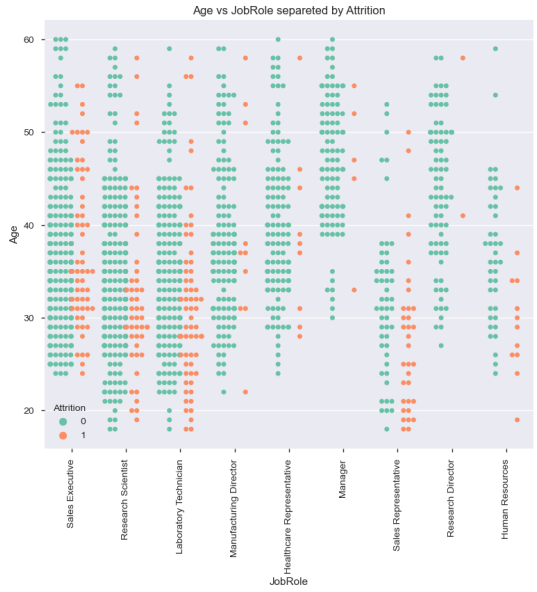
[44]:
```
def categorical_numerical(numerical_col, categorical_col1, categorical_col2):


    f,ax = plt.subplots(1,2, figsize=(20,8))

    g1= sns.swarmplot( categorical_col1, numerical_col,hue='Attrition',␣
 ↪data=df, dodge=True, ax=ax[0], palette='Set2')
    ax[0].set_title(f'{numerical_col} vs {categorical_col1} separeted by␣
 ↪Attrition')
    g1.set_xticklabels(g1.get_xticklabels(), rotation=90)


    g2 = sns.swarmplot( categorical_col2, numerical_col,hue='Attrition',␣
 ↪data=df, dodge=True, ax=ax[1], palette='Set2')
    ax[1].set_title(f'{numerical_col} vs {categorical_col1} separeted by␣
 ↪Attrition')
    g2.set_xticklabels(g2.get_xticklabels(), rotation=90)
```

[45]:
```
categorical_numerical('Age','Gender','MaritalStatus')
```

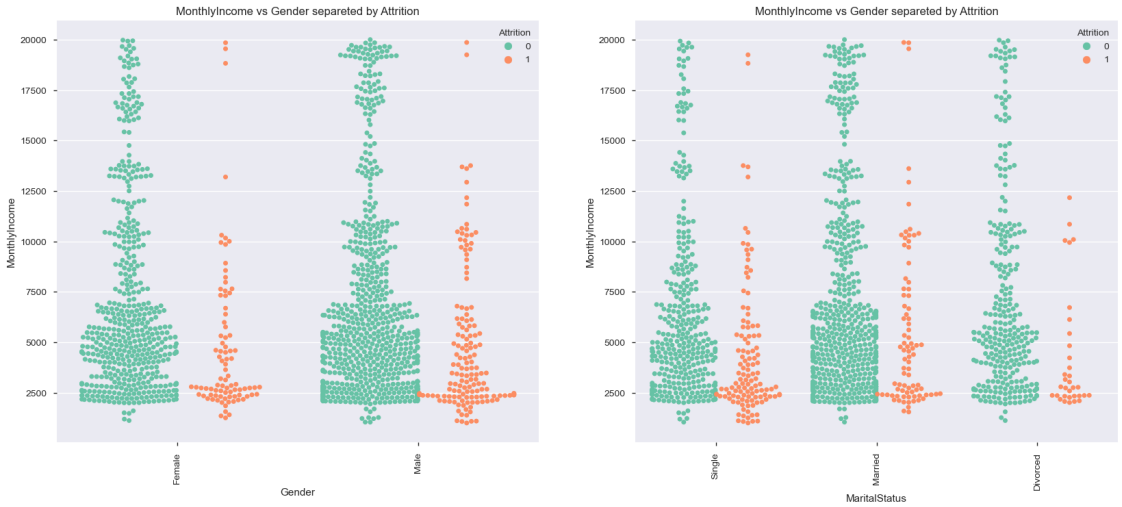




[46]:
```
categorical_numerical('Age','JobRole','EducationField')
```



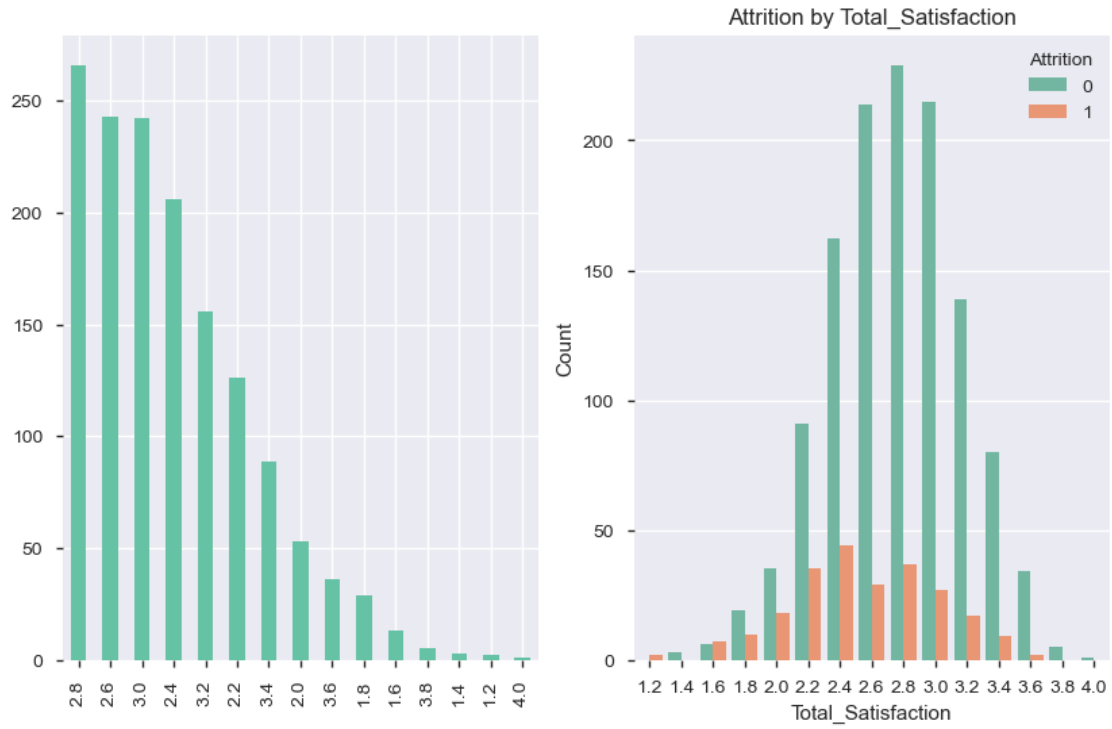
[47]:
```
categorical_numerical('MonthlyIncome','Gender','MaritalStatus')
```



2.1 Feature Engineering

[48]:
```
# 'EnviornmentSatisfaction', 'JobInvolvement', 'JobSatisfacction',␣
↪'RelationshipSatisfaction', 'WorklifeBalance' can be clubbed into a single␣
↪feature 'TotalSatisfaction'

df['Total_Satisfaction'] = (df['EnvironmentSatisfaction'] +
                            df['JobInvolvement'] +
                            df['JobSatisfaction'] +
                            df['RelationshipSatisfaction'] +
                            df['WorkLifeBalance']) /5

# Drop Columns
df.
↪drop(['EnvironmentSatisfaction','JobInvolvement','JobSatisfaction','RelationshipSatisfactio
↪axis=1, inplace=True)
```

[49]:
```
categorical_column_viz('Total_Satisfaction')
```



[50]:
```
df.Total_Satisfaction.describe()
```

[50]:
```
count    1470.000000
mean        2.730748
std         0.428551
min         1.200000
25%         2.400000
50%         2.800000
75%         3.000000
max         4.000000
Name: Total_Satisfaction, dtype: float64
```

[51]:
```
# Convert Total satisfaction into boolean
# median = 2.8
# x = 1 if x >= 2.8

df['Total_Satisfaction_bool'] = df['Total_Satisfaction'].apply(lambda x:1 if␣
 ↪x>=2.8 else 0 )
df.drop('Total_Satisfaction', axis=1, inplace=True)
```

[52]:
```
# It can be observed that the rate of attrition of employees below age of 35 is␣
 ↪high
```

```
df['Age_bool'] = df['Age'].apply(lambda x:1 if x<35 else 0)
df.drop('Age', axis=1, inplace=True)
```

[53]:
```
# It can be observed that the employees are more likey the drop the job if␣
 ↪dailtRate less than 800

df['DailyRate_bool'] = df['DailyRate'].apply(lambda x:1 if x<800 else 0)
df.drop('DailyRate', axis=1, inplace=True)
```

[54]:
```
# Employees working at R&D Department have higher attrition rate

df['Department_bool'] = df['Department'].apply(lambda x:1 if x=='Research &␣
 ↪Development' else 0)
df.drop('Department', axis=1, inplace=True)
```

[55]:
```
# Rate of attrition of employees is high if DistanceFromHome > 10

df['DistanceFromHome_bool'] = df['DistanceFromHome'].apply(lambda x:1 if x>10␣
 ↪else 0)
df.drop('DistanceFromHome', axis=1, inplace=True)
```

[56]:
```
# Employees are more likey to drop the job if the employee is working as␣
 ↪Laboratory Technician

df['JobRole_bool'] = df['JobRole'].apply(lambda x:1 if x=='Laboratory␣
 ↪Technician' else 0)
df.drop('JobRole', axis=1, inplace=True)
```

[57]:
```
# Employees are more likey to the drop the job if the employee's hourly rate <␣
 ↪65

df['HourlyRate_bool'] = df['HourlyRate'].apply(lambda x:1 if x<65 else 0)
df.drop('HourlyRate', axis=1, inplace=True)
```

[58]:
```
# Employees are more likey to the drop the job if the employee's MonthlyIncome␣
 ↪< 4000

df['MonthlyIncome_bool'] = df['MonthlyIncome'].apply(lambda x:1 if x<4000 else␣
 ↪0)
df.drop('MonthlyIncome', axis=1, inplace=True)
```

[59]:
```
# Rate of attrition of employees is high if NumCompaniesWorked < 3

df['NumCompaniesWorked_bool'] = df['NumCompaniesWorked'].apply(lambda x:1 if␣
 ↪x>3 else 0)
df.drop('NumCompaniesWorked', axis=1, inplace=True)
```

[60]:
```
# Employees are more likey to the drop the job if the employee's␣
 ↪TotalWorkingYears < 8

df['TotalWorkingYears_bool'] = df['TotalWorkingYears'].apply(lambda x:1 if x<8␣
 ↪else 0)
df.drop('TotalWorkingYears', axis=1, inplace=True)
```

[61]:
```
# Employees are more likey to the drop the job if the employee's YearsAtCompany␣
 ↪< 3

df['YearsAtCompany_bool'] = df['YearsAtCompany'].apply(lambda x:1 if x<3 else 0)
df.drop('YearsAtCompany', axis=1, inplace=True)
```

[62]:
```
# Employees are more likey to the drop the job if the employee's␣
 ↪YearsInCurrentRole < 3

df['YearsInCurrentRole_bool'] = df['YearsInCurrentRole'].apply(lambda x:1 if␣
 ↪x<3 else 0)
df.drop('YearsInCurrentRole', axis=1, inplace=True)
```

[63]:
```
# Employees are more likey to the drop the job if the employee's␣
 ↪YearsSinceLastPromotion < 1

df['YearsSinceLastPromotion_bool'] = df['YearsSinceLastPromotion'].apply(lambda␣
 ↪x:1 if x<1 else 0)
df.drop('YearsSinceLastPromotion', axis=1, inplace=True)
```

[64]:
```
# Employees are more likey to the drop the job if the employee's␣
 ↪YearsWithCurrManager < 1

df['YearsWithCurrManager_bool'] = df['YearsWithCurrManager'].apply(lambda x:1␣
 ↪if x<1 else 0)
df.drop('YearsWithCurrManager', axis=1, inplace=True)
```

[65]:
```
df['Gender'] = df['Gender'].apply(lambda x:1 if x=='Female' else 0)
```

[66]:
```
df.drop('MonthlyRate', axis=1, inplace=True)
df.drop('PercentSalaryHike', axis=1, inplace=True)
```

[67]:
```
convert_category =␣
 ↪['BusinessTravel','Education','EducationField','MaritalStatus','StockOptionLevel','OverTime
for col in convert_category:
        df[col] = df[col].astype('category')
```

[68]:
```
df.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 1470 entries, 0 to 1469
Data columns (total 25 columns):
Attrition                         1470 non-null int64
BusinessTravel                    1470 non-null category
Education                         1470 non-null category
EducationField                    1470 non-null category
Gender                            1470 non-null category
JobLevel                          1470 non-null int64
MaritalStatus                     1470 non-null category
OverTime                          1470 non-null category
PerformanceRating                 1470 non-null int64
StockOptionLevel                  1470 non-null category
TrainingTimesLastYear             1470 non-null category
Total_Satisfaction_bool           1470 non-null int64
Age_bool                          1470 non-null int64
DailyRate_bool                    1470 non-null int64
Department_bool                   1470 non-null int64
DistanceFromHome_bool             1470 non-null int64
JobRole_bool                      1470 non-null int64
HourlyRate_bool                   1470 non-null int64
MonthlyIncome_bool                1470 non-null int64
NumCompaniesWorked_bool           1470 non-null int64
TotalWorkingYears_bool            1470 non-null int64
YearsAtCompany_bool               1470 non-null int64
YearsInCurrentRole_bool           1470 non-null int64
YearsSinceLastPromotion_bool      1470 non-null int64
YearsWithCurrManager_bool         1470 non-null int64
dtypes: category(8), int64(17)
memory usage: 208.2 KB
```

[69]:
```
#separate the categorical and numerical data
X_categorical = df.select_dtypes(include=['category'])
X_numerical = df.select_dtypes(include=['int64'])
X_numerical.drop('Attrition', axis=1, inplace=True)
```

[70]:
```
y = df['Attrition']
```

[71]:
```
# One HOt Encoding Categorical Features

onehotencoder = OneHotEncoder()

X_categorical = onehotencoder.fit_transform(X_categorical).toarray()
X_categorical = pd.DataFrame(X_categorical)
X_categorical
```

[71]:
```
        0    1    2    3    4    5    6    7    8    9   …   22   23   24  \
0     0.0  0.0  1.0  0.0  1.0  0.0  0.0  0.0  0.0  1.0  …  0.0  0.0  0.0
1     0.0  1.0  0.0  1.0  0.0  0.0  0.0  0.0  0.0  1.0  …  1.0  0.0  0.0
2     0.0  0.0  1.0  0.0  1.0  0.0  0.0  0.0  0.0  0.0  …  0.0  0.0  0.0
3     0.0  1.0  0.0  0.0  0.0  0.0  1.0  0.0  0.0  1.0  …  0.0  0.0  0.0
4     0.0  0.0  1.0  1.0  0.0  0.0  0.0  0.0  0.0  0.0  …  1.0  0.0  0.0
…     …    …    …    …    …    …    …    …    …    …  …  …    …    …
1465  0.0  1.0  0.0  0.0  1.0  0.0  0.0  0.0  0.0  0.0  …  1.0  0.0  0.0
1466  0.0  0.0  1.0  1.0  0.0  0.0  0.0  0.0  0.0  0.0  …  1.0  0.0  0.0
1467  0.0  0.0  1.0  0.0  0.0  1.0  0.0  0.0  0.0  1.0  …  1.0  0.0  0.0
1468  0.0  1.0  0.0  0.0  0.0  1.0  0.0  0.0  0.0  0.0  …  0.0  0.0  0.0
1469  0.0  0.0  1.0  0.0  0.0  1.0  0.0  0.0  0.0  0.0  …  0.0  0.0  0.0

        25   26   27   28   29   30   31
0     1.0  0.0  0.0  0.0  0.0  0.0  0.0
1     0.0  0.0  0.0  1.0  0.0  0.0  0.0
2     0.0  0.0  0.0  1.0  0.0  0.0  0.0
3     0.0  0.0  0.0  1.0  0.0  0.0  0.0
4     0.0  0.0  0.0  1.0  0.0  0.0  0.0
…     …    …    …    …    …    …    …
1465  0.0  0.0  0.0  1.0  0.0  0.0  0.0
1466  0.0  0.0  0.0  0.0  0.0  1.0  0.0
1467  1.0  0.0  0.0  0.0  0.0  0.0  0.0
1468  0.0  0.0  0.0  1.0  0.0  0.0  0.0
1469  0.0  0.0  0.0  1.0  0.0  0.0  0.0

[1470 rows x 32 columns]
```

[72]:
```
#concat the categorical and numerical values

X_all = pd.concat([X_categorical, X_numerical], axis=1)
X_all.head()
```

[72]:
```
     0    1    2    3    4    5    6    7    8    9  …  \
0  0.0  0.0  1.0  0.0  1.0  0.0  0.0  0.0  0.0  1.0  …
1  0.0  1.0  0.0  1.0  0.0  0.0  0.0  0.0  0.0  1.0  …
2  0.0  0.0  1.0  0.0  1.0  0.0  0.0  0.0  0.0  0.0  …
3  0.0  1.0  0.0  0.0  0.0  0.0  1.0  0.0  0.0  1.0  …
4  0.0  0.0  1.0  1.0  0.0  0.0  0.0  0.0  0.0  0.0  …

   DistanceFromHome_bool  JobRole_bool  HourlyRate_bool  MonthlyIncome_bool  \
0                      0             0                0                   0
1                      0             0                1                   0
2                      0             1                0                   1
3                      0             0                1                   1
4                      0             1                1                   1
```

```
   NumCompaniesWorked_bool  TotalWorkingYears_bool  YearsAtCompany_bool  \
0                        1                       0                    0
1                        0                       0                    0
2                        1                       1                    1
3                        0                       0                    0
4                        1                       1                    1

   YearsInCurrentRole_bool  YearsSinceLastPromotion_bool  \
0                        0                             1
1                        0                             0
2                        1                             1
3                        0                             0
4                        1                             0

   YearsWithCurrManager_bool
0                          0
1                          0
2                          1
3                          1
4                          0

[5 rows x 48 columns]
```

[73]:
```
X_all.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 1470 entries, 0 to 1469
Data columns (total 48 columns):
0                               1470 non-null float64
1                               1470 non-null float64
2                               1470 non-null float64
3                               1470 non-null float64
4                               1470 non-null float64
5                               1470 non-null float64
6                               1470 non-null float64
7                               1470 non-null float64
8                               1470 non-null float64
9                               1470 non-null float64
10                              1470 non-null float64
11                              1470 non-null float64
12                              1470 non-null float64
13                              1470 non-null float64
14                              1470 non-null float64
15                              1470 non-null float64
16                              1470 non-null float64
17                              1470 non-null float64
18                              1470 non-null float64
```

```
19                              1470 non-null float64
20                              1470 non-null float64
21                              1470 non-null float64
22                              1470 non-null float64
23                              1470 non-null float64
24                              1470 non-null float64
25                              1470 non-null float64
26                              1470 non-null float64
27                              1470 non-null float64
28                              1470 non-null float64
29                              1470 non-null float64
30                              1470 non-null float64
31                              1470 non-null float64
JobLevel                        1470 non-null int64
PerformanceRating               1470 non-null int64
Total_Satisfaction_bool         1470 non-null int64
Age_bool                        1470 non-null int64
DailyRate_bool                  1470 non-null int64
Department_bool                 1470 non-null int64
DistanceFromHome_bool           1470 non-null int64
JobRole_bool                    1470 non-null int64
HourlyRate_bool                 1470 non-null int64
MonthlyIncome_bool              1470 non-null int64
NumCompaniesWorked_bool         1470 non-null int64
TotalWorkingYears_bool          1470 non-null int64
YearsAtCompany_bool             1470 non-null int64
YearsInCurrentRole_bool         1470 non-null int64
YearsSinceLastPromotion_bool    1470 non-null int64
YearsWithCurrManager_bool       1470 non-null int64
dtypes: float64(32), int64(16)
memory usage: 551.4 KB
```

2.1.1 Split Data

[74]:
```
X_train,X_test, y_train, y_test = train_test_split(X_all,y, test_size=0.30)
```

[75]:
```
print(f"Train data shape: {X_train.shape}, Test Data Shape {X_test.shape}")
```

```
Train data shape: (1029, 48), Test Data Shape (441, 48)
```

[76]:
```
X_train.head()
```

[76]:

	0	1	2	3	4	5	6	7	8	9	…	\
772	0.0	1.0	0.0	0.0	0.0	1.0	0.0	0.0	0.0	0.0	…	
1403	0.0	0.0	1.0	0.0	0.0	0.0	1.0	0.0	0.0	0.0	…	
9	0.0	0.0	1.0	0.0	0.0	1.0	0.0	0.0	0.0	0.0	…	
662	0.0	0.0	1.0	0.0	0.0	1.0	0.0	0.0	0.0	0.0	…	

```
1387  0.0  0.0  1.0  0.0  0.0  1.0  0.0  0.0  0.0  1.0  …

      DistanceFromHome_bool  JobRole_bool  HourlyRate_bool  \
772                       0             0                1
1403                      1             0                0
9                         1             0                0
662                       0             0                1
1387                      0             0                0

      MonthlyIncome_bool  NumCompaniesWorked_bool  TotalWorkingYears_bool  \
772                    1                        0                       0
1403                   0                        0                       0
9                      0                        1                       0
662                    1                        0                       1
1387                   0                        0                       1

      YearsAtCompany_bool  YearsInCurrentRole_bool  \
772                     0                        0
1403                    0                        0
9                       0                        0
662                     1                        1
1387                    0                        0

      YearsSinceLastPromotion_bool  YearsWithCurrManager_bool
772                              1                         0
1403                             0                         0
9                                0                         0
662                              1                         0
1387                             1                         0

[5 rows x 48 columns]
```

2.2 Train Data

[77]:
```
# Function that runs the requested algorithm and returns the accuracy metrics
def fit_ml_algo(algo, X_train,y_train, cv):

    # One Pass
    model = algo.fit(X_train, y_train)
    acc = round(model.score(X_train, y_train) * 100, 2)

    # Cross Validation
    train_pred = model_selection.
 ↪cross_val_predict(algo,X_train,y_train,cv=cv,n_jobs = -1)

    # Cross-validation accuracy metric
    acc_cv = round(metrics.accuracy_score(y_train, train_pred) * 100, 2)
```

```
    return train_pred, acc, acc_cv
```

2.2.1 Logistic Regression

[78]:
```
# Logistic Regression
start_time = time.time()
train_pred_log, acc_log, acc_cv_log = fit_ml_algo(LogisticRegression(),␣
 ↪X_train,y_train, 10)
log_time = (time.time() - start_time)
print("Accuracy: %s" % acc_log)
print("Accuracy CV 10-Fold: %s" % acc_cv_log)
print("Running Time: %s" % datetime.timedelta(seconds=log_time))
```

```
Accuracy: 89.89
Accuracy CV 10-Fold: 87.66
Running Time: 0:00:02.534987
```

2.2.2 Support Vector Machine

[79]:
```
# SVC
start_time = time.time()
train_pred_svc, acc_svc, acc_cv_svc = fit_ml_algo(SVC(),X_train,y_train,10)
svc_time = (time.time() - start_time)
print("Accuracy: %s" % acc_svc)
print("Accuracy CV 10-Fold: %s" % acc_cv_svc)
print("Running Time: %s" % datetime.timedelta(seconds=svc_time))
```

```
Accuracy: 87.76
Accuracy CV 10-Fold: 86.1
Running Time: 0:00:00.207994
```

2.2.3 Linear Support Vector Machines

[80]:
```
# Linear SVC
start_time = time.time()
train_pred_svc, acc_linear_svc, acc_cv_linear_svc =␣
 ↪fit_ml_algo(LinearSVC(),X_train, y_train,10)
linear_svc_time = (time.time() - start_time)
print("Accuracy: %s" % acc_linear_svc)
print("Accuracy CV 10-Fold: %s" % acc_cv_linear_svc)
print("Running Time: %s" % datetime.timedelta(seconds=linear_svc_time))
```

```
Accuracy: 89.5
Accuracy CV 10-Fold: 87.27
Running Time: 0:00:00.269995
```

2.2.4 K Nearest Neighbour

[81]:
```
# K Nearest Neighbour
start_time = time.time()
train_pred_knn, acc_knn, acc_cv_knn =␣
 ↪fit_ml_algo(KNeighborsClassifier(n_neighbors = 3),X_train,y_train,10)
knn_time = (time.time() - start_time)
print("Accuracy: %s" % acc_knn)
print("Accuracy CV 10-Fold: %s" % acc_cv_knn)
print("Running Time: %s" % datetime.timedelta(seconds=knn_time))
```

```
Accuracy: 89.21
Accuracy CV 10-Fold: 83.28
Running Time: 0:00:00.239998
```

2.2.5 Gaussian Naive Bayes

[82]:
```
# Gaussian Naive Bayes
start_time = time.time()
train_pred_gaussian, acc_gaussian, acc_cv_gaussian =␣
 ↪fit_ml_algo(GaussianNB(),X_train,y_train,10)
gaussian_time = (time.time() - start_time)
print("Accuracy: %s" % acc_gaussian)
print("Accuracy CV 10-Fold: %s" % acc_cv_gaussian)
print("Running Time: %s" % datetime.timedelta(seconds=gaussian_time))
```

```
Accuracy: 80.17
Accuracy CV 10-Fold: 77.45
Running Time: 0:00:00.064000
```

2.2.6 Perceptron

[83]:
```
# Perceptron
start_time = time.time()
train_pred_gaussian, acc_perceptron, acc_cv_perceptron =␣
 ↪fit_ml_algo(Perceptron(),X_train,y_train,10)
perceptron_time = (time.time() - start_time)
print("Accuracy: %s" % acc_perceptron)
print("Accuracy CV 10-Fold: %s" % acc_cv_perceptron)
print("Running Time: %s" % datetime.timedelta(seconds=perceptron_time))
```

```
Accuracy: 87.27
Accuracy CV 10-Fold: 82.12
Running Time: 0:00:00.073985
```

2.2.7 Stochastic Gradient Descent

[84]:
```
# Stochastic Gradient Descent
start_time = time.time()
train_pred_sgd, acc_sgd, acc_cv_sgd = fit_ml_algo(SGDClassifier(),X_train,␣
 ↪y_train,10)
sgd_time = (time.time() - start_time)
print("Accuracy: %s" % acc_sgd)
print("Accuracy CV 10-Fold: %s" % acc_cv_sgd)
print("Running Time: %s" % datetime.timedelta(seconds=sgd_time))
```

```
Accuracy: 86.78
Accuracy CV 10-Fold: 83.97
Running Time: 0:00:00.096004
```

2.2.8 Decision Tree

[85]:
```
# Decision Tree
start_time = time.time()
train_pred_dt, acc_dt, acc_cv_dt =␣
 ↪fit_ml_algo(DecisionTreeClassifier(),X_train, y_train,10)
dt_time = (time.time() - start_time)
print("Accuracy: %s" % acc_dt)
print("Accuracy CV 10-Fold: %s" % acc_cv_dt)
print("Running Time: %s" % datetime.timedelta(seconds=dt_time))
```

```
Accuracy: 100.0
Accuracy CV 10-Fold: 78.62
Running Time: 0:00:00.098000
```

2.2.9 Gradient Boosting Trees

[86]:
```
# Gradient Boosting Trees
start_time = time.time()
train_pred_gbt, acc_gbt, acc_cv_gbt =␣
 ↪fit_ml_algo(GradientBoostingClassifier(),X_train, y_train,10)
gbt_time = (time.time() - start_time)
print("Accuracy: %s" % acc_gbt)
print("Accuracy CV 10-Fold: %s" % acc_cv_gbt)
print("Running Time: %s" % datetime.timedelta(seconds=gbt_time))
```

```
Accuracy: 93.0
Accuracy CV 10-Fold: 87.17
Running Time: 0:00:00.702999
```

2.2.10 Random Forest

[87]:
```
# Random Forest
start_time = time.time()
train_pred_dt, acc_rf, acc_cv_rf =␣
 ↪fit_ml_algo(RandomForestClassifier(n_estimators=100),X_train, y_train,10)
rf_time = (time.time() - start_time)
print("Accuracy: %s" % acc_rf)
print("Accuracy CV 10-Fold: %s" % acc_cv_rf)
print("Running Time: %s" % datetime.timedelta(seconds=rf_time))
```

```
Accuracy: 100.0
Accuracy CV 10-Fold: 85.33
Running Time: 0:00:00.789033
```

2.2.11 CatBoost Classifier

[88]:
```
# Define the categorical features for the CatBoost model
cat_features = np.where(X_train.dtypes != np.float)[0]
cat_features
```

[88]:
```
array([32, 33, 34, 35, 36, 37, 38, 39, 40, 41, 42, 43, 44, 45, 46, 47],
      dtype=int64)
```

[89]:
```
# pool training data and categorical feature labels together
train_pool = Pool(X_train, y_train,cat_features)
```

[90]:
```
# CatBoost
catboost_model =␣
 ↪CatBoostClassifier(iterations=1000,custom_loss=['Accuracy'],loss_function='Logloss')

# Fit CatBoost model
catboost_model.fit(train_pool,plot=True)

# CatBoost accuracy
acc_catboost = round(catboost_model.score(X_train, y_train) * 100, 2)
```

```
<IPython.core.display.HTML object>
```

```
MetricVisualizer(layout=Layout(align_self='stretch', height='500px'))
```

```
Learning rate set to 0.010429
0:      learn: 0.6840844        total: 194ms    remaining: 3m 13s
1:      learn: 0.6751003        total: 224ms    remaining: 1m 51s
2:      learn: 0.6667403        total: 242ms    remaining: 1m 20s
3:      learn: 0.6591424        total: 260ms    remaining: 1m 4s
4:      learn: 0.6512910        total: 282ms    remaining: 56.1s
5:      learn: 0.6443287        total: 304ms    remaining: 50.3s
6:      learn: 0.6389286        total: 330ms    remaining: 46.8s
```

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7:      learn: 0.6318779        total: 348ms    remaining: 43.2s
8:      learn: 0.6244658        total: 370ms    remaining: 40.8s
9:      learn: 0.6187083        total: 383ms    remaining: 37.9s
10:     learn: 0.6125992        total: 404ms    remaining: 36.3s
11:     learn: 0.6065297        total: 425ms    remaining: 35s
12:     learn: 0.6008210        total: 435ms    remaining: 33s
13:     learn: 0.5951041        total: 460ms    remaining: 32.4s
14:     learn: 0.5898887        total: 478ms    remaining: 31.4s
15:     learn: 0.5856523        total: 501ms    remaining: 30.8s
16:     learn: 0.5809214        total: 528ms    remaining: 30.5s
17:     learn: 0.5758351        total: 554ms    remaining: 30.2s
18:     learn: 0.5710821        total: 586ms    remaining: 30.2s
19:     learn: 0.5662542        total: 617ms    remaining: 30.3s
20:     learn: 0.5629216        total: 633ms    remaining: 29.5s
21:     learn: 0.5573205        total: 672ms    remaining: 29.9s
22:     learn: 0.5542450        total: 678ms    remaining: 28.8s
23:     learn: 0.5502309        total: 722ms    remaining: 29.3s
24:     learn: 0.5461708        total: 750ms    remaining: 29.2s
25:     learn: 0.5411904        total: 764ms    remaining: 28.6s
26:     learn: 0.5379127        total: 788ms    remaining: 28.4s
27:     learn: 0.5331074        total: 813ms    remaining: 28.2s
28:     learn: 0.5293879        total: 838ms    remaining: 28.1s
29:     learn: 0.5267960        total: 857ms    remaining: 27.7s
30:     learn: 0.5220648        total: 883ms    remaining: 27.6s
31:     learn: 0.5191213        total: 890ms    remaining: 26.9s
32:     learn: 0.5159774        total: 907ms    remaining: 26.6s
33:     learn: 0.5117084        total: 938ms    remaining: 26.7s
34:     learn: 0.5067497        total: 956ms    remaining: 26.4s
35:     learn: 0.5025896        total: 978ms    remaining: 26.2s
36:     learn: 0.4990751        total: 1000ms   remaining: 26s
37:     learn: 0.4956833        total: 1.03s    remaining: 26s
38:     learn: 0.4927487        total: 1.05s    remaining: 25.9s
39:     learn: 0.4900711        total: 1.07s    remaining: 25.6s
40:     learn: 0.4873041        total: 1.09s    remaining: 25.6s
41:     learn: 0.4846739        total: 1.11s    remaining: 25.4s
42:     learn: 0.4810324        total: 1.15s    remaining: 25.5s
43:     learn: 0.4775376        total: 1.18s    remaining: 25.6s
44:     learn: 0.4736146        total: 1.2s     remaining: 25.6s
45:     learn: 0.4709697        total: 1.22s    remaining: 25.3s
46:     learn: 0.4693703        total: 1.23s    remaining: 24.9s
47:     learn: 0.4651147        total: 1.26s    remaining: 25s
48:     learn: 0.4620828        total: 1.28s    remaining: 24.9s
49:     learn: 0.4599567        total: 1.31s    remaining: 24.8s
50:     learn: 0.4564415        total: 1.32s    remaining: 24.6s
51:     learn: 0.4540572        total: 1.34s    remaining: 24.4s
52:     learn: 0.4517035        total: 1.36s    remaining: 24.3s
53:     learn: 0.4498173        total: 1.37s    remaining: 23.9s
54:     learn: 0.4464823        total: 1.39s    remaining: 23.9s
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55:     learn: 0.4450025        total: 1.4s     remaining: 23.5s
56:     learn: 0.4422124        total: 1.42s    remaining: 23.5s
57:     learn: 0.4394659        total: 1.44s    remaining: 23.4s
58:     learn: 0.4380256        total: 1.45s    remaining: 23.1s
59:     learn: 0.4368737        total: 1.48s    remaining: 23.1s
60:     learn: 0.4342259        total: 1.49s    remaining: 23s
61:     learn: 0.4318660        total: 1.51s    remaining: 22.8s
62:     learn: 0.4294512        total: 1.53s    remaining: 22.7s
63:     learn: 0.4270956        total: 1.54s    remaining: 22.5s
64:     learn: 0.4242305        total: 1.56s    remaining: 22.5s
65:     learn: 0.4225191        total: 1.58s    remaining: 22.4s
66:     learn: 0.4205765        total: 1.6s     remaining: 22.4s
67:     learn: 0.4189717        total: 1.63s    remaining: 22.4s
68:     learn: 0.4174900        total: 1.65s    remaining: 22.2s
69:     learn: 0.4152923        total: 1.69s    remaining: 22.4s
70:     learn: 0.4129048        total: 1.71s    remaining: 22.3s
71:     learn: 0.4115429        total: 1.72s    remaining: 22.2s
72:     learn: 0.4096293        total: 1.74s    remaining: 22.2s
73:     learn: 0.4085538        total: 1.75s    remaining: 21.9s
74:     learn: 0.4069641        total: 1.76s    remaining: 21.8s
75:     learn: 0.4053311        total: 1.78s    remaining: 21.7s
76:     learn: 0.4041398        total: 1.8s     remaining: 21.5s
77:     learn: 0.4031767        total: 1.81s    remaining: 21.4s
78:     learn: 0.4014818        total: 1.84s    remaining: 21.4s
79:     learn: 0.3993202        total: 1.86s    remaining: 21.4s
80:     learn: 0.3979864        total: 1.88s    remaining: 21.3s
81:     learn: 0.3959652        total: 1.92s    remaining: 21.5s
82:     learn: 0.3944150        total: 1.96s    remaining: 21.6s
83:     learn: 0.3929593        total: 1.97s    remaining: 21.5s
84:     learn: 0.3917197        total: 1.99s    remaining: 21.4s
85:     learn: 0.3899639        total: 2.01s    remaining: 21.4s
86:     learn: 0.3885023        total: 2.04s    remaining: 21.4s
87:     learn: 0.3866710        total: 2.08s    remaining: 21.6s
88:     learn: 0.3854473        total: 2.11s    remaining: 21.6s
89:     learn: 0.3847993        total: 2.11s    remaining: 21.4s
90:     learn: 0.3837347        total: 2.13s    remaining: 21.3s
91:     learn: 0.3823282        total: 2.15s    remaining: 21.2s
92:     learn: 0.3810013        total: 2.19s    remaining: 21.4s
93:     learn: 0.3801489        total: 2.2s     remaining: 21.2s
94:     learn: 0.3790201        total: 2.23s    remaining: 21.3s
95:     learn: 0.3781355        total: 2.25s    remaining: 21.2s
96:     learn: 0.3763092        total: 2.28s    remaining: 21.2s
97:     learn: 0.3759197        total: 2.28s    remaining: 21s
98:     learn: 0.3747299        total: 2.31s    remaining: 21s
99:     learn: 0.3735791        total: 2.33s    remaining: 20.9s
100:    learn: 0.3724895        total: 2.35s    remaining: 20.9s
101:    learn: 0.3710284        total: 2.38s    remaining: 20.9s
102:    learn: 0.3703675        total: 2.4s     remaining: 20.9s
```

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103:    learn: 0.3691347        total: 2.42s    remaining: 20.9s
104:    learn: 0.3680027        total: 2.45s    remaining: 20.9s
105:    learn: 0.3669490        total: 2.47s    remaining: 20.9s
106:    learn: 0.3660834        total: 2.49s    remaining: 20.8s
107:    learn: 0.3651267        total: 2.51s    remaining: 20.7s
108:    learn: 0.3639285        total: 2.54s    remaining: 20.8s
109:    learn: 0.3629105        total: 2.57s    remaining: 20.8s
110:    learn: 0.3618046        total: 2.6s     remaining: 20.8s
111:    learn: 0.3613890        total: 2.61s    remaining: 20.7s
112:    learn: 0.3609700        total: 2.62s    remaining: 20.5s
113:    learn: 0.3599654        total: 2.65s    remaining: 20.6s
114:    learn: 0.3595923        total: 2.65s    remaining: 20.4s
115:    learn: 0.3585628        total: 2.68s    remaining: 20.4s
116:    learn: 0.3577941        total: 2.7s     remaining: 20.4s
117:    learn: 0.3568351        total: 2.72s    remaining: 20.4s
118:    learn: 0.3564866        total: 2.73s    remaining: 20.2s
119:    learn: 0.3556981        total: 2.75s    remaining: 20.1s
120:    learn: 0.3547374        total: 2.77s    remaining: 20.2s
121:    learn: 0.3540920        total: 2.79s    remaining: 20.1s
122:    learn: 0.3531104        total: 2.82s    remaining: 20.1s
123:    learn: 0.3525849        total: 2.84s    remaining: 20.1s
124:    learn: 0.3523008        total: 2.84s    remaining: 19.9s
125:    learn: 0.3515001        total: 2.86s    remaining: 19.8s
126:    learn: 0.3506319        total: 2.9s     remaining: 19.9s
127:    learn: 0.3495708        total: 2.92s    remaining: 19.9s
128:    learn: 0.3486175        total: 2.94s    remaining: 19.9s
129:    learn: 0.3474532        total: 2.97s    remaining: 19.9s
130:    learn: 0.3463516        total: 3s       remaining: 19.9s
131:    learn: 0.3448715        total: 3.03s    remaining: 19.9s
132:    learn: 0.3437007        total: 3.07s    remaining: 20s
133:    learn: 0.3434710        total: 3.07s    remaining: 19.9s
134:    learn: 0.3426499        total: 3.11s    remaining: 19.9s
135:    learn: 0.3418782        total: 3.14s    remaining: 19.9s
136:    learn: 0.3413142        total: 3.17s    remaining: 20s
137:    learn: 0.3400415        total: 3.19s    remaining: 20s
138:    learn: 0.3391545        total: 3.22s    remaining: 20s
139:    learn: 0.3384186        total: 3.24s    remaining: 19.9s
140:    learn: 0.3371946        total: 3.27s    remaining: 19.9s
141:    learn: 0.3364210        total: 3.29s    remaining: 19.9s
142:    learn: 0.3357086        total: 3.31s    remaining: 19.9s
143:    learn: 0.3347802        total: 3.33s    remaining: 19.8s
144:    learn: 0.3345007        total: 3.33s    remaining: 19.6s
145:    learn: 0.3338671        total: 3.35s    remaining: 19.6s
146:    learn: 0.3335246        total: 3.36s    remaining: 19.5s
147:    learn: 0.3324481        total: 3.38s    remaining: 19.5s
148:    learn: 0.3319722        total: 3.4s     remaining: 19.4s
149:    learn: 0.3314753        total: 3.44s    remaining: 19.5s
150:    learn: 0.3313430        total: 3.45s    remaining: 19.4s
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151:    learn: 0.3304355        total: 3.47s    remaining: 19.3s
152:    learn: 0.3296934        total: 3.49s    remaining: 19.3s
153:    learn: 0.3288176        total: 3.51s    remaining: 19.3s
154:    learn: 0.3283649        total: 3.53s    remaining: 19.3s
155:    learn: 0.3278195        total: 3.56s    remaining: 19.3s
156:    learn: 0.3270961        total: 3.58s    remaining: 19.2s
157:    learn: 0.3263672        total: 3.6s     remaining: 19.2s
158:    learn: 0.3255675        total: 3.64s    remaining: 19.2s
159:    learn: 0.3248393        total: 3.67s    remaining: 19.3s
160:    learn: 0.3236548        total: 3.69s    remaining: 19.2s
161:    learn: 0.3230119        total: 3.72s    remaining: 19.2s
162:    learn: 0.3225039        total: 3.73s    remaining: 19.2s
163:    learn: 0.3218043        total: 3.75s    remaining: 19.1s
164:    learn: 0.3209844        total: 3.77s    remaining: 19.1s
165:    learn: 0.3204749        total: 3.79s    remaining: 19.1s
166:    learn: 0.3198861        total: 3.81s    remaining: 19s
167:    learn: 0.3193415        total: 3.82s    remaining: 18.9s
168:    learn: 0.3188314        total: 3.84s    remaining: 18.9s
169:    learn: 0.3180725        total: 3.88s    remaining: 18.9s
170:    learn: 0.3177966        total: 3.89s    remaining: 18.9s
171:    learn: 0.3174566        total: 3.91s    remaining: 18.8s
172:    learn: 0.3164693        total: 3.93s    remaining: 18.8s
173:    learn: 0.3158136        total: 3.95s    remaining: 18.7s
174:    learn: 0.3150702        total: 3.98s    remaining: 18.8s
175:    learn: 0.3145904        total: 4s       remaining: 18.7s
176:    learn: 0.3140729        total: 4.04s    remaining: 18.8s
177:    learn: 0.3135585        total: 4.07s    remaining: 18.8s
178:    learn: 0.3132967        total: 4.08s    remaining: 18.7s
179:    learn: 0.3127600        total: 4.12s    remaining: 18.8s
180:    learn: 0.3126557        total: 4.13s    remaining: 18.7s
181:    learn: 0.3120733        total: 4.15s    remaining: 18.7s
182:    learn: 0.3113617        total: 4.17s    remaining: 18.6s
183:    learn: 0.3104375        total: 4.19s    remaining: 18.6s
184:    learn: 0.3098817        total: 4.21s    remaining: 18.6s
185:    learn: 0.3092089        total: 4.24s    remaining: 18.5s
186:    learn: 0.3085546        total: 4.26s    remaining: 18.5s
187:    learn: 0.3076987        total: 4.28s    remaining: 18.5s
188:    learn: 0.3071068        total: 4.3s     remaining: 18.5s
189:    learn: 0.3064752        total: 4.32s    remaining: 18.4s
190:    learn: 0.3059190        total: 4.33s    remaining: 18.4s
191:    learn: 0.3055102        total: 4.35s    remaining: 18.3s
192:    learn: 0.3052974        total: 4.37s    remaining: 18.3s
193:    learn: 0.3047911        total: 4.4s     remaining: 18.3s
194:    learn: 0.3041728        total: 4.42s    remaining: 18.3s
195:    learn: 0.3040991        total: 4.43s    remaining: 18.2s
196:    learn: 0.3031509        total: 4.45s    remaining: 18.1s
197:    learn: 0.3025423        total: 4.49s    remaining: 18.2s
198:    learn: 0.3021439        total: 4.52s    remaining: 18.2s
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199:    learn: 0.3017814        total: 4.55s    remaining: 18.2s
200:    learn: 0.3013342        total: 4.57s    remaining: 18.2s
201:    learn: 0.3006072        total: 4.59s    remaining: 18.1s
202:    learn: 0.3004558        total: 4.61s    remaining: 18.1s
203:    learn: 0.2998606        total: 4.63s    remaining: 18.1s
204:    learn: 0.2993524        total: 4.66s    remaining: 18.1s
205:    learn: 0.2989241        total: 4.67s    remaining: 18s
206:    learn: 0.2985723        total: 4.69s    remaining: 18s
207:    learn: 0.2982949        total: 4.72s    remaining: 18s
208:    learn: 0.2978827        total: 4.73s    remaining: 17.9s
209:    learn: 0.2970757        total: 4.76s    remaining: 17.9s
210:    learn: 0.2965444        total: 4.77s    remaining: 17.8s
211:    learn: 0.2958294        total: 4.79s    remaining: 17.8s
212:    learn: 0.2951823        total: 4.83s    remaining: 17.8s
213:    learn: 0.2948077        total: 4.85s    remaining: 17.8s
214:    learn: 0.2942335        total: 4.88s    remaining: 17.8s
215:    learn: 0.2936184        total: 4.9s     remaining: 17.8s
216:    learn: 0.2931262        total: 4.93s    remaining: 17.8s
217:    learn: 0.2927834        total: 4.95s    remaining: 17.8s
218:    learn: 0.2923190        total: 4.99s    remaining: 17.8s
219:    learn: 0.2918497        total: 5.03s    remaining: 17.8s
220:    learn: 0.2915095        total: 5.06s    remaining: 17.8s
221:    learn: 0.2915020        total: 5.07s    remaining: 17.8s
222:    learn: 0.2909746        total: 5.11s    remaining: 17.8s
223:    learn: 0.2904234        total: 5.12s    remaining: 17.7s
224:    learn: 0.2898110        total: 5.15s    remaining: 17.7s
225:    learn: 0.2893857        total: 5.18s    remaining: 17.8s
226:    learn: 0.2889462        total: 5.2s     remaining: 17.7s
227:    learn: 0.2882824        total: 5.22s    remaining: 17.7s
228:    learn: 0.2878468        total: 5.23s    remaining: 17.6s
229:    learn: 0.2876125        total: 5.25s    remaining: 17.6s
230:    learn: 0.2870509        total: 5.28s    remaining: 17.6s
231:    learn: 0.2864991        total: 5.3s     remaining: 17.5s
232:    learn: 0.2863319        total: 5.32s    remaining: 17.5s
233:    learn: 0.2859217        total: 5.34s    remaining: 17.5s
234:    learn: 0.2857607        total: 5.36s    remaining: 17.5s
235:    learn: 0.2852085        total: 5.4s     remaining: 17.5s
236:    learn: 0.2849456        total: 5.44s    remaining: 17.5s
237:    learn: 0.2845163        total: 5.45s    remaining: 17.5s
238:    learn: 0.2839865        total: 5.48s    remaining: 17.4s
239:    learn: 0.2836972        total: 5.5s     remaining: 17.4s
240:    learn: 0.2833170        total: 5.51s    remaining: 17.4s
241:    learn: 0.2827385        total: 5.53s    remaining: 17.3s
242:    learn: 0.2824809        total: 5.56s    remaining: 17.3s
243:    learn: 0.2819181        total: 5.58s    remaining: 17.3s
244:    learn: 0.2814870        total: 5.61s    remaining: 17.3s
245:    learn: 0.2811034        total: 5.62s    remaining: 17.2s
246:    learn: 0.2806099        total: 5.64s    remaining: 17.2s
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247:    learn: 0.2804478        total: 5.65s    remaining: 17.1s
248:    learn: 0.2799485        total: 5.67s    remaining: 17.1s
249:    learn: 0.2794224        total: 5.7s     remaining: 17.1s
250:    learn: 0.2789213        total: 5.73s    remaining: 17.1s
251:    learn: 0.2785424        total: 5.74s    remaining: 17s
252:    learn: 0.2779771        total: 5.76s    remaining: 17s
253:    learn: 0.2777043        total: 5.79s    remaining: 17s
254:    learn: 0.2773532        total: 5.81s    remaining: 17s
255:    learn: 0.2769246        total: 5.83s    remaining: 17s
256:    learn: 0.2765800        total: 5.86s    remaining: 16.9s
257:    learn: 0.2760757        total: 5.88s    remaining: 16.9s
258:    learn: 0.2756307        total: 5.91s    remaining: 16.9s
259:    learn: 0.2753861        total: 5.92s    remaining: 16.9s
260:    learn: 0.2750657        total: 5.95s    remaining: 16.8s
261:    learn: 0.2745602        total: 5.97s    remaining: 16.8s
262:    learn: 0.2743902        total: 5.99s    remaining: 16.8s
263:    learn: 0.2739585        total: 6.04s    remaining: 16.8s
264:    learn: 0.2738744        total: 6.06s    remaining: 16.8s
265:    learn: 0.2737280        total: 6.08s    remaining: 16.8s
266:    learn: 0.2733571        total: 6.1s     remaining: 16.8s
267:    learn: 0.2729728        total: 6.12s    remaining: 16.7s
268:    learn: 0.2724304        total: 6.15s    remaining: 16.7s
269:    learn: 0.2722134        total: 6.17s    remaining: 16.7s
270:    learn: 0.2716321        total: 6.2s     remaining: 16.7s
271:    learn: 0.2711778        total: 6.23s    remaining: 16.7s
272:    learn: 0.2708963        total: 6.25s    remaining: 16.6s
273:    learn: 0.2705062        total: 6.29s    remaining: 16.7s
274:    learn: 0.2702070        total: 6.31s    remaining: 16.6s
275:    learn: 0.2698010        total: 6.33s    remaining: 16.6s
276:    learn: 0.2694926        total: 6.34s    remaining: 16.5s
277:    learn: 0.2690492        total: 6.36s    remaining: 16.5s
278:    learn: 0.2687557        total: 6.37s    remaining: 16.5s
279:    learn: 0.2680411        total: 6.4s     remaining: 16.5s
280:    learn: 0.2675846        total: 6.43s    remaining: 16.5s
281:    learn: 0.2673865        total: 6.45s    remaining: 16.4s
282:    learn: 0.2668153        total: 6.47s    remaining: 16.4s
283:    learn: 0.2666864        total: 6.48s    remaining: 16.3s
284:    learn: 0.2663311        total: 6.51s    remaining: 16.3s
285:    learn: 0.2661117        total: 6.53s    remaining: 16.3s
286:    learn: 0.2657454        total: 6.56s    remaining: 16.3s
287:    learn: 0.2656899        total: 6.57s    remaining: 16.2s
288:    learn: 0.2654163        total: 6.6s     remaining: 16.2s
289:    learn: 0.2652146        total: 6.62s    remaining: 16.2s
290:    learn: 0.2648181        total: 6.66s    remaining: 16.2s
291:    learn: 0.2646459        total: 6.68s    remaining: 16.2s
292:    learn: 0.2641573        total: 6.69s    remaining: 16.1s
293:    learn: 0.2637244        total: 6.71s    remaining: 16.1s
294:    learn: 0.2633668        total: 6.73s    remaining: 16.1s
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295:    learn: 0.2628915        total: 6.75s    remaining: 16.1s
296:    learn: 0.2627370        total: 6.78s    remaining: 16s
297:    learn: 0.2625937        total: 6.79s    remaining: 16s
298:    learn: 0.2622223        total: 6.82s    remaining: 16s
299:    learn: 0.2619898        total: 6.83s    remaining: 15.9s
300:    learn: 0.2613647        total: 6.86s    remaining: 15.9s
301:    learn: 0.2609799        total: 6.88s    remaining: 15.9s
302:    learn: 0.2608640        total: 6.89s    remaining: 15.8s
303:    learn: 0.2606759        total: 6.9s     remaining: 15.8s
304:    learn: 0.2602344        total: 6.92s    remaining: 15.8s
305:    learn: 0.2600443        total: 6.94s    remaining: 15.7s
306:    learn: 0.2598138        total: 6.96s    remaining: 15.7s
307:    learn: 0.2596676        total: 6.98s    remaining: 15.7s
308:    learn: 0.2595364        total: 6.99s    remaining: 15.6s
309:    learn: 0.2591015        total: 7.02s    remaining: 15.6s
310:    learn: 0.2588817        total: 7.06s    remaining: 15.6s
311:    learn: 0.2585196        total: 7.09s    remaining: 15.6s
312:    learn: 0.2580860        total: 7.11s    remaining: 15.6s
313:    learn: 0.2577965        total: 7.13s    remaining: 15.6s
314:    learn: 0.2575276        total: 7.15s    remaining: 15.5s
315:    learn: 0.2572530        total: 7.16s    remaining: 15.5s
316:    learn: 0.2569789        total: 7.18s    remaining: 15.5s
317:    learn: 0.2567487        total: 7.21s    remaining: 15.5s
318:    learn: 0.2564517        total: 7.23s    remaining: 15.4s
319:    learn: 0.2561106        total: 7.26s    remaining: 15.4s
320:    learn: 0.2558903        total: 7.29s    remaining: 15.4s
321:    learn: 0.2558385        total: 7.3s     remaining: 15.4s
322:    learn: 0.2555291        total: 7.32s    remaining: 15.3s
323:    learn: 0.2554262        total: 7.33s    remaining: 15.3s
324:    learn: 0.2550508        total: 7.37s    remaining: 15.3s
325:    learn: 0.2546047        total: 7.39s    remaining: 15.3s
326:    learn: 0.2540286        total: 7.42s    remaining: 15.3s
327:    learn: 0.2538419        total: 7.44s    remaining: 15.2s
328:    learn: 0.2536309        total: 7.46s    remaining: 15.2s
329:    learn: 0.2533987        total: 7.48s    remaining: 15.2s
330:    learn: 0.2530594        total: 7.51s    remaining: 15.2s
331:    learn: 0.2527164        total: 7.54s    remaining: 15.2s
332:    learn: 0.2525244        total: 7.58s    remaining: 15.2s
333:    learn: 0.2522175        total: 7.6s     remaining: 15.2s
334:    learn: 0.2519898        total: 7.63s    remaining: 15.2s
335:    learn: 0.2516307        total: 7.66s    remaining: 15.1s
336:    learn: 0.2513790        total: 7.7s     remaining: 15.1s
337:    learn: 0.2512162        total: 7.72s    remaining: 15.1s
338:    learn: 0.2507776        total: 7.75s    remaining: 15.1s
339:    learn: 0.2503914        total: 7.78s    remaining: 15.1s
340:    learn: 0.2500873        total: 7.8s     remaining: 15.1s
341:    learn: 0.2498485        total: 7.83s    remaining: 15.1s
342:    learn: 0.2495397        total: 7.85s    remaining: 15s
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343:    learn: 0.2492038        total: 7.88s    remaining: 15s
344:    learn: 0.2487913        total: 7.9s     remaining: 15s
345:    learn: 0.2486025        total: 7.93s    remaining: 15s
346:    learn: 0.2483937        total: 7.96s    remaining: 15s
347:    learn: 0.2480680        total: 7.99s    remaining: 15s
348:    learn: 0.2478302        total: 8.02s    remaining: 15s
349:    learn: 0.2476887        total: 8.04s    remaining: 14.9s
350:    learn: 0.2474916        total: 8.07s    remaining: 14.9s
351:    learn: 0.2473086        total: 8.09s    remaining: 14.9s
352:    learn: 0.2469599        total: 8.15s    remaining: 14.9s
353:    learn: 0.2464170        total: 8.19s    remaining: 14.9s
354:    learn: 0.2462533        total: 8.2s     remaining: 14.9s
355:    learn: 0.2462074        total: 8.21s    remaining: 14.8s
356:    learn: 0.2459836        total: 8.24s    remaining: 14.8s
357:    learn: 0.2458466        total: 8.26s    remaining: 14.8s
358:    learn: 0.2455631        total: 8.3s     remaining: 14.8s
359:    learn: 0.2453371        total: 8.33s    remaining: 14.8s
360:    learn: 0.2452626        total: 8.34s    remaining: 14.8s
361:    learn: 0.2449330        total: 8.36s    remaining: 14.7s
362:    learn: 0.2446932        total: 8.39s    remaining: 14.7s
363:    learn: 0.2442830        total: 8.42s    remaining: 14.7s
364:    learn: 0.2441341        total: 8.44s    remaining: 14.7s
365:    learn: 0.2438883        total: 8.46s    remaining: 14.7s
366:    learn: 0.2435668        total: 8.49s    remaining: 14.6s
367:    learn: 0.2433386        total: 8.51s    remaining: 14.6s
368:    learn: 0.2433189        total: 8.52s    remaining: 14.6s
369:    learn: 0.2429321        total: 8.55s    remaining: 14.6s
370:    learn: 0.2429168        total: 8.56s    remaining: 14.5s
371:    learn: 0.2426022        total: 8.6s     remaining: 14.5s
372:    learn: 0.2422925        total: 8.63s    remaining: 14.5s
373:    learn: 0.2419677        total: 8.65s    remaining: 14.5s
374:    learn: 0.2419346        total: 8.66s    remaining: 14.4s
375:    learn: 0.2416149        total: 8.69s    remaining: 14.4s
376:    learn: 0.2415345        total: 8.71s    remaining: 14.4s
377:    learn: 0.2415180        total: 8.72s    remaining: 14.4s
378:    learn: 0.2413704        total: 8.76s    remaining: 14.4s
379:    learn: 0.2412663        total: 8.78s    remaining: 14.3s
380:    learn: 0.2409583        total: 8.8s     remaining: 14.3s
381:    learn: 0.2407398        total: 8.82s    remaining: 14.3s
382:    learn: 0.2404484        total: 8.85s    remaining: 14.3s
383:    learn: 0.2402614        total: 8.87s    remaining: 14.2s
384:    learn: 0.2398791        total: 8.9s     remaining: 14.2s
385:    learn: 0.2395020        total: 8.92s    remaining: 14.2s
386:    learn: 0.2392803        total: 8.94s    remaining: 14.2s
387:    learn: 0.2390529        total: 8.96s    remaining: 14.1s
388:    learn: 0.2387313        total: 8.98s    remaining: 14.1s
389:    learn: 0.2383634        total: 9s       remaining: 14.1s
390:    learn: 0.2382969        total: 9.01s    remaining: 14s
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391:    learn: 0.2377778        total: 9.04s    remaining: 14s
392:    learn: 0.2376838        total: 9.06s    remaining: 14s
393:    learn: 0.2374448        total: 9.08s    remaining: 14s
394:    learn: 0.2372722        total: 9.11s    remaining: 13.9s
395:    learn: 0.2370617        total: 9.13s    remaining: 13.9s
396:    learn: 0.2367784        total: 9.14s    remaining: 13.9s
397:    learn: 0.2364979        total: 9.16s    remaining: 13.9s
398:    learn: 0.2362676        total: 9.18s    remaining: 13.8s
399:    learn: 0.2362301        total: 9.19s    remaining: 13.8s
400:    learn: 0.2358538        total: 9.22s    remaining: 13.8s
401:    learn: 0.2356430        total: 9.24s    remaining: 13.7s
402:    learn: 0.2354852        total: 9.26s    remaining: 13.7s
403:    learn: 0.2352493        total: 9.28s    remaining: 13.7s
404:    learn: 0.2350804        total: 9.29s    remaining: 13.7s
405:    learn: 0.2349252        total: 9.31s    remaining: 13.6s
406:    learn: 0.2345477        total: 9.33s    remaining: 13.6s
407:    learn: 0.2342050        total: 9.35s    remaining: 13.6s
408:    learn: 0.2337828        total: 9.39s    remaining: 13.6s
409:    learn: 0.2334545        total: 9.41s    remaining: 13.5s
410:    learn: 0.2331381        total: 9.42s    remaining: 13.5s
411:    learn: 0.2328703        total: 9.44s    remaining: 13.5s
412:    learn: 0.2327103        total: 9.46s    remaining: 13.4s
413:    learn: 0.2323345        total: 9.47s    remaining: 13.4s
414:    learn: 0.2319610        total: 9.5s     remaining: 13.4s
415:    learn: 0.2317844        total: 9.51s    remaining: 13.4s
416:    learn: 0.2314291        total: 9.54s    remaining: 13.3s
417:    learn: 0.2313148        total: 9.54s    remaining: 13.3s
418:    learn: 0.2311297        total: 9.57s    remaining: 13.3s
419:    learn: 0.2309957        total: 9.6s     remaining: 13.3s
420:    learn: 0.2309699        total: 9.6s     remaining: 13.2s
421:    learn: 0.2307820        total: 9.63s    remaining: 13.2s
422:    learn: 0.2303292        total: 9.65s    remaining: 13.2s
423:    learn: 0.2302433        total: 9.66s    remaining: 13.1s
424:    learn: 0.2299036        total: 9.68s    remaining: 13.1s
425:    learn: 0.2295111        total: 9.72s    remaining: 13.1s
426:    learn: 0.2291885        total: 9.74s    remaining: 13.1s
427:    learn: 0.2290462        total: 9.76s    remaining: 13s
428:    learn: 0.2287640        total: 9.79s    remaining: 13s
429:    learn: 0.2284531        total: 9.82s    remaining: 13s
430:    learn: 0.2283095        total: 9.84s    remaining: 13s
431:    learn: 0.2280010        total: 9.86s    remaining: 13s
432:    learn: 0.2279898        total: 9.86s    remaining: 12.9s
433:    learn: 0.2278586        total: 9.87s    remaining: 12.9s
434:    learn: 0.2276556        total: 9.89s    remaining: 12.8s
435:    learn: 0.2275772        total: 9.9s     remaining: 12.8s
436:    learn: 0.2272647        total: 9.92s    remaining: 12.8s
437:    learn: 0.2270487        total: 9.95s    remaining: 12.8s
438:    learn: 0.2268934        total: 9.98s    remaining: 12.8s
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439:    learn: 0.2268688        total: 9.99s    remaining: 12.7s
440:    learn: 0.2266594        total: 10s      remaining: 12.7s
441:    learn: 0.2264393        total: 10s      remaining: 12.7s
442:    learn: 0.2264384        total: 10.1s    remaining: 12.6s
443:    learn: 0.2263553        total: 10.1s    remaining: 12.6s
444:    learn: 0.2260353        total: 10.1s    remaining: 12.6s
445:    learn: 0.2256645        total: 10.1s    remaining: 12.6s
446:    learn: 0.2253462        total: 10.2s    remaining: 12.6s
447:    learn: 0.2250436        total: 10.2s    remaining: 12.5s
448:    learn: 0.2247983        total: 10.2s    remaining: 12.5s
449:    learn: 0.2246227        total: 10.2s    remaining: 12.5s
450:    learn: 0.2246110        total: 10.2s    remaining: 12.5s
451:    learn: 0.2242868        total: 10.3s    remaining: 12.4s
452:    learn: 0.2240645        total: 10.3s    remaining: 12.4s
453:    learn: 0.2237929        total: 10.3s    remaining: 12.4s
454:    learn: 0.2234575        total: 10.3s    remaining: 12.4s
455:    learn: 0.2232149        total: 10.4s    remaining: 12.4s
456:    learn: 0.2228528        total: 10.4s    remaining: 12.3s
457:    learn: 0.2226984        total: 10.4s    remaining: 12.3s
458:    learn: 0.2222970        total: 10.4s    remaining: 12.3s
459:    learn: 0.2220039        total: 10.5s    remaining: 12.3s
460:    learn: 0.2217825        total: 10.5s    remaining: 12.2s
461:    learn: 0.2213970        total: 10.5s    remaining: 12.2s
462:    learn: 0.2210663        total: 10.5s    remaining: 12.2s
463:    learn: 0.2207751        total: 10.5s    remaining: 12.2s
464:    learn: 0.2205431        total: 10.6s    remaining: 12.2s
465:    learn: 0.2202876        total: 10.6s    remaining: 12.2s
466:    learn: 0.2199764        total: 10.6s    remaining: 12.1s
467:    learn: 0.2198718        total: 10.7s    remaining: 12.1s
468:    learn: 0.2196857        total: 10.7s    remaining: 12.1s
469:    learn: 0.2195687        total: 10.7s    remaining: 12s
470:    learn: 0.2195385        total: 10.7s    remaining: 12s
471:    learn: 0.2194945        total: 10.7s    remaining: 12s
472:    learn: 0.2192047        total: 10.7s    remaining: 12s
473:    learn: 0.2187590        total: 10.8s    remaining: 12s
474:    learn: 0.2185538        total: 10.8s    remaining: 11.9s
475:    learn: 0.2183626        total: 10.8s    remaining: 11.9s
476:    learn: 0.2181474        total: 10.9s    remaining: 11.9s
477:    learn: 0.2178299        total: 10.9s    remaining: 11.9s
478:    learn: 0.2177191        total: 10.9s    remaining: 11.8s
479:    learn: 0.2174997        total: 10.9s    remaining: 11.8s
480:    learn: 0.2170910        total: 10.9s    remaining: 11.8s
481:    learn: 0.2170044        total: 10.9s    remaining: 11.8s
482:    learn: 0.2167618        total: 11s      remaining: 11.7s
483:    learn: 0.2166134        total: 11s      remaining: 11.7s
484:    learn: 0.2165043        total: 11s      remaining: 11.7s
485:    learn: 0.2162006        total: 11.1s    remaining: 11.7s
486:    learn: 0.2160604        total: 11.1s    remaining: 11.7s
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487:    learn: 0.2158971        total: 11.1s    remaining: 11.7s
488:    learn: 0.2156819        total: 11.1s    remaining: 11.6s
489:    learn: 0.2151998        total: 11.2s    remaining: 11.6s
490:    learn: 0.2151656        total: 11.2s    remaining: 11.6s
491:    learn: 0.2149107        total: 11.2s    remaining: 11.6s
492:    learn: 0.2144086        total: 11.2s    remaining: 11.5s
493:    learn: 0.2139709        total: 11.3s    remaining: 11.5s
494:    learn: 0.2135218        total: 11.3s    remaining: 11.5s
495:    learn: 0.2133779        total: 11.3s    remaining: 11.5s
496:    learn: 0.2130072        total: 11.3s    remaining: 11.5s
497:    learn: 0.2128052        total: 11.3s    remaining: 11.4s
498:    learn: 0.2126653        total: 11.4s    remaining: 11.4s
499:    learn: 0.2125428        total: 11.4s    remaining: 11.4s
500:    learn: 0.2124048        total: 11.4s    remaining: 11.4s
501:    learn: 0.2122746        total: 11.4s    remaining: 11.3s
502:    learn: 0.2121134        total: 11.5s    remaining: 11.3s
503:    learn: 0.2119405        total: 11.5s    remaining: 11.3s
504:    learn: 0.2117748        total: 11.5s    remaining: 11.3s
505:    learn: 0.2116352        total: 11.5s    remaining: 11.2s
506:    learn: 0.2114907        total: 11.5s    remaining: 11.2s
507:    learn: 0.2113750        total: 11.5s    remaining: 11.2s
508:    learn: 0.2111716        total: 11.6s    remaining: 11.2s
509:    learn: 0.2109873        total: 11.6s    remaining: 11.1s
510:    learn: 0.2106202        total: 11.6s    remaining: 11.1s
511:    learn: 0.2104763        total: 11.7s    remaining: 11.1s
512:    learn: 0.2103851        total: 11.7s    remaining: 11.1s
513:    learn: 0.2101722        total: 11.7s    remaining: 11.1s
514:    learn: 0.2101229        total: 11.7s    remaining: 11s
515:    learn: 0.2099575        total: 11.7s    remaining: 11s
516:    learn: 0.2096539        total: 11.8s    remaining: 11s
517:    learn: 0.2095497        total: 11.8s    remaining: 11s
518:    learn: 0.2094187        total: 11.8s    remaining: 10.9s
519:    learn: 0.2092877        total: 11.8s    remaining: 10.9s
520:    learn: 0.2091394        total: 11.9s    remaining: 10.9s
521:    learn: 0.2089454        total: 11.9s    remaining: 10.9s
522:    learn: 0.2086533        total: 11.9s    remaining: 10.9s
523:    learn: 0.2085461        total: 12s      remaining: 10.9s
524:    learn: 0.2082940        total: 12s      remaining: 10.8s
525:    learn: 0.2080437        total: 12s      remaining: 10.8s
526:    learn: 0.2078803        total: 12s      remaining: 10.8s
527:    learn: 0.2075746        total: 12s      remaining: 10.8s
528:    learn: 0.2071173        total: 12.1s    remaining: 10.8s
529:    learn: 0.2068028        total: 12.1s    remaining: 10.7s
530:    learn: 0.2065377        total: 12.1s    remaining: 10.7s
531:    learn: 0.2065212        total: 12.1s    remaining: 10.7s
532:    learn: 0.2064882        total: 12.2s    remaining: 10.7s
533:    learn: 0.2063144        total: 12.2s    remaining: 10.6s
534:    learn: 0.2062256        total: 12.2s    remaining: 10.6s
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535:    learn: 0.2060315        total: 12.2s    remaining: 10.6s
536:    learn: 0.2059006        total: 12.2s    remaining: 10.6s
537:    learn: 0.2056532        total: 12.3s    remaining: 10.5s
538:    learn: 0.2056055        total: 12.3s    remaining: 10.5s
539:    learn: 0.2054159        total: 12.3s    remaining: 10.5s
540:    learn: 0.2054000        total: 12.3s    remaining: 10.4s
541:    learn: 0.2052071        total: 12.3s    remaining: 10.4s
542:    learn: 0.2049456        total: 12.3s    remaining: 10.4s
543:    learn: 0.2046541        total: 12.4s    remaining: 10.4s
544:    learn: 0.2044265        total: 12.4s    remaining: 10.3s
545:    learn: 0.2042814        total: 12.4s    remaining: 10.3s
546:    learn: 0.2040813        total: 12.4s    remaining: 10.3s
547:    learn: 0.2038539        total: 12.5s    remaining: 10.3s
548:    learn: 0.2035652        total: 12.5s    remaining: 10.3s
549:    learn: 0.2032855        total: 12.5s    remaining: 10.2s
550:    learn: 0.2029664        total: 12.5s    remaining: 10.2s
551:    learn: 0.2027561        total: 12.6s    remaining: 10.2s
552:    learn: 0.2025637        total: 12.6s    remaining: 10.2s
553:    learn: 0.2024428        total: 12.6s    remaining: 10.2s
554:    learn: 0.2022069        total: 12.6s    remaining: 10.1s
555:    learn: 0.2020738        total: 12.7s    remaining: 10.1s
556:    learn: 0.2019355        total: 12.7s    remaining: 10.1s
557:    learn: 0.2018039        total: 12.7s    remaining: 10.1s
558:    learn: 0.2016998        total: 12.7s    remaining: 10s
559:    learn: 0.2014200        total: 12.7s    remaining: 10s
560:    learn: 0.2013045        total: 12.8s    remaining: 9.99s
561:    learn: 0.2012237        total: 12.8s    remaining: 9.97s
562:    learn: 0.2008837        total: 12.8s    remaining: 9.94s
563:    learn: 0.2007374        total: 12.8s    remaining: 9.91s
564:    learn: 0.2006191        total: 12.9s    remaining: 9.9s
565:    learn: 0.2004713        total: 12.9s    remaining: 9.87s
566:    learn: 0.2000806        total: 12.9s    remaining: 9.85s
567:    learn: 0.1997570        total: 12.9s    remaining: 9.83s
568:    learn: 0.1996077        total: 12.9s    remaining: 9.8s
569:    learn: 0.1992729        total: 13s      remaining: 9.77s
570:    learn: 0.1988563        total: 13s      remaining: 9.75s
571:    learn: 0.1984953        total: 13s      remaining: 9.72s
572:    learn: 0.1983292        total: 13s      remaining: 9.71s
573:    learn: 0.1981977        total: 13.1s    remaining: 9.7s
574:    learn: 0.1980584        total: 13.1s    remaining: 9.68s
575:    learn: 0.1977023        total: 13.1s    remaining: 9.66s
576:    learn: 0.1975766        total: 13.1s    remaining: 9.63s
577:    learn: 0.1975275        total: 13.2s    remaining: 9.61s
578:    learn: 0.1974041        total: 13.2s    remaining: 9.58s
579:    learn: 0.1974030        total: 13.2s    remaining: 9.54s
580:    learn: 0.1970996        total: 13.2s    remaining: 9.52s
581:    learn: 0.1968648        total: 13.2s    remaining: 9.49s
582:    learn: 0.1967160        total: 13.2s    remaining: 9.47s
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583:    learn: 0.1964522        total: 13.3s    remaining: 9.46s
584:    learn: 0.1960076        total: 13.3s    remaining: 9.45s
585:    learn: 0.1959541        total: 13.3s    remaining: 9.41s
586:    learn: 0.1958770        total: 13.3s    remaining: 9.39s
587:    learn: 0.1957097        total: 13.4s    remaining: 9.37s
588:    learn: 0.1955726        total: 13.4s    remaining: 9.35s
589:    learn: 0.1953545        total: 13.4s    remaining: 9.33s
590:    learn: 0.1949529        total: 13.4s    remaining: 9.31s
591:    learn: 0.1947839        total: 13.5s    remaining: 9.28s
592:    learn: 0.1947433        total: 13.5s    remaining: 9.26s
593:    learn: 0.1944721        total: 13.5s    remaining: 9.24s
594:    learn: 0.1940982        total: 13.5s    remaining: 9.22s
595:    learn: 0.1937857        total: 13.6s    remaining: 9.2s
596:    learn: 0.1936940        total: 13.6s    remaining: 9.18s
597:    learn: 0.1936377        total: 13.6s    remaining: 9.15s
598:    learn: 0.1933399        total: 13.7s    remaining: 9.14s
599:    learn: 0.1931995        total: 13.7s    remaining: 9.13s
600:    learn: 0.1929296        total: 13.7s    remaining: 9.11s
601:    learn: 0.1927915        total: 13.7s    remaining: 9.08s
602:    learn: 0.1925653        total: 13.8s    remaining: 9.06s
603:    learn: 0.1922659        total: 13.8s    remaining: 9.04s
604:    learn: 0.1921267        total: 13.8s    remaining: 9.02s
605:    learn: 0.1918421        total: 13.8s    remaining: 8.99s
606:    learn: 0.1915888        total: 13.8s    remaining: 8.96s
607:    learn: 0.1914998        total: 13.9s    remaining: 8.94s
608:    learn: 0.1912448        total: 13.9s    remaining: 8.92s
609:    learn: 0.1910970        total: 13.9s    remaining: 8.9s
610:    learn: 0.1908882        total: 13.9s    remaining: 8.88s
611:    learn: 0.1907280        total: 14s      remaining: 8.85s
612:    learn: 0.1904967        total: 14s      remaining: 8.83s
613:    learn: 0.1904727        total: 14s      remaining: 8.8s
614:    learn: 0.1903444        total: 14s      remaining: 8.78s
615:    learn: 0.1902702        total: 14s      remaining: 8.75s
616:    learn: 0.1899841        total: 14.1s    remaining: 8.73s
617:    learn: 0.1897641        total: 14.1s    remaining: 8.72s
618:    learn: 0.1894046        total: 14.1s    remaining: 8.7s
619:    learn: 0.1891757        total: 14.2s    remaining: 8.68s
620:    learn: 0.1890051        total: 14.2s    remaining: 8.65s
621:    learn: 0.1889188        total: 14.2s    remaining: 8.63s
622:    learn: 0.1887166        total: 14.2s    remaining: 8.61s
623:    learn: 0.1886455        total: 14.2s    remaining: 8.58s
624:    learn: 0.1886330        total: 14.2s    remaining: 8.55s
625:    learn: 0.1883564        total: 14.3s    remaining: 8.53s
626:    learn: 0.1882434        total: 14.3s    remaining: 8.5s
627:    learn: 0.1879714        total: 14.3s    remaining: 8.48s
628:    learn: 0.1877975        total: 14.4s    remaining: 8.46s
629:    learn: 0.1877572        total: 14.4s    remaining: 8.44s
630:    learn: 0.1875745        total: 14.4s    remaining: 8.42s
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631:    learn: 0.1871581        total: 14.4s    remaining: 8.39s
632:    learn: 0.1870419        total: 14.4s    remaining: 8.36s
633:    learn: 0.1869054        total: 14.4s    remaining: 8.34s
634:    learn: 0.1865430        total: 14.5s    remaining: 8.31s
635:    learn: 0.1863507        total: 14.5s    remaining: 8.28s
636:    learn: 0.1862099        total: 14.5s    remaining: 8.26s
637:    learn: 0.1861014        total: 14.5s    remaining: 8.23s
638:    learn: 0.1857791        total: 14.5s    remaining: 8.21s
639:    learn: 0.1856232        total: 14.6s    remaining: 8.19s
640:    learn: 0.1851962        total: 14.6s    remaining: 8.17s
641:    learn: 0.1850400        total: 14.6s    remaining: 8.14s
642:    learn: 0.1847649        total: 14.6s    remaining: 8.12s
643:    learn: 0.1846152        total: 14.6s    remaining: 8.09s
644:    learn: 0.1844893        total: 14.7s    remaining: 8.08s
645:    learn: 0.1843546        total: 14.7s    remaining: 8.05s
646:    learn: 0.1841314        total: 14.7s    remaining: 8.03s
647:    learn: 0.1839421        total: 14.7s    remaining: 8s
648:    learn: 0.1838157        total: 14.7s    remaining: 7.97s
649:    learn: 0.1836687        total: 14.8s    remaining: 7.95s
650:    learn: 0.1833372        total: 14.8s    remaining: 7.92s
651:    learn: 0.1832630        total: 14.8s    remaining: 7.9s
652:    learn: 0.1831061        total: 14.8s    remaining: 7.88s
653:    learn: 0.1827932        total: 14.9s    remaining: 7.86s
654:    learn: 0.1823027        total: 14.9s    remaining: 7.83s
655:    learn: 0.1821337        total: 14.9s    remaining: 7.81s
656:    learn: 0.1820075        total: 14.9s    remaining: 7.79s
657:    learn: 0.1816775        total: 14.9s    remaining: 7.76s
658:    learn: 0.1816313        total: 14.9s    remaining: 7.74s
659:    learn: 0.1815545        total: 15s      remaining: 7.71s
660:    learn: 0.1813495        total: 15s      remaining: 7.68s
661:    learn: 0.1813125        total: 15s      remaining: 7.66s
662:    learn: 0.1811312        total: 15s      remaining: 7.64s
663:    learn: 0.1809780        total: 15.1s    remaining: 7.62s
664:    learn: 0.1808430        total: 15.1s    remaining: 7.59s
665:    learn: 0.1807351        total: 15.1s    remaining: 7.56s
666:    learn: 0.1804734        total: 15.1s    remaining: 7.54s
667:    learn: 0.1802957        total: 15.1s    remaining: 7.52s
668:    learn: 0.1801704        total: 15.2s    remaining: 7.5s
669:    learn: 0.1800690        total: 15.2s    remaining: 7.48s
670:    learn: 0.1799121        total: 15.2s    remaining: 7.45s
671:    learn: 0.1798635        total: 15.2s    remaining: 7.42s
672:    learn: 0.1796852        total: 15.2s    remaining: 7.4s
673:    learn: 0.1795222        total: 15.2s    remaining: 7.38s
674:    learn: 0.1791986        total: 15.3s    remaining: 7.35s
675:    learn: 0.1791159        total: 15.3s    remaining: 7.33s
676:    learn: 0.1790210        total: 15.3s    remaining: 7.31s
677:    learn: 0.1788708        total: 15.3s    remaining: 7.28s
678:    learn: 0.1786580        total: 15.4s    remaining: 7.26s
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679:    learn: 0.1784604        total: 15.4s    remaining: 7.23s
680:    learn: 0.1783165        total: 15.4s    remaining: 7.22s
681:    learn: 0.1781045        total: 15.4s    remaining: 7.19s
682:    learn: 0.1779133        total: 15.4s    remaining: 7.16s
683:    learn: 0.1776635        total: 15.5s    remaining: 7.14s
684:    learn: 0.1775362        total: 15.5s    remaining: 7.11s
685:    learn: 0.1773241        total: 15.5s    remaining: 7.09s
686:    learn: 0.1772781        total: 15.5s    remaining: 7.06s
687:    learn: 0.1771704        total: 15.5s    remaining: 7.04s
688:    learn: 0.1770646        total: 15.5s    remaining: 7.02s
689:    learn: 0.1768857        total: 15.6s    remaining: 6.99s
690:    learn: 0.1768528        total: 15.6s    remaining: 6.97s
691:    learn: 0.1765412        total: 15.6s    remaining: 6.95s
692:    learn: 0.1761982        total: 15.6s    remaining: 6.93s
693:    learn: 0.1761192        total: 15.7s    remaining: 6.9s
694:    learn: 0.1758473        total: 15.7s    remaining: 6.89s
695:    learn: 0.1756474        total: 15.7s    remaining: 6.87s
696:    learn: 0.1754768        total: 15.8s    remaining: 6.85s
697:    learn: 0.1753295        total: 15.8s    remaining: 6.82s
698:    learn: 0.1751247        total: 15.8s    remaining: 6.8s
699:    learn: 0.1749720        total: 15.8s    remaining: 6.77s
700:    learn: 0.1749427        total: 15.8s    remaining: 6.75s
701:    learn: 0.1747763        total: 15.8s    remaining: 6.72s
702:    learn: 0.1745915        total: 15.9s    remaining: 6.7s
703:    learn: 0.1742760        total: 15.9s    remaining: 6.68s
704:    learn: 0.1741202        total: 15.9s    remaining: 6.65s
705:    learn: 0.1738783        total: 15.9s    remaining: 6.63s
706:    learn: 0.1737529        total: 16s      remaining: 6.61s
707:    learn: 0.1734945        total: 16s      remaining: 6.59s
708:    learn: 0.1732819        total: 16s      remaining: 6.56s
709:    learn: 0.1730580        total: 16s      remaining: 6.54s
710:    learn: 0.1727183        total: 16s      remaining: 6.52s
711:    learn: 0.1723323        total: 16.1s    remaining: 6.5s
712:    learn: 0.1720872        total: 16.1s    remaining: 6.48s
713:    learn: 0.1719544        total: 16.1s    remaining: 6.45s
714:    learn: 0.1716358        total: 16.1s    remaining: 6.43s
715:    learn: 0.1715334        total: 16.1s    remaining: 6.4s
716:    learn: 0.1713103        total: 16.2s    remaining: 6.38s
717:    learn: 0.1711110        total: 16.2s    remaining: 6.36s
718:    learn: 0.1710649        total: 16.2s    remaining: 6.34s
719:    learn: 0.1709761        total: 16.2s    remaining: 6.31s
720:    learn: 0.1707982        total: 16.3s    remaining: 6.29s
721:    learn: 0.1705675        total: 16.3s    remaining: 6.26s
722:    learn: 0.1704687        total: 16.3s    remaining: 6.24s
723:    learn: 0.1702544        total: 16.3s    remaining: 6.22s
724:    learn: 0.1701245        total: 16.3s    remaining: 6.19s
725:    learn: 0.1699720        total: 16.4s    remaining: 6.17s
726:    learn: 0.1698763        total: 16.4s    remaining: 6.14s
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727:    learn: 0.1696940        total: 16.4s    remaining: 6.12s
728:    learn: 0.1695511        total: 16.4s    remaining: 6.1s
729:    learn: 0.1693953        total: 16.4s    remaining: 6.07s
730:    learn: 0.1692803        total: 16.4s    remaining: 6.04s
731:    learn: 0.1691265        total: 16.4s    remaining: 6.02s
732:    learn: 0.1690366        total: 16.5s    remaining: 6s
733:    learn: 0.1689158        total: 16.5s    remaining: 5.97s
734:    learn: 0.1685617        total: 16.5s    remaining: 5.95s
735:    learn: 0.1683011        total: 16.5s    remaining: 5.93s
736:    learn: 0.1680016        total: 16.6s    remaining: 5.91s
737:    learn: 0.1677486        total: 16.6s    remaining: 5.89s
738:    learn: 0.1675797        total: 16.6s    remaining: 5.86s
739:    learn: 0.1673828        total: 16.6s    remaining: 5.84s
740:    learn: 0.1672378        total: 16.7s    remaining: 5.82s
741:    learn: 0.1671096        total: 16.7s    remaining: 5.8s
742:    learn: 0.1668730        total: 16.7s    remaining: 5.77s
743:    learn: 0.1667233        total: 16.7s    remaining: 5.76s
744:    learn: 0.1665467        total: 16.8s    remaining: 5.74s
745:    learn: 0.1663351        total: 16.8s    remaining: 5.71s
746:    learn: 0.1661448        total: 16.8s    remaining: 5.69s
747:    learn: 0.1659336        total: 16.8s    remaining: 5.67s
748:    learn: 0.1658422        total: 16.8s    remaining: 5.64s
749:    learn: 0.1656684        total: 16.9s    remaining: 5.62s
750:    learn: 0.1655721        total: 16.9s    remaining: 5.6s
751:    learn: 0.1654057        total: 16.9s    remaining: 5.58s
752:    learn: 0.1651658        total: 16.9s    remaining: 5.55s
753:    learn: 0.1650389        total: 16.9s    remaining: 5.53s
754:    learn: 0.1648458        total: 17s      remaining: 5.51s
755:    learn: 0.1647159        total: 17s      remaining: 5.48s
756:    learn: 0.1646088        total: 17s      remaining: 5.46s
757:    learn: 0.1644224        total: 17s      remaining: 5.44s
758:    learn: 0.1642866        total: 17.1s    remaining: 5.42s
759:    learn: 0.1641238        total: 17.1s    remaining: 5.39s
760:    learn: 0.1639954        total: 17.1s    remaining: 5.37s
761:    learn: 0.1638659        total: 17.1s    remaining: 5.35s
762:    learn: 0.1635159        total: 17.1s    remaining: 5.32s
763:    learn: 0.1634282        total: 17.2s    remaining: 5.3s
764:    learn: 0.1632966        total: 17.2s    remaining: 5.28s
765:    learn: 0.1631554        total: 17.2s    remaining: 5.26s
766:    learn: 0.1629328        total: 17.2s    remaining: 5.24s
767:    learn: 0.1627753        total: 17.3s    remaining: 5.22s
768:    learn: 0.1626802        total: 17.3s    remaining: 5.19s
769:    learn: 0.1624548        total: 17.3s    remaining: 5.17s
770:    learn: 0.1623832        total: 17.3s    remaining: 5.14s
771:    learn: 0.1622082        total: 17.3s    remaining: 5.11s
772:    learn: 0.1620224        total: 17.3s    remaining: 5.09s
773:    learn: 0.1618863        total: 17.3s    remaining: 5.07s
774:    learn: 0.1615394        total: 17.4s    remaining: 5.04s
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775:    learn: 0.1612486        total: 17.4s    remaining: 5.02s
776:    learn: 0.1610743        total: 17.4s    remaining: 5s
777:    learn: 0.1608466        total: 17.4s    remaining: 4.97s
778:    learn: 0.1606793        total: 17.5s    remaining: 4.95s
779:    learn: 0.1606048        total: 17.5s    remaining: 4.93s
780:    learn: 0.1603685        total: 17.5s    remaining: 4.9s
781:    learn: 0.1603125        total: 17.5s    remaining: 4.88s
782:    learn: 0.1601242        total: 17.5s    remaining: 4.85s
783:    learn: 0.1598969        total: 17.5s    remaining: 4.83s
784:    learn: 0.1597113        total: 17.6s    remaining: 4.81s
785:    learn: 0.1595116        total: 17.6s    remaining: 4.79s
786:    learn: 0.1593991        total: 17.6s    remaining: 4.76s
787:    learn: 0.1591699        total: 17.6s    remaining: 4.74s
788:    learn: 0.1589421        total: 17.6s    remaining: 4.72s
789:    learn: 0.1585635        total: 17.7s    remaining: 4.7s
790:    learn: 0.1584072        total: 17.7s    remaining: 4.67s
791:    learn: 0.1583186        total: 17.7s    remaining: 4.65s
792:    learn: 0.1579683        total: 17.7s    remaining: 4.63s
793:    learn: 0.1577890        total: 17.8s    remaining: 4.61s
794:    learn: 0.1576257        total: 17.8s    remaining: 4.59s
795:    learn: 0.1574484        total: 17.8s    remaining: 4.57s
796:    learn: 0.1572499        total: 17.8s    remaining: 4.54s
797:    learn: 0.1571263        total: 17.9s    remaining: 4.52s
798:    learn: 0.1570480        total: 17.9s    remaining: 4.5s
799:    learn: 0.1568980        total: 17.9s    remaining: 4.47s
800:    learn: 0.1565959        total: 17.9s    remaining: 4.45s
801:    learn: 0.1564855        total: 17.9s    remaining: 4.43s
802:    learn: 0.1562929        total: 18s      remaining: 4.41s
803:    learn: 0.1561961        total: 18s      remaining: 4.39s
804:    learn: 0.1560618        total: 18s      remaining: 4.36s
805:    learn: 0.1559030        total: 18s      remaining: 4.34s
806:    learn: 0.1556785        total: 18.1s    remaining: 4.32s
807:    learn: 0.1554316        total: 18.1s    remaining: 4.29s
808:    learn: 0.1551293        total: 18.1s    remaining: 4.27s
809:    learn: 0.1550598        total: 18.1s    remaining: 4.25s
810:    learn: 0.1546950        total: 18.1s    remaining: 4.22s
811:    learn: 0.1546420        total: 18.1s    remaining: 4.2s
812:    learn: 0.1545543        total: 18.1s    remaining: 4.17s
813:    learn: 0.1543657        total: 18.2s    remaining: 4.15s
814:    learn: 0.1542855        total: 18.2s    remaining: 4.13s
815:    learn: 0.1540635        total: 18.2s    remaining: 4.11s
816:    learn: 0.1539600        total: 18.2s    remaining: 4.08s
817:    learn: 0.1538228        total: 18.2s    remaining: 4.06s
818:    learn: 0.1537014        total: 18.3s    remaining: 4.04s
819:    learn: 0.1536239        total: 18.3s    remaining: 4.01s
820:    learn: 0.1533835        total: 18.3s    remaining: 3.99s
821:    learn: 0.1532758        total: 18.3s    remaining: 3.97s
822:    learn: 0.1531220        total: 18.3s    remaining: 3.94s
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823:    learn: 0.1530054        total: 18.4s    remaining: 3.92s
824:    learn: 0.1528698        total: 18.4s    remaining: 3.9s
825:    learn: 0.1525198        total: 18.4s    remaining: 3.88s
826:    learn: 0.1523445        total: 18.4s    remaining: 3.85s
827:    learn: 0.1520242        total: 18.4s    remaining: 3.83s
828:    learn: 0.1518589        total: 18.5s    remaining: 3.81s
829:    learn: 0.1516278        total: 18.5s    remaining: 3.78s
830:    learn: 0.1513539        total: 18.5s    remaining: 3.76s
831:    learn: 0.1510021        total: 18.5s    remaining: 3.74s
832:    learn: 0.1508325        total: 18.5s    remaining: 3.72s
833:    learn: 0.1505820        total: 18.6s    remaining: 3.69s
834:    learn: 0.1505094        total: 18.6s    remaining: 3.67s
835:    learn: 0.1503849        total: 18.6s    remaining: 3.65s
836:    learn: 0.1501598        total: 18.6s    remaining: 3.62s
837:    learn: 0.1500419        total: 18.6s    remaining: 3.6s
838:    learn: 0.1499503        total: 18.7s    remaining: 3.58s
839:    learn: 0.1498438        total: 18.7s    remaining: 3.55s
840:    learn: 0.1496917        total: 18.7s    remaining: 3.53s
841:    learn: 0.1495669        total: 18.7s    remaining: 3.51s
842:    learn: 0.1494156        total: 18.7s    remaining: 3.48s
843:    learn: 0.1492814        total: 18.7s    remaining: 3.46s
844:    learn: 0.1491228        total: 18.8s    remaining: 3.44s
845:    learn: 0.1489616        total: 18.8s    remaining: 3.42s
846:    learn: 0.1487922        total: 18.8s    remaining: 3.4s
847:    learn: 0.1487140        total: 18.9s    remaining: 3.38s
848:    learn: 0.1485815        total: 18.9s    remaining: 3.36s
849:    learn: 0.1485049        total: 18.9s    remaining: 3.34s
850:    learn: 0.1484125        total: 18.9s    remaining: 3.31s
851:    learn: 0.1482403        total: 19s      remaining: 3.29s
852:    learn: 0.1480522        total: 19s      remaining: 3.27s
853:    learn: 0.1479231        total: 19s      remaining: 3.25s
854:    learn: 0.1477017        total: 19s      remaining: 3.22s
855:    learn: 0.1476689        total: 19s      remaining: 3.2s
856:    learn: 0.1475808        total: 19.1s    remaining: 3.18s
857:    learn: 0.1474891        total: 19.1s    remaining: 3.15s
858:    learn: 0.1473555        total: 19.1s    remaining: 3.13s
859:    learn: 0.1472910        total: 19.1s    remaining: 3.11s
860:    learn: 0.1472230        total: 19.1s    remaining: 3.09s
861:    learn: 0.1469445        total: 19.1s    remaining: 3.06s
862:    learn: 0.1468433        total: 19.2s    remaining: 3.04s
863:    learn: 0.1467698        total: 19.2s    remaining: 3.02s
864:    learn: 0.1467049        total: 19.2s    remaining: 2.99s
865:    learn: 0.1464937        total: 19.2s    remaining: 2.97s
866:    learn: 0.1463290        total: 19.2s    remaining: 2.95s
867:    learn: 0.1462440        total: 19.2s    remaining: 2.92s
868:    learn: 0.1461849        total: 19.2s    remaining: 2.9s
869:    learn: 0.1459736        total: 19.2s    remaining: 2.87s
870:    learn: 0.1457998        total: 19.3s    remaining: 2.85s
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871:    learn: 0.1456129        total: 19.3s    remaining: 2.83s
872:    learn: 0.1453199        total: 19.3s    remaining: 2.81s
873:    learn: 0.1450990        total: 19.3s    remaining: 2.79s
874:    learn: 0.1449085        total: 19.4s    remaining: 2.77s
875:    learn: 0.1447381        total: 19.4s    remaining: 2.75s
876:    learn: 0.1445953        total: 19.4s    remaining: 2.72s
877:    learn: 0.1444540        total: 19.4s    remaining: 2.7s
878:    learn: 0.1442472        total: 19.5s    remaining: 2.68s
879:    learn: 0.1441272        total: 19.5s    remaining: 2.65s
880:    learn: 0.1439576        total: 19.5s    remaining: 2.63s
881:    learn: 0.1438491        total: 19.5s    remaining: 2.61s
882:    learn: 0.1436852        total: 19.5s    remaining: 2.58s
883:    learn: 0.1435007        total: 19.5s    remaining: 2.56s
884:    learn: 0.1432817        total: 19.6s    remaining: 2.54s
885:    learn: 0.1430988        total: 19.6s    remaining: 2.52s
886:    learn: 0.1429028        total: 19.6s    remaining: 2.5s
887:    learn: 0.1427631        total: 19.6s    remaining: 2.47s
888:    learn: 0.1426656        total: 19.6s    remaining: 2.45s
889:    learn: 0.1424008        total: 19.7s    remaining: 2.43s
890:    learn: 0.1422349        total: 19.7s    remaining: 2.41s
891:    learn: 0.1420840        total: 19.7s    remaining: 2.38s
892:    learn: 0.1419502        total: 19.7s    remaining: 2.36s
893:    learn: 0.1418011        total: 19.7s    remaining: 2.34s
894:    learn: 0.1417049        total: 19.8s    remaining: 2.32s
895:    learn: 0.1416275        total: 19.8s    remaining: 2.3s
896:    learn: 0.1414903        total: 19.8s    remaining: 2.27s
897:    learn: 0.1414664        total: 19.8s    remaining: 2.25s
898:    learn: 0.1413798        total: 19.8s    remaining: 2.23s
899:    learn: 0.1412256        total: 19.9s    remaining: 2.21s
900:    learn: 0.1410937        total: 19.9s    remaining: 2.18s
901:    learn: 0.1408168        total: 19.9s    remaining: 2.16s
902:    learn: 0.1406582        total: 19.9s    remaining: 2.14s
903:    learn: 0.1405692        total: 19.9s    remaining: 2.11s
904:    learn: 0.1404419        total: 19.9s    remaining: 2.09s
905:    learn: 0.1403090        total: 20s      remaining: 2.07s
906:    learn: 0.1401523        total: 20s      remaining: 2.05s
907:    learn: 0.1400501        total: 20s      remaining: 2.03s
908:    learn: 0.1399093        total: 20s      remaining: 2s
909:    learn: 0.1396744        total: 20s      remaining: 1.98s
910:    learn: 0.1395579        total: 20.1s    remaining: 1.96s
911:    learn: 0.1393587        total: 20.1s    remaining: 1.94s
912:    learn: 0.1392559        total: 20.1s    remaining: 1.91s
913:    learn: 0.1391627        total: 20.1s    remaining: 1.89s
914:    learn: 0.1390780        total: 20.1s    remaining: 1.87s
915:    learn: 0.1388342        total: 20.1s    remaining: 1.85s
916:    learn: 0.1387421        total: 20.2s    remaining: 1.83s
917:    learn: 0.1384974        total: 20.2s    remaining: 1.8s
918:    learn: 0.1381956        total: 20.2s    remaining: 1.78s
```

```
919:    learn: 0.1380953        total: 20.3s    remaining: 1.76s
920:    learn: 0.1379993        total: 20.3s    remaining: 1.74s
921:    learn: 0.1378181        total: 20.3s    remaining: 1.72s
922:    learn: 0.1377520        total: 20.3s    remaining: 1.69s
923:    learn: 0.1374577        total: 20.3s    remaining: 1.67s
924:    learn: 0.1373145        total: 20.4s    remaining: 1.65s
925:    learn: 0.1371653        total: 20.4s    remaining: 1.63s
926:    learn: 0.1370150        total: 20.4s    remaining: 1.61s
927:    learn: 0.1368534        total: 20.4s    remaining: 1.58s
928:    learn: 0.1365818        total: 20.4s    remaining: 1.56s
929:    learn: 0.1364215        total: 20.4s    remaining: 1.54s
930:    learn: 0.1362850        total: 20.5s    remaining: 1.52s
931:    learn: 0.1361509        total: 20.5s    remaining: 1.49s
932:    learn: 0.1360208        total: 20.5s    remaining: 1.47s
933:    learn: 0.1358153        total: 20.5s    remaining: 1.45s
934:    learn: 0.1355711        total: 20.6s    remaining: 1.43s
935:    learn: 0.1354957        total: 20.6s    remaining: 1.41s
936:    learn: 0.1353951        total: 20.6s    remaining: 1.38s
937:    learn: 0.1352754        total: 20.6s    remaining: 1.36s
938:    learn: 0.1351108        total: 20.6s    remaining: 1.34s
939:    learn: 0.1349806        total: 20.6s    remaining: 1.31s
940:    learn: 0.1348947        total: 20.6s    remaining: 1.29s
941:    learn: 0.1347892        total: 20.6s    remaining: 1.27s
942:    learn: 0.1347157        total: 20.6s    remaining: 1.25s
943:    learn: 0.1346472        total: 20.7s    remaining: 1.23s
944:    learn: 0.1343789        total: 20.7s    remaining: 1.2s
945:    learn: 0.1342442        total: 20.7s    remaining: 1.18s
946:    learn: 0.1341433        total: 20.7s    remaining: 1.16s
947:    learn: 0.1338410        total: 20.7s    remaining: 1.14s
948:    learn: 0.1337698        total: 20.7s    remaining: 1.11s
949:    learn: 0.1336928        total: 20.8s    remaining: 1.09s
950:    learn: 0.1335291        total: 20.8s    remaining: 1.07s
951:    learn: 0.1333808        total: 20.8s    remaining: 1.05s
952:    learn: 0.1333064        total: 20.8s    remaining: 1.03s
953:    learn: 0.1331783        total: 20.9s    remaining: 1s
954:    learn: 0.1330425        total: 20.9s    remaining: 984ms
955:    learn: 0.1329988        total: 20.9s    remaining: 961ms
956:    learn: 0.1329306        total: 20.9s    remaining: 939ms
957:    learn: 0.1327738        total: 20.9s    remaining: 917ms
958:    learn: 0.1325596        total: 20.9s    remaining: 895ms
959:    learn: 0.1325104        total: 21s      remaining: 874ms
960:    learn: 0.1324093        total: 21s      remaining: 851ms
961:    learn: 0.1323012        total: 21s      remaining: 829ms
962:    learn: 0.1321540        total: 21s      remaining: 807ms
963:    learn: 0.1319299        total: 21s      remaining: 785ms
964:    learn: 0.1318821        total: 21s      remaining: 762ms
965:    learn: 0.1316333        total: 21s      remaining: 740ms
966:    learn: 0.1315349        total: 21s      remaining: 717ms
```

```
967:    learn: 0.1314386        total: 21s      remaining: 695ms
968:    learn: 0.1313097        total: 21s      remaining: 673ms
969:    learn: 0.1312133        total: 21.1s    remaining: 651ms
970:    learn: 0.1311368        total: 21.1s    remaining: 630ms
971:    learn: 0.1310035        total: 21.1s    remaining: 608ms
972:    learn: 0.1308428        total: 21.1s    remaining: 586ms
973:    learn: 0.1307004        total: 21.1s    remaining: 564ms
974:    learn: 0.1306020        total: 21.1s    remaining: 542ms
975:    learn: 0.1304890        total: 21.2s    remaining: 521ms
976:    learn: 0.1303751        total: 21.2s    remaining: 499ms
977:    learn: 0.1302499        total: 21.2s    remaining: 478ms
978:    learn: 0.1301667        total: 21.3s    remaining: 456ms
979:    learn: 0.1300456        total: 21.3s    remaining: 434ms
980:    learn: 0.1299356        total: 21.3s    remaining: 413ms
981:    learn: 0.1298297        total: 21.3s    remaining: 391ms
982:    learn: 0.1296673        total: 21.4s    remaining: 369ms
983:    learn: 0.1295425        total: 21.4s    remaining: 347ms
984:    learn: 0.1294663        total: 21.4s    remaining: 325ms
985:    learn: 0.1292356        total: 21.4s    remaining: 304ms
986:    learn: 0.1291563        total: 21.4s    remaining: 282ms
987:    learn: 0.1290762        total: 21.4s    remaining: 260ms
988:    learn: 0.1290078        total: 21.4s    remaining: 238ms
989:    learn: 0.1289771        total: 21.5s    remaining: 217ms
990:    learn: 0.1287572        total: 21.5s    remaining: 195ms
991:    learn: 0.1286737        total: 21.5s    remaining: 173ms
992:    learn: 0.1286221        total: 21.5s    remaining: 152ms
993:    learn: 0.1284892        total: 21.5s    remaining: 130ms
994:    learn: 0.1284003        total: 21.5s    remaining: 108ms
995:    learn: 0.1283317        total: 21.5s    remaining: 86.5ms
996:    learn: 0.1282570        total: 21.6s    remaining: 64.9ms
997:    learn: 0.1281082        total: 21.6s    remaining: 43.3ms
998:    learn: 0.1280582        total: 21.6s    remaining: 21.6ms
999:    learn: 0.1279371        total: 21.6s    remaining: 0us
```

[91]:
```
start_time = time.time()

# Set params for cross-validation as same as initial model
cv_params = catboost_model.get_params()

# cross-validation
cv_data = cv(train_pool,cv_params,fold_count=10,plot=True)
catboost_time = (time.time() - start_time)

# Cross-validation accuracy metric
acc_cv_catboost = round(np.max(cv_data['test-Accuracy-mean']) * 100, 2)
```

```
<IPython.core.display.HTML object>
```

```
MetricVisualizer(layout=Layout(align_self='stretch', height='500px'))
```

```
0:      learn: 0.6737115        test: 0.6745023 best: 0.6745023 (0)     total:
484ms    remaining: 8m 3s
1:      learn: 0.6520071        test: 0.6541913 best: 0.6541913 (1)     total:
1.1s     remaining: 9m 10s
2:      learn: 0.6322050        test: 0.6358143 best: 0.6358143 (2)     total:
1.66s    remaining: 9m 10s
3:      learn: 0.6132054        test: 0.6176364 best: 0.6176364 (3)     total:
2.16s    remaining: 8m 59s
4:      learn: 0.5960814        test: 0.6017297 best: 0.6017297 (4)     total:
2.61s    remaining: 8m 39s
5:      learn: 0.5790739        test: 0.5854931 best: 0.5854931 (5)     total:
3.14s    remaining: 8m 39s
6:      learn: 0.5634889        test: 0.5710245 best: 0.5710245 (6)     total:
3.67s    remaining: 8m 41s
7:      learn: 0.5492512        test: 0.5576805 best: 0.5576805 (7)     total:
4.13s    remaining: 8m 31s
8:      learn: 0.5361871        test: 0.5454584 best: 0.5454584 (8)     total:
4.59s    remaining: 8m 25s
9:      learn: 0.5251836        test: 0.5349541 best: 0.5349541 (9)     total:
5.02s    remaining: 8m 17s
10:     learn: 0.5121243        test: 0.5227255 best: 0.5227255 (10)    total:
5.56s    remaining: 8m 19s
11:     learn: 0.5030016        test: 0.5140236 best: 0.5140236 (11)    total:
5.98s    remaining: 8m 12s
12:     learn: 0.4944215        test: 0.5063273 best: 0.5063273 (12)    total:
6.39s    remaining: 8m 5s
13:     learn: 0.4841957        test: 0.4968845 best: 0.4968845 (13)    total:
6.85s    remaining: 8m 2s
14:     learn: 0.4753133        test: 0.4888574 best: 0.4888574 (14)    total:
7.3s     remaining: 7m 59s
15:     learn: 0.4674244        test: 0.4816908 best: 0.4816908 (15)    total:
7.79s    remaining: 7m 59s
16:     learn: 0.4600928        test: 0.4748838 best: 0.4748838 (16)    total:
8.21s    remaining: 7m 54s
17:     learn: 0.4527676        test: 0.4690336 best: 0.4690336 (17)    total:
8.67s    remaining: 7m 53s
18:     learn: 0.4450340        test: 0.4624304 best: 0.4624304 (18)    total:
9.13s    remaining: 7m 51s
19:     learn: 0.4380100        test: 0.4560942 best: 0.4560942 (19)    total:
9.62s    remaining: 7m 51s
20:     learn: 0.4316867        test: 0.4509238 best: 0.4509238 (20)    total:
10.1s    remaining: 7m 50s
21:     learn: 0.4249895        test: 0.4449998 best: 0.4449998 (21)    total:
10.6s    remaining: 7m 49s
22:     learn: 0.4191342        test: 0.4402401 best: 0.4402401 (22)    total:
11s      remaining: 7m 48s
```

```
23:     learn: 0.4142407        test: 0.4359893 best: 0.4359893 (23)    total:
11.4s    remaining: 7m 44s
24:     learn: 0.4088102        test: 0.4317462 best: 0.4317462 (24)    total:
11.9s    remaining: 7m 43s
25:     learn: 0.4039603        test: 0.4276027 best: 0.4276027 (25)    total:
12.4s    remaining: 7m 43s
26:     learn: 0.3995790        test: 0.4240910 best: 0.4240910 (26)    total:
12.8s    remaining: 7m 42s
27:     learn: 0.3944882        test: 0.4206859 best: 0.4206859 (27)    total:
13.4s    remaining: 7m 43s
28:     learn: 0.3905315        test: 0.4178255 best: 0.4178255 (28)    total:
13.8s    remaining: 7m 42s
29:     learn: 0.3863156        test: 0.4146024 best: 0.4146024 (29)    total:
14.3s    remaining: 7m 41s
30:     learn: 0.3820769        test: 0.4114771 best: 0.4114771 (30)    total:
14.7s    remaining: 7m 40s
31:     learn: 0.3777607        test: 0.4081519 best: 0.4081519 (31)    total:
15.2s    remaining: 7m 38s
32:     learn: 0.3740052        test: 0.4054784 best: 0.4054784 (32)    total:
15.7s    remaining: 7m 39s
33:     learn: 0.3705985        test: 0.4027355 best: 0.4027355 (33)    total:
16.1s    remaining: 7m 37s
34:     learn: 0.3679669        test: 0.4006240 best: 0.4006240 (34)    total:
16.5s    remaining: 7m 35s
35:     learn: 0.3645520        test: 0.3985176 best: 0.3985176 (35)    total:
17s      remaining: 7m 35s
36:     learn: 0.3612944        test: 0.3960772 best: 0.3960772 (36)    total:
17.5s    remaining: 7m 34s
37:     learn: 0.3581154        test: 0.3941147 best: 0.3941147 (37)    total:
17.9s    remaining: 7m 34s
38:     learn: 0.3553853        test: 0.3921635 best: 0.3921635 (38)    total:
18.4s    remaining: 7m 32s
39:     learn: 0.3519605        test: 0.3905092 best: 0.3905092 (39)    total:
18.8s    remaining: 7m 32s
40:     learn: 0.3489767        test: 0.3886562 best: 0.3886562 (40)    total:
19.3s    remaining: 7m 32s
41:     learn: 0.3459483        test: 0.3862965 best: 0.3862965 (41)    total:
19.8s    remaining: 7m 32s
42:     learn: 0.3432483        test: 0.3848562 best: 0.3848562 (42)    total:
20.3s    remaining: 7m 31s
43:     learn: 0.3407204        test: 0.3832197 best: 0.3832197 (43)    total:
20.7s    remaining: 7m 29s
44:     learn: 0.3388650        test: 0.3822518 best: 0.3822518 (44)    total:
21.2s    remaining: 7m 29s
45:     learn: 0.3365898        test: 0.3813003 best: 0.3813003 (45)    total:
21.7s    remaining: 7m 30s
46:     learn: 0.3338751        test: 0.3797721 best: 0.3797721 (46)    total:
22.2s    remaining: 7m 29s
```

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47:     learn: 0.3315388        test: 0.3783930 best: 0.3783930 (47)    total:
22.7s    remaining: 7m 30s
48:     learn: 0.3295336        test: 0.3772677 best: 0.3772677 (48)    total:
23.2s    remaining: 7m 30s
49:     learn: 0.3270767        test: 0.3758601 best: 0.3758601 (49)    total:
23.7s    remaining: 7m 29s
50:     learn: 0.3247213        test: 0.3750406 best: 0.3750406 (50)    total:
24.1s    remaining: 7m 29s
51:     learn: 0.3225665        test: 0.3738657 best: 0.3738657 (51)    total:
24.6s    remaining: 7m 28s
52:     learn: 0.3209179        test: 0.3730404 best: 0.3730404 (52)    total:
25s      remaining: 7m 27s
53:     learn: 0.3194040        test: 0.3721224 best: 0.3721224 (53)    total:
25.5s    remaining: 7m 26s
54:     learn: 0.3175149        test: 0.3710633 best: 0.3710633 (54)    total:
25.9s    remaining: 7m 25s
55:     learn: 0.3152538        test: 0.3701924 best: 0.3701924 (55)    total:
26.4s    remaining: 7m 25s
56:     learn: 0.3134752        test: 0.3692544 best: 0.3692544 (56)    total:
26.9s    remaining: 7m 25s
57:     learn: 0.3116101        test: 0.3683382 best: 0.3683382 (57)    total:
27.4s    remaining: 7m 24s
58:     learn: 0.3096403        test: 0.3675791 best: 0.3675791 (58)    total:
27.8s    remaining: 7m 23s
59:     learn: 0.3080261        test: 0.3670593 best: 0.3670593 (59)    total:
28.3s    remaining: 7m 22s
60:     learn: 0.3062927        test: 0.3661352 best: 0.3661352 (60)    total:
28.7s    remaining: 7m 22s
61:     learn: 0.3043835        test: 0.3653289 best: 0.3653289 (61)    total:
29.2s    remaining: 7m 22s
62:     learn: 0.3029488        test: 0.3645579 best: 0.3645579 (62)    total:
29.7s    remaining: 7m 22s
63:     learn: 0.3008929        test: 0.3640957 best: 0.3640957 (63)    total:
30.2s    remaining: 7m 21s
64:     learn: 0.2992230        test: 0.3635105 best: 0.3635105 (64)    total:
30.7s    remaining: 7m 21s
65:     learn: 0.2978642        test: 0.3628858 best: 0.3628858 (65)    total:
31.2s    remaining: 7m 21s
66:     learn: 0.2962399        test: 0.3623020 best: 0.3623020 (66)    total:
31.7s    remaining: 7m 20s
67:     learn: 0.2946891        test: 0.3617061 best: 0.3617061 (67)    total:
32.2s    remaining: 7m 21s
68:     learn: 0.2934494        test: 0.3616084 best: 0.3616084 (68)    total:
32.6s    remaining: 7m 19s
69:     learn: 0.2920674        test: 0.3609324 best: 0.3609324 (69)    total:
33.1s    remaining: 7m 19s
70:     learn: 0.2905602        test: 0.3602346 best: 0.3602346 (70)    total:
33.5s    remaining: 7m 18s
```

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71:     learn: 0.2891514        test: 0.3599812 best: 0.3599812 (71)    total:
33.9s    remaining: 7m 17s
72:     learn: 0.2875943        test: 0.3591242 best: 0.3591242 (72)    total:
34.4s    remaining: 7m 17s
73:     learn: 0.2864028        test: 0.3588844 best: 0.3588844 (73)    total:
34.9s    remaining: 7m 16s
74:     learn: 0.2850766        test: 0.3585818 best: 0.3585818 (74)    total:
35.4s    remaining: 7m 16s
75:     learn: 0.2836369        test: 0.3582406 best: 0.3582406 (75)    total:
35.9s    remaining: 7m 16s
76:     learn: 0.2823831        test: 0.3579642 best: 0.3579642 (76)    total:
36.4s    remaining: 7m 16s
77:     learn: 0.2809575        test: 0.3576490 best: 0.3576490 (77)    total:
36.8s    remaining: 7m 15s
78:     learn: 0.2798490        test: 0.3573487 best: 0.3573487 (78)    total:
37.3s    remaining: 7m 14s
79:     learn: 0.2786083        test: 0.3570293 best: 0.3570293 (79)    total:
37.7s    remaining: 7m 14s
80:     learn: 0.2774823        test: 0.3566724 best: 0.3566724 (80)    total:
38.2s    remaining: 7m 13s
81:     learn: 0.2761896        test: 0.3567908 best: 0.3566724 (80)    total:
38.7s    remaining: 7m 13s
82:     learn: 0.2748909        test: 0.3564432 best: 0.3564432 (82)    total:
39.2s    remaining: 7m 13s
83:     learn: 0.2736394        test: 0.3562171 best: 0.3562171 (83)    total:
39.7s    remaining: 7m 13s
84:     learn: 0.2725333        test: 0.3556134 best: 0.3556134 (84)    total:
40.2s    remaining: 7m 12s
85:     learn: 0.2712860        test: 0.3555220 best: 0.3555220 (85)    total:
40.7s    remaining: 7m 12s
86:     learn: 0.2700402        test: 0.3550211 best: 0.3550211 (86)    total:
41.2s    remaining: 7m 11s
87:     learn: 0.2686594        test: 0.3546235 best: 0.3546235 (87)    total:
41.7s    remaining: 7m 12s
88:     learn: 0.2677996        test: 0.3543401 best: 0.3543401 (88)    total:
42.2s    remaining: 7m 11s
89:     learn: 0.2666192        test: 0.3539230 best: 0.3539230 (89)    total:
42.7s    remaining: 7m 11s
90:     learn: 0.2656114        test: 0.3536149 best: 0.3536149 (90)    total:
43.2s    remaining: 7m 11s
91:     learn: 0.2646345        test: 0.3535594 best: 0.3535594 (91)    total:
43.6s    remaining: 7m 10s
92:     learn: 0.2633791        test: 0.3533766 best: 0.3533766 (92)    total:
44.1s    remaining: 7m 9s
93:     learn: 0.2624115        test: 0.3532844 best: 0.3532844 (93)    total:
44.5s    remaining: 7m 9s
94:     learn: 0.2612449        test: 0.3531698 best: 0.3531698 (94)    total:
45s      remaining: 7m 8s
```

```
95:     learn: 0.2602886        test: 0.3530168 best: 0.3530168 (95)    total:
45.5s    remaining: 7m 8s
96:     learn: 0.2592732        test: 0.3527620 best: 0.3527620 (96)    total:
46s      remaining: 7m 8s
97:     learn: 0.2583203        test: 0.3530239 best: 0.3527620 (96)    total:
46.4s    remaining: 7m 7s
98:     learn: 0.2571382        test: 0.3529176 best: 0.3527620 (96)    total:
46.9s    remaining: 7m 7s
99:     learn: 0.2559648        test: 0.3526922 best: 0.3526922 (99)    total:
47.4s    remaining: 7m 6s
100:    learn: 0.2552561        test: 0.3526822 best: 0.3526822 (100)   total:
47.9s    remaining: 7m 6s
101:    learn: 0.2543334        test: 0.3524172 best: 0.3524172 (101)   total:
48.3s    remaining: 7m 5s
102:    learn: 0.2531692        test: 0.3520248 best: 0.3520248 (102)   total:
48.8s    remaining: 7m 4s
103:    learn: 0.2521897        test: 0.3518161 best: 0.3518161 (103)   total:
49.3s    remaining: 7m 4s
104:    learn: 0.2513354        test: 0.3518041 best: 0.3518041 (104)   total:
49.8s    remaining: 7m 4s
105:    learn: 0.2503169        test: 0.3518925 best: 0.3518041 (104)   total:
50.2s    remaining: 7m 3s
106:    learn: 0.2492904        test: 0.3516792 best: 0.3516792 (106)   total:
50.7s    remaining: 7m 2s
107:    learn: 0.2484219        test: 0.3516026 best: 0.3516026 (107)   total:
51.1s    remaining: 7m 2s
108:    learn: 0.2476082        test: 0.3515278 best: 0.3515278 (108)   total:
51.6s    remaining: 7m 1s
109:    learn: 0.2466774        test: 0.3511980 best: 0.3511980 (109)   total:
52s      remaining: 7m 1s
110:    learn: 0.2457751        test: 0.3509747 best: 0.3509747 (110)   total:
52.5s    remaining: 7m
111:    learn: 0.2450402        test: 0.3508876 best: 0.3508876 (111)   total:
52.9s    remaining: 6m 59s
112:    learn: 0.2440091        test: 0.3506764 best: 0.3506764 (112)   total:
53.4s    remaining: 6m 59s
113:    learn: 0.2432629        test: 0.3505943 best: 0.3505943 (113)   total:
53.9s    remaining: 6m 58s
114:    learn: 0.2422095        test: 0.3502531 best: 0.3502531 (114)   total:
54.4s    remaining: 6m 58s
115:    learn: 0.2411771        test: 0.3503397 best: 0.3502531 (114)   total:
54.9s    remaining: 6m 58s
116:    learn: 0.2402493        test: 0.3501662 best: 0.3501662 (116)   total:
55.3s    remaining: 6m 57s
117:    learn: 0.2395803        test: 0.3500442 best: 0.3500442 (117)   total:
55.8s    remaining: 6m 57s
118:    learn: 0.2388829        test: 0.3500127 best: 0.3500127 (118)   total:
56.2s    remaining: 6m 56s
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119:    learn: 0.2380486        test: 0.3497956 best: 0.3497956 (119)   total:
56.7s    remaining: 6m 55s
120:    learn: 0.2373706        test: 0.3497708 best: 0.3497708 (120)   total:
57.2s    remaining: 6m 55s
121:    learn: 0.2365680        test: 0.3493680 best: 0.3493680 (121)   total:
58s      remaining: 6m 57s
122:    learn: 0.2357473        test: 0.3493187 best: 0.3493187 (122)   total:
59s      remaining: 7m
123:    learn: 0.2349948        test: 0.3492039 best: 0.3492039 (123)   total:
59.4s    remaining: 6m 59s
124:    learn: 0.2342808        test: 0.3491788 best: 0.3491788 (124)   total:
59.9s    remaining: 6m 59s
125:    learn: 0.2336016        test: 0.3492396 best: 0.3491788 (124)   total:
1m       remaining: 6m 58s
126:    learn: 0.2328120        test: 0.3490498 best: 0.3490498 (126)   total:
1m       remaining: 6m 57s
127:    learn: 0.2319774        test: 0.3492648 best: 0.3490498 (126)   total:
1m 1s    remaining: 6m 57s
128:    learn: 0.2312723        test: 0.3491710 best: 0.3490498 (126)   total:
1m 1s    remaining: 6m 56s
129:    learn: 0.2303805        test: 0.3488697 best: 0.3488697 (129)   total:
1m 2s    remaining: 6m 56s
130:    learn: 0.2294332        test: 0.3487035 best: 0.3487035 (130)   total:
1m 2s    remaining: 6m 55s
131:    learn: 0.2284534        test: 0.3486811 best: 0.3486811 (131)   total:
1m 3s    remaining: 6m 55s
132:    learn: 0.2274982        test: 0.3482079 best: 0.3482079 (132)   total:
1m 3s    remaining: 6m 54s
133:    learn: 0.2269842        test: 0.3481545 best: 0.3481545 (133)   total:
1m 4s    remaining: 6m 53s
134:    learn: 0.2261727        test: 0.3481663 best: 0.3481545 (133)   total:
1m 4s    remaining: 6m 53s
135:    learn: 0.2254827        test: 0.3480275 best: 0.3480275 (135)   total:
1m 5s    remaining: 6m 53s
136:    learn: 0.2248013        test: 0.3478283 best: 0.3478283 (136)   total:
1m 5s    remaining: 6m 52s
137:    learn: 0.2241534        test: 0.3476130 best: 0.3476130 (137)   total:
1m 5s    remaining: 6m 52s
138:    learn: 0.2233970        test: 0.3473072 best: 0.3473072 (138)   total:
1m 6s    remaining: 6m 51s
139:    learn: 0.2227930        test: 0.3471181 best: 0.3471181 (139)   total:
1m 6s    remaining: 6m 50s
140:    learn: 0.2219374        test: 0.3469992 best: 0.3469992 (140)   total:
1m 7s    remaining: 6m 50s
141:    learn: 0.2213549        test: 0.3471363 best: 0.3469992 (140)   total:
1m 7s    remaining: 6m 49s
142:    learn: 0.2206906        test: 0.3471041 best: 0.3469992 (140)   total:
1m 8s    remaining: 6m 49s
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143:    learn: 0.2199384        test: 0.3470751 best: 0.3469992 (140)   total:
1m 8s    remaining: 6m 49s
144:    learn: 0.2191923        test: 0.3467001 best: 0.3467001 (144)   total:
1m 9s    remaining: 6m 49s
145:    learn: 0.2182647        test: 0.3467364 best: 0.3467001 (144)   total:
1m 9s    remaining: 6m 48s
146:    learn: 0.2175695        test: 0.3467311 best: 0.3467001 (144)   total:
1m 10s   remaining: 6m 48s
147:    learn: 0.2169515        test: 0.3467162 best: 0.3467001 (144)   total:
1m 10s   remaining: 6m 47s
148:    learn: 0.2163073        test: 0.3466431 best: 0.3466431 (148)   total:
1m 11s   remaining: 6m 47s
149:    learn: 0.2155653        test: 0.3468458 best: 0.3466431 (148)   total:
1m 11s   remaining: 6m 46s
150:    learn: 0.2149574        test: 0.3469161 best: 0.3466431 (148)   total:
1m 12s   remaining: 6m 46s
151:    learn: 0.2141281        test: 0.3472557 best: 0.3466431 (148)   total:
1m 12s   remaining: 6m 46s
152:    learn: 0.2135612        test: 0.3473968 best: 0.3466431 (148)   total:
1m 13s   remaining: 6m 45s
153:    learn: 0.2128352        test: 0.3474403 best: 0.3466431 (148)   total:
1m 13s   remaining: 6m 45s
154:    learn: 0.2122178        test: 0.3476798 best: 0.3466431 (148)   total:
1m 14s   remaining: 6m 44s
155:    learn: 0.2115667        test: 0.3475317 best: 0.3466431 (148)   total:
1m 14s   remaining: 6m 43s
156:    learn: 0.2107547        test: 0.3473716 best: 0.3466431 (148)   total:
1m 15s   remaining: 6m 43s
157:    learn: 0.2100656        test: 0.3471067 best: 0.3466431 (148)   total:
1m 15s   remaining: 6m 43s
158:    learn: 0.2095314        test: 0.3469661 best: 0.3466431 (148)   total:
1m 16s   remaining: 6m 42s
159:    learn: 0.2088606        test: 0.3469196 best: 0.3466431 (148)   total:
1m 16s   remaining: 6m 42s
160:    learn: 0.2082322        test: 0.3469439 best: 0.3466431 (148)   total:
1m 17s   remaining: 6m 41s
161:    learn: 0.2075334        test: 0.3470322 best: 0.3466431 (148)   total:
1m 17s   remaining: 6m 41s
162:    learn: 0.2068457        test: 0.3471209 best: 0.3466431 (148)   total:
1m 18s   remaining: 6m 40s
163:    learn: 0.2061732        test: 0.3469421 best: 0.3466431 (148)   total:
1m 18s   remaining: 6m 39s
164:    learn: 0.2055269        test: 0.3467593 best: 0.3466431 (148)   total:
1m 18s   remaining: 6m 39s
165:    learn: 0.2048227        test: 0.3466128 best: 0.3466128 (165)   total:
1m 19s   remaining: 6m 38s
166:    learn: 0.2041959        test: 0.3466082 best: 0.3466082 (166)   total:
1m 19s   remaining: 6m 38s
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167:    learn: 0.2033867        test: 0.3463207 best: 0.3463207 (167)   total:
1m 20s   remaining: 6m 38s
168:    learn: 0.2026572        test: 0.3463149 best: 0.3463149 (168)   total:
1m 20s   remaining: 6m 37s
169:    learn: 0.2019807        test: 0.3460547 best: 0.3460547 (169)   total:
1m 21s   remaining: 6m 37s
170:    learn: 0.2013115        test: 0.3458283 best: 0.3458283 (170)   total:
1m 22s   remaining: 6m 37s
171:    learn: 0.2006715        test: 0.3457892 best: 0.3457892 (171)   total:
1m 22s   remaining: 6m 36s
172:    learn: 0.2000612        test: 0.3459927 best: 0.3457892 (171)   total:
1m 22s   remaining: 6m 36s
173:    learn: 0.1994889        test: 0.3458993 best: 0.3457892 (171)   total:
1m 23s   remaining: 6m 35s
174:    learn: 0.1989627        test: 0.3457128 best: 0.3457128 (174)   total:
1m 23s   remaining: 6m 35s
175:    learn: 0.1982895        test: 0.3456339 best: 0.3456339 (175)   total:
1m 24s   remaining: 6m 34s
176:    learn: 0.1975342        test: 0.3457393 best: 0.3456339 (175)   total:
1m 24s   remaining: 6m 34s
177:    learn: 0.1968419        test: 0.3456758 best: 0.3456339 (175)   total:
1m 25s   remaining: 6m 34s
178:    learn: 0.1963048        test: 0.3456430 best: 0.3456339 (175)   total:
1m 25s   remaining: 6m 33s
179:    learn: 0.1956450        test: 0.3457209 best: 0.3456339 (175)   total:
1m 26s   remaining: 6m 33s
180:    learn: 0.1951131        test: 0.3455276 best: 0.3455276 (180)   total:
1m 26s   remaining: 6m 32s
181:    learn: 0.1946234        test: 0.3454860 best: 0.3454860 (181)   total:
1m 27s   remaining: 6m 32s
182:    learn: 0.1940690        test: 0.3453529 best: 0.3453529 (182)   total:
1m 27s   remaining: 6m 32s
183:    learn: 0.1934373        test: 0.3454939 best: 0.3453529 (182)   total:
1m 28s   remaining: 6m 31s
184:    learn: 0.1928113        test: 0.3455715 best: 0.3453529 (182)   total:
1m 28s   remaining: 6m 31s
185:    learn: 0.1921783        test: 0.3456022 best: 0.3453529 (182)   total:
1m 29s   remaining: 6m 30s
186:    learn: 0.1914468        test: 0.3453123 best: 0.3453123 (186)   total:
1m 29s   remaining: 6m 30s
187:    learn: 0.1909692        test: 0.3452221 best: 0.3452221 (187)   total:
1m 30s   remaining: 6m 29s
188:    learn: 0.1905059        test: 0.3452133 best: 0.3452133 (188)   total:
1m 30s   remaining: 6m 29s
189:    learn: 0.1899009        test: 0.3451640 best: 0.3451640 (189)   total:
1m 31s   remaining: 6m 28s
190:    learn: 0.1893090        test: 0.3452676 best: 0.3451640 (189)   total:
1m 31s   remaining: 6m 28s
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191:    learn: 0.1886989        test: 0.3453888 best: 0.3451640 (189)   total:
1m 32s   remaining: 6m 27s
192:    learn: 0.1880341        test: 0.3454039 best: 0.3451640 (189)   total:
1m 32s   remaining: 6m 27s
193:    learn: 0.1874280        test: 0.3455843 best: 0.3451640 (189)   total:
1m 33s   remaining: 6m 26s
194:    learn: 0.1869715        test: 0.3455108 best: 0.3451640 (189)   total:
1m 33s   remaining: 6m 26s
195:    learn: 0.1863461        test: 0.3455636 best: 0.3451640 (189)   total:
1m 34s   remaining: 6m 25s
196:    learn: 0.1858280        test: 0.3455467 best: 0.3451640 (189)   total:
1m 34s   remaining: 6m 25s
197:    learn: 0.1851444        test: 0.3454909 best: 0.3451640 (189)   total:
1m 34s   remaining: 6m 24s
198:    learn: 0.1845361        test: 0.3455146 best: 0.3451640 (189)   total:
1m 35s   remaining: 6m 24s
199:    learn: 0.1839876        test: 0.3455075 best: 0.3451640 (189)   total:
1m 35s   remaining: 6m 23s
200:    learn: 0.1833890        test: 0.3454338 best: 0.3451640 (189)   total:
1m 36s   remaining: 6m 23s
201:    learn: 0.1828383        test: 0.3452832 best: 0.3451640 (189)   total:
1m 36s   remaining: 6m 22s
202:    learn: 0.1822923        test: 0.3453779 best: 0.3451640 (189)   total:
1m 37s   remaining: 6m 22s
203:    learn: 0.1817109        test: 0.3454069 best: 0.3451640 (189)   total:
1m 37s   remaining: 6m 21s
204:    learn: 0.1810556        test: 0.3456016 best: 0.3451640 (189)   total:
1m 38s   remaining: 6m 21s
205:    learn: 0.1805588        test: 0.3457633 best: 0.3451640 (189)   total:
1m 38s   remaining: 6m 20s
206:    learn: 0.1800428        test: 0.3456309 best: 0.3451640 (189)   total:
1m 39s   remaining: 6m 20s
207:    learn: 0.1793887        test: 0.3457913 best: 0.3451640 (189)   total:
1m 39s   remaining: 6m 19s
208:    learn: 0.1787835        test: 0.3458388 best: 0.3451640 (189)   total:
1m 40s   remaining: 6m 19s
209:    learn: 0.1781187        test: 0.3458524 best: 0.3451640 (189)   total:
1m 40s   remaining: 6m 18s
210:    learn: 0.1775539        test: 0.3458122 best: 0.3451640 (189)   total:
1m 41s   remaining: 6m 18s
211:    learn: 0.1770107        test: 0.3462000 best: 0.3451640 (189)   total:
1m 41s   remaining: 6m 17s
212:    learn: 0.1765835        test: 0.3462513 best: 0.3451640 (189)   total:
1m 42s   remaining: 6m 17s
213:    learn: 0.1759454        test: 0.3462729 best: 0.3451640 (189)   total:
1m 42s   remaining: 6m 17s
214:    learn: 0.1754164        test: 0.3462268 best: 0.3451640 (189)   total:
1m 43s   remaining: 6m 16s
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215:    learn: 0.1748664        test: 0.3461882 best: 0.3451640 (189)   total:
1m 43s   remaining: 6m 16s
216:    learn: 0.1742833        test: 0.3459051 best: 0.3451640 (189)   total:
1m 44s   remaining: 6m 15s
217:    learn: 0.1736351        test: 0.3458893 best: 0.3451640 (189)   total:
1m 45s   remaining: 6m 17s
218:    learn: 0.1731282        test: 0.3459585 best: 0.3451640 (189)   total:
1m 45s   remaining: 6m 17s
219:    learn: 0.1725894        test: 0.3461715 best: 0.3451640 (189)   total:
1m 46s   remaining: 6m 17s
220:    learn: 0.1720337        test: 0.3460626 best: 0.3451640 (189)   total:
1m 46s   remaining: 6m 16s
221:    learn: 0.1714790        test: 0.3460267 best: 0.3451640 (189)   total:
1m 47s   remaining: 6m 16s
222:    learn: 0.1708572        test: 0.3460588 best: 0.3451640 (189)   total:
1m 47s   remaining: 6m 16s
223:    learn: 0.1703548        test: 0.3460011 best: 0.3451640 (189)   total:
1m 48s   remaining: 6m 15s
224:    learn: 0.1697901        test: 0.3460805 best: 0.3451640 (189)   total:
1m 48s   remaining: 6m 15s
225:    learn: 0.1692271        test: 0.3461524 best: 0.3451640 (189)   total:
1m 49s   remaining: 6m 14s
226:    learn: 0.1685020        test: 0.3461819 best: 0.3451640 (189)   total:
1m 50s   remaining: 6m 14s
227:    learn: 0.1681303        test: 0.3461973 best: 0.3451640 (189)   total:
1m 50s   remaining: 6m 14s
228:    learn: 0.1676113        test: 0.3462394 best: 0.3451640 (189)   total:
1m 50s   remaining: 6m 13s
229:    learn: 0.1671597        test: 0.3463654 best: 0.3451640 (189)   total:
1m 51s   remaining: 6m 13s
230:    learn: 0.1666203        test: 0.3463630 best: 0.3451640 (189)   total:
1m 52s   remaining: 6m 12s
231:    learn: 0.1660149        test: 0.3463210 best: 0.3451640 (189)   total:
1m 52s   remaining: 6m 12s
232:    learn: 0.1653431        test: 0.3462456 best: 0.3451640 (189)   total:
1m 53s   remaining: 6m 12s
233:    learn: 0.1647706        test: 0.3465150 best: 0.3451640 (189)   total:
1m 53s   remaining: 6m 11s
234:    learn: 0.1642332        test: 0.3465684 best: 0.3451640 (189)   total:
1m 54s   remaining: 6m 11s
235:    learn: 0.1638139        test: 0.3466324 best: 0.3451640 (189)   total:
1m 54s   remaining: 6m 10s
236:    learn: 0.1631505        test: 0.3466505 best: 0.3451640 (189)   total:
1m 54s   remaining: 6m 9s
237:    learn: 0.1626982        test: 0.3466838 best: 0.3451640 (189)   total:
1m 55s   remaining: 6m 9s
238:    learn: 0.1621332        test: 0.3465950 best: 0.3451640 (189)   total:
1m 55s   remaining: 6m 8s
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239:    learn: 0.1616517        test: 0.3464527 best: 0.3451640 (189)   total:
1m 56s   remaining: 6m 8s
240:    learn: 0.1611945        test: 0.3466875 best: 0.3451640 (189)   total:
1m 56s   remaining: 6m 8s
241:    learn: 0.1606384        test: 0.3467147 best: 0.3451640 (189)   total:
1m 57s   remaining: 6m 7s
242:    learn: 0.1601950        test: 0.3468719 best: 0.3451640 (189)   total:
1m 57s   remaining: 6m 7s
243:    learn: 0.1594966        test: 0.3468857 best: 0.3451640 (189)   total:
1m 58s   remaining: 6m 7s
244:    learn: 0.1590676        test: 0.3468850 best: 0.3451640 (189)   total:
1m 58s   remaining: 6m 6s
245:    learn: 0.1585329        test: 0.3467493 best: 0.3451640 (189)   total:
1m 59s   remaining: 6m 5s
246:    learn: 0.1579412        test: 0.3468262 best: 0.3451640 (189)   total:
1m 59s   remaining: 6m 5s
247:    learn: 0.1574683        test: 0.3470041 best: 0.3451640 (189)   total:
2m       remaining: 6m 4s
248:    learn: 0.1568547        test: 0.3469431 best: 0.3451640 (189)   total:
2m       remaining: 6m 4s
249:    learn: 0.1563965        test: 0.3469922 best: 0.3451640 (189)   total:
2m 1s    remaining: 6m 4s
250:    learn: 0.1557340        test: 0.3469675 best: 0.3451640 (189)   total:
2m 1s    remaining: 6m 3s
251:    learn: 0.1552090        test: 0.3470334 best: 0.3451640 (189)   total:
2m 2s    remaining: 6m 3s
252:    learn: 0.1548419        test: 0.3469715 best: 0.3451640 (189)   total:
2m 2s    remaining: 6m 2s
253:    learn: 0.1543643        test: 0.3472049 best: 0.3451640 (189)   total:
2m 3s    remaining: 6m 2s
254:    learn: 0.1538625        test: 0.3470777 best: 0.3451640 (189)   total:
2m 3s    remaining: 6m 1s
255:    learn: 0.1534681        test: 0.3471779 best: 0.3451640 (189)   total:
2m 4s    remaining: 6m 1s
256:    learn: 0.1528912        test: 0.3474320 best: 0.3451640 (189)   total:
2m 4s    remaining: 6m
257:    learn: 0.1525029        test: 0.3472371 best: 0.3451640 (189)   total:
2m 5s    remaining: 6m
258:    learn: 0.1519609        test: 0.3475376 best: 0.3451640 (189)   total:
2m 5s    remaining: 5m 59s
259:    learn: 0.1514500        test: 0.3476644 best: 0.3451640 (189)   total:
2m 6s    remaining: 5m 59s
260:    learn: 0.1509375        test: 0.3476834 best: 0.3451640 (189)   total:
2m 6s    remaining: 5m 58s
261:    learn: 0.1503682        test: 0.3477048 best: 0.3451640 (189)   total:
2m 7s    remaining: 5m 57s
262:    learn: 0.1499303        test: 0.3477622 best: 0.3451640 (189)   total:
2m 7s    remaining: 5m 57s
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263:    learn: 0.1494519        test: 0.3479711 best: 0.3451640 (189)   total:
2m 7s    remaining: 5m 56s
264:    learn: 0.1489418        test: 0.3479573 best: 0.3451640 (189)   total:
2m 8s    remaining: 5m 56s
265:    learn: 0.1483123        test: 0.3480912 best: 0.3451640 (189)   total:
2m 8s    remaining: 5m 55s
266:    learn: 0.1477550        test: 0.3482556 best: 0.3451640 (189)   total:
2m 9s    remaining: 5m 55s
267:    learn: 0.1471949        test: 0.3482934 best: 0.3451640 (189)   total:
2m 10s   remaining: 5m 55s
268:    learn: 0.1465567        test: 0.3483110 best: 0.3451640 (189)   total:
2m 10s   remaining: 5m 54s
269:    learn: 0.1459635        test: 0.3485294 best: 0.3451640 (189)   total:
2m 11s   remaining: 5m 54s
270:    learn: 0.1454885        test: 0.3486363 best: 0.3451640 (189)   total:
2m 11s   remaining: 5m 53s
271:    learn: 0.1449767        test: 0.3486461 best: 0.3451640 (189)   total:
2m 12s   remaining: 5m 53s
272:    learn: 0.1444190        test: 0.3486027 best: 0.3451640 (189)   total:
2m 12s   remaining: 5m 52s
273:    learn: 0.1439998        test: 0.3485465 best: 0.3451640 (189)   total:
2m 13s   remaining: 5m 52s
274:    learn: 0.1434089        test: 0.3483819 best: 0.3451640 (189)   total:
2m 13s   remaining: 5m 51s
275:    learn: 0.1429148        test: 0.3484019 best: 0.3451640 (189)   total:
2m 13s   remaining: 5m 51s
276:    learn: 0.1424600        test: 0.3483841 best: 0.3451640 (189)   total:
2m 14s   remaining: 5m 50s
277:    learn: 0.1419785        test: 0.3485206 best: 0.3451640 (189)   total:
2m 14s   remaining: 5m 50s
278:    learn: 0.1414825        test: 0.3489339 best: 0.3451640 (189)   total:
2m 15s   remaining: 5m 49s
279:    learn: 0.1409897        test: 0.3491306 best: 0.3451640 (189)   total:
2m 15s   remaining: 5m 49s
280:    learn: 0.1403804        test: 0.3491310 best: 0.3451640 (189)   total:
2m 16s   remaining: 5m 48s
281:    learn: 0.1399421        test: 0.3489349 best: 0.3451640 (189)   total:
2m 16s   remaining: 5m 48s
282:    learn: 0.1394200        test: 0.3489670 best: 0.3451640 (189)   total:
2m 17s   remaining: 5m 47s
283:    learn: 0.1389698        test: 0.3490055 best: 0.3451640 (189)   total:
2m 17s   remaining: 5m 47s
284:    learn: 0.1385053        test: 0.3490319 best: 0.3451640 (189)   total:
2m 18s   remaining: 5m 47s
285:    learn: 0.1380148        test: 0.3490325 best: 0.3451640 (189)   total:
2m 18s   remaining: 5m 46s
286:    learn: 0.1375916        test: 0.3492488 best: 0.3451640 (189)   total:
2m 19s   remaining: 5m 46s
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287:    learn: 0.1371140        test: 0.3493552 best: 0.3451640 (189)   total:
2m 19s   remaining: 5m 45s
288:    learn: 0.1366309        test: 0.3494748 best: 0.3451640 (189)   total:
2m 20s   remaining: 5m 45s
289:    learn: 0.1360187        test: 0.3493771 best: 0.3451640 (189)   total:
2m 20s   remaining: 5m 44s
290:    learn: 0.1355583        test: 0.3494659 best: 0.3451640 (189)   total:
2m 21s   remaining: 5m 44s
291:    learn: 0.1351093        test: 0.3495141 best: 0.3451640 (189)   total:
2m 22s   remaining: 5m 45s
292:    learn: 0.1344972        test: 0.3496365 best: 0.3451640 (189)   total:
2m 23s   remaining: 5m 45s
293:    learn: 0.1340318        test: 0.3496159 best: 0.3451640 (189)   total:
2m 23s   remaining: 5m 44s
294:    learn: 0.1335437        test: 0.3496561 best: 0.3451640 (189)   total:
2m 24s   remaining: 5m 44s
295:    learn: 0.1329681        test: 0.3498510 best: 0.3451640 (189)   total:
2m 24s   remaining: 5m 43s
296:    learn: 0.1324147        test: 0.3499986 best: 0.3451640 (189)   total:
2m 25s   remaining: 5m 43s
297:    learn: 0.1319667        test: 0.3499338 best: 0.3451640 (189)   total:
2m 25s   remaining: 5m 42s
298:    learn: 0.1315017        test: 0.3500997 best: 0.3451640 (189)   total:
2m 26s   remaining: 5m 42s
299:    learn: 0.1310913        test: 0.3501085 best: 0.3451640 (189)   total:
2m 26s   remaining: 5m 41s
300:    learn: 0.1305647        test: 0.3500218 best: 0.3451640 (189)   total:
2m 27s   remaining: 5m 41s
301:    learn: 0.1300722        test: 0.3501336 best: 0.3451640 (189)   total:
2m 27s   remaining: 5m 40s
302:    learn: 0.1296894        test: 0.3503196 best: 0.3451640 (189)   total:
2m 27s   remaining: 5m 40s
303:    learn: 0.1293056        test: 0.3502987 best: 0.3451640 (189)   total:
2m 28s   remaining: 5m 39s
304:    learn: 0.1287970        test: 0.3503122 best: 0.3451640 (189)   total:
2m 28s   remaining: 5m 39s
305:    learn: 0.1283933        test: 0.3503321 best: 0.3451640 (189)   total:
2m 29s   remaining: 5m 38s
306:    learn: 0.1279281        test: 0.3506057 best: 0.3451640 (189)   total:
2m 29s   remaining: 5m 37s
307:    learn: 0.1274366        test: 0.3506255 best: 0.3451640 (189)   total:
2m 30s   remaining: 5m 37s
308:    learn: 0.1269078        test: 0.3507985 best: 0.3451640 (189)   total:
2m 30s   remaining: 5m 36s
309:    learn: 0.1264833        test: 0.3509652 best: 0.3451640 (189)   total:
2m 31s   remaining: 5m 36s
310:    learn: 0.1260356        test: 0.3509415 best: 0.3451640 (189)   total:
2m 31s   remaining: 5m 35s
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311:    learn: 0.1256195        test: 0.3507820 best: 0.3451640 (189)   total:
2m 32s   remaining: 5m 35s
312:    learn: 0.1252176        test: 0.3509262 best: 0.3451640 (189)   total:
2m 32s   remaining: 5m 34s
313:    learn: 0.1247882        test: 0.3509337 best: 0.3451640 (189)   total:
2m 33s   remaining: 5m 34s
314:    learn: 0.1243764        test: 0.3510774 best: 0.3451640 (189)   total:
2m 33s   remaining: 5m 33s
315:    learn: 0.1239461        test: 0.3511202 best: 0.3451640 (189)   total:
2m 34s   remaining: 5m 33s
316:    learn: 0.1234900        test: 0.3511163 best: 0.3451640 (189)   total:
2m 34s   remaining: 5m 32s
317:    learn: 0.1230392        test: 0.3510040 best: 0.3451640 (189)   total:
2m 34s   remaining: 5m 32s
318:    learn: 0.1226599        test: 0.3512657 best: 0.3451640 (189)   total:
2m 35s   remaining: 5m 31s
319:    learn: 0.1222538        test: 0.3513419 best: 0.3451640 (189)   total:
2m 35s   remaining: 5m 31s
320:    learn: 0.1218380        test: 0.3514197 best: 0.3451640 (189)   total:
2m 36s   remaining: 5m 30s
321:    learn: 0.1213764        test: 0.3515787 best: 0.3451640 (189)   total:
2m 36s   remaining: 5m 30s
322:    learn: 0.1209572        test: 0.3514643 best: 0.3451640 (189)   total:
2m 37s   remaining: 5m 29s
323:    learn: 0.1205702        test: 0.3515635 best: 0.3451640 (189)   total:
2m 37s   remaining: 5m 28s
324:    learn: 0.1202221        test: 0.3517916 best: 0.3451640 (189)   total:
2m 38s   remaining: 5m 28s
325:    learn: 0.1198496        test: 0.3518729 best: 0.3451640 (189)   total:
2m 38s   remaining: 5m 27s
326:    learn: 0.1195145        test: 0.3518521 best: 0.3451640 (189)   total:
2m 39s   remaining: 5m 27s
327:    learn: 0.1191476        test: 0.3520912 best: 0.3451640 (189)   total:
2m 39s   remaining: 5m 26s
328:    learn: 0.1186804        test: 0.3520679 best: 0.3451640 (189)   total:
2m 39s   remaining: 5m 26s
329:    learn: 0.1183580        test: 0.3519898 best: 0.3451640 (189)   total:
2m 40s   remaining: 5m 25s
330:    learn: 0.1178759        test: 0.3522023 best: 0.3451640 (189)   total:
2m 40s   remaining: 5m 25s
331:    learn: 0.1175371        test: 0.3522645 best: 0.3451640 (189)   total:
2m 41s   remaining: 5m 24s
332:    learn: 0.1170560        test: 0.3523706 best: 0.3451640 (189)   total:
2m 41s   remaining: 5m 24s
333:    learn: 0.1166478        test: 0.3525808 best: 0.3451640 (189)   total:
2m 42s   remaining: 5m 23s
334:    learn: 0.1162144        test: 0.3526774 best: 0.3451640 (189)   total:
2m 42s   remaining: 5m 23s
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335:    learn: 0.1157954        test: 0.3525987 best: 0.3451640 (189)   total:
2m 43s   remaining: 5m 22s
336:    learn: 0.1153639        test: 0.3525042 best: 0.3451640 (189)   total:
2m 43s   remaining: 5m 22s
337:    learn: 0.1150186        test: 0.3525477 best: 0.3451640 (189)   total:
2m 44s   remaining: 5m 21s
338:    learn: 0.1146909        test: 0.3524058 best: 0.3451640 (189)   total:
2m 44s   remaining: 5m 21s
339:    learn: 0.1143913        test: 0.3526806 best: 0.3451640 (189)   total:
2m 45s   remaining: 5m 20s
340:    learn: 0.1140080        test: 0.3526985 best: 0.3451640 (189)   total:
2m 45s   remaining: 5m 19s
341:    learn: 0.1136593        test: 0.3530050 best: 0.3451640 (189)   total:
2m 46s   remaining: 5m 19s
342:    learn: 0.1132847        test: 0.3532703 best: 0.3451640 (189)   total:
2m 46s   remaining: 5m 18s
343:    learn: 0.1130489        test: 0.3532057 best: 0.3451640 (189)   total:
2m 47s   remaining: 5m 18s
344:    learn: 0.1126340        test: 0.3530565 best: 0.3451640 (189)   total:
2m 47s   remaining: 5m 17s
345:    learn: 0.1123005        test: 0.3531683 best: 0.3451640 (189)   total:
2m 47s   remaining: 5m 17s
346:    learn: 0.1120082        test: 0.3534542 best: 0.3451640 (189)   total:
2m 48s   remaining: 5m 16s
347:    learn: 0.1117063        test: 0.3534911 best: 0.3451640 (189)   total:
2m 48s   remaining: 5m 16s
348:    learn: 0.1113892        test: 0.3536574 best: 0.3451640 (189)   total:
2m 49s   remaining: 5m 15s
349:    learn: 0.1110290        test: 0.3536698 best: 0.3451640 (189)   total:
2m 49s   remaining: 5m 15s
350:    learn: 0.1107371        test: 0.3538015 best: 0.3451640 (189)   total:
2m 50s   remaining: 5m 14s
351:    learn: 0.1104388        test: 0.3538301 best: 0.3451640 (189)   total:
2m 50s   remaining: 5m 14s
352:    learn: 0.1101094        test: 0.3540539 best: 0.3451640 (189)   total:
2m 51s   remaining: 5m 13s
353:    learn: 0.1097842        test: 0.3542341 best: 0.3451640 (189)   total:
2m 51s   remaining: 5m 13s
354:    learn: 0.1094159        test: 0.3545398 best: 0.3451640 (189)   total:
2m 52s   remaining: 5m 12s
355:    learn: 0.1090589        test: 0.3547557 best: 0.3451640 (189)   total:
2m 52s   remaining: 5m 12s
356:    learn: 0.1087193        test: 0.3549615 best: 0.3451640 (189)   total:
2m 53s   remaining: 5m 11s
357:    learn: 0.1083640        test: 0.3548737 best: 0.3451640 (189)   total:
2m 53s   remaining: 5m 11s
358:    learn: 0.1080986        test: 0.3550102 best: 0.3451640 (189)   total:
2m 54s   remaining: 5m 10s
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359:    learn: 0.1078016        test: 0.3552811 best: 0.3451640 (189)   total:
2m 54s   remaining: 5m 10s
360:    learn: 0.1074050        test: 0.3553356 best: 0.3451640 (189)   total:
2m 55s   remaining: 5m 9s
361:    learn: 0.1071323        test: 0.3552266 best: 0.3451640 (189)   total:
2m 55s   remaining: 5m 9s
362:    learn: 0.1068659        test: 0.3552625 best: 0.3451640 (189)   total:
2m 56s   remaining: 5m 8s
363:    learn: 0.1064979        test: 0.3552607 best: 0.3451640 (189)   total:
2m 56s   remaining: 5m 8s
364:    learn: 0.1062454        test: 0.3554087 best: 0.3451640 (189)   total:
2m 56s   remaining: 5m 7s
365:    learn: 0.1059918        test: 0.3555634 best: 0.3451640 (189)   total:
2m 57s   remaining: 5m 7s
366:    learn: 0.1055990        test: 0.3555485 best: 0.3451640 (189)   total:
2m 57s   remaining: 5m 6s
367:    learn: 0.1053700        test: 0.3555417 best: 0.3451640 (189)   total:
2m 58s   remaining: 5m 6s
368:    learn: 0.1050710        test: 0.3555134 best: 0.3451640 (189)   total:
2m 58s   remaining: 5m 5s
369:    learn: 0.1047146        test: 0.3556913 best: 0.3451640 (189)   total:
2m 59s   remaining: 5m 5s
370:    learn: 0.1043518        test: 0.3556794 best: 0.3451640 (189)   total:
2m 59s   remaining: 5m 4s
371:    learn: 0.1040840        test: 0.3555437 best: 0.3451640 (189)   total:
3m       remaining: 5m 4s
372:    learn: 0.1037075        test: 0.3559015 best: 0.3451640 (189)   total:
3m       remaining: 5m 3s
373:    learn: 0.1033465        test: 0.3559672 best: 0.3451640 (189)   total:
3m 1s    remaining: 5m 3s
374:    learn: 0.1030435        test: 0.3560910 best: 0.3451640 (189)   total:
3m 1s    remaining: 5m 2s
375:    learn: 0.1027691        test: 0.3562297 best: 0.3451640 (189)   total:
3m 1s    remaining: 5m 2s
376:    learn: 0.1024358        test: 0.3563510 best: 0.3451640 (189)   total:
3m 2s    remaining: 5m 1s
377:    learn: 0.1021181        test: 0.3565736 best: 0.3451640 (189)   total:
3m 2s    remaining: 5m
378:    learn: 0.1017779        test: 0.3566985 best: 0.3451640 (189)   total:
3m 3s    remaining: 5m
379:    learn: 0.1014208        test: 0.3567553 best: 0.3451640 (189)   total:
3m 3s    remaining: 4m 59s
380:    learn: 0.1011767        test: 0.3567755 best: 0.3451640 (189)   total:
3m 4s    remaining: 4m 59s
381:    learn: 0.1009134        test: 0.3568065 best: 0.3451640 (189)   total:
3m 4s    remaining: 4m 58s
382:    learn: 0.1007029        test: 0.3568293 best: 0.3451640 (189)   total:
3m 4s    remaining: 4m 58s
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383:    learn: 0.1004037        test: 0.3570456 best: 0.3451640 (189)   total:
3m 5s    remaining: 4m 57s
384:    learn: 0.1000385        test: 0.3570051 best: 0.3451640 (189)   total:
3m 5s    remaining: 4m 56s
385:    learn: 0.0997573        test: 0.3572556 best: 0.3451640 (189)   total:
3m 7s    remaining: 4m 57s
386:    learn: 0.0995117        test: 0.3573886 best: 0.3451640 (189)   total:
3m 7s    remaining: 4m 57s
387:    learn: 0.0991289        test: 0.3573724 best: 0.3451640 (189)   total:
3m 8s    remaining: 4m 56s
388:    learn: 0.0988253        test: 0.3574937 best: 0.3451640 (189)   total:
3m 8s    remaining: 4m 56s
389:    learn: 0.0985072        test: 0.3573389 best: 0.3451640 (189)   total:
3m 8s    remaining: 4m 55s
390:    learn: 0.0981178        test: 0.3575197 best: 0.3451640 (189)   total:
3m 9s    remaining: 4m 54s
391:    learn: 0.0978735        test: 0.3576053 best: 0.3451640 (189)   total:
3m 9s    remaining: 4m 54s
392:    learn: 0.0976047        test: 0.3577017 best: 0.3451640 (189)   total:
3m 10s   remaining: 4m 53s
393:    learn: 0.0972723        test: 0.3576668 best: 0.3451640 (189)   total:
3m 10s   remaining: 4m 53s
394:    learn: 0.0970667        test: 0.3576327 best: 0.3451640 (189)   total:
3m 11s   remaining: 4m 53s
395:    learn: 0.0968205        test: 0.3575982 best: 0.3451640 (189)   total:
3m 11s   remaining: 4m 52s
396:    learn: 0.0965109        test: 0.3577738 best: 0.3451640 (189)   total:
3m 12s   remaining: 4m 52s
397:    learn: 0.0962638        test: 0.3579435 best: 0.3451640 (189)   total:
3m 12s   remaining: 4m 51s
398:    learn: 0.0959918        test: 0.3581603 best: 0.3451640 (189)   total:
3m 13s   remaining: 4m 51s
399:    learn: 0.0957130        test: 0.3580561 best: 0.3451640 (189)   total:
3m 13s   remaining: 4m 50s
400:    learn: 0.0955010        test: 0.3581346 best: 0.3451640 (189)   total:
3m 14s   remaining: 4m 50s
401:    learn: 0.0951481        test: 0.3582150 best: 0.3451640 (189)   total:
3m 14s   remaining: 4m 49s
402:    learn: 0.0949415        test: 0.3582600 best: 0.3451640 (189)   total:
3m 15s   remaining: 4m 49s
403:    learn: 0.0946383        test: 0.3582402 best: 0.3451640 (189)   total:
3m 15s   remaining: 4m 48s
404:    learn: 0.0943570        test: 0.3584026 best: 0.3451640 (189)   total:
3m 16s   remaining: 4m 48s
405:    learn: 0.0940608        test: 0.3582941 best: 0.3451640 (189)   total:
3m 16s   remaining: 4m 47s
406:    learn: 0.0937778        test: 0.3584522 best: 0.3451640 (189)   total:
3m 16s   remaining: 4m 47s
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407:    learn: 0.0934737        test: 0.3585119 best: 0.3451640 (189)   total:
3m 17s   remaining: 4m 46s
408:    learn: 0.0931427        test: 0.3586076 best: 0.3451640 (189)   total:
3m 18s   remaining: 4m 46s
409:    learn: 0.0928649        test: 0.3585650 best: 0.3451640 (189)   total:
3m 18s   remaining: 4m 45s
410:    learn: 0.0926371        test: 0.3585744 best: 0.3451640 (189)   total:
3m 19s   remaining: 4m 45s
411:    learn: 0.0923427        test: 0.3588470 best: 0.3451640 (189)   total:
3m 19s   remaining: 4m 44s
412:    learn: 0.0920328        test: 0.3589421 best: 0.3451640 (189)   total:
3m 20s   remaining: 4m 44s
413:    learn: 0.0917211        test: 0.3591059 best: 0.3451640 (189)   total:
3m 20s   remaining: 4m 43s
414:    learn: 0.0915151        test: 0.3593186 best: 0.3451640 (189)   total:
3m 21s   remaining: 4m 43s
415:    learn: 0.0912649        test: 0.3592780 best: 0.3451640 (189)   total:
3m 21s   remaining: 4m 42s
416:    learn: 0.0909260        test: 0.3593298 best: 0.3451640 (189)   total:
3m 22s   remaining: 4m 42s
417:    learn: 0.0906457        test: 0.3594587 best: 0.3451640 (189)   total:
3m 22s   remaining: 4m 42s
418:    learn: 0.0904258        test: 0.3594160 best: 0.3451640 (189)   total:
3m 23s   remaining: 4m 41s
419:    learn: 0.0902254        test: 0.3594076 best: 0.3451640 (189)   total:
3m 23s   remaining: 4m 41s
420:    learn: 0.0899533        test: 0.3594444 best: 0.3451640 (189)   total:
3m 23s   remaining: 4m 40s
421:    learn: 0.0897300        test: 0.3594083 best: 0.3451640 (189)   total:
3m 24s   remaining: 4m 39s
422:    learn: 0.0895222        test: 0.3594474 best: 0.3451640 (189)   total:
3m 24s   remaining: 4m 39s
423:    learn: 0.0892396        test: 0.3595281 best: 0.3451640 (189)   total:
3m 25s   remaining: 4m 38s
424:    learn: 0.0890057        test: 0.3596111 best: 0.3451640 (189)   total:
3m 25s   remaining: 4m 38s
425:    learn: 0.0887245        test: 0.3597463 best: 0.3451640 (189)   total:
3m 26s   remaining: 4m 38s
426:    learn: 0.0884458        test: 0.3597029 best: 0.3451640 (189)   total:
3m 26s   remaining: 4m 37s
427:    learn: 0.0881642        test: 0.3597947 best: 0.3451640 (189)   total:
3m 27s   remaining: 4m 37s
428:    learn: 0.0879512        test: 0.3600580 best: 0.3451640 (189)   total:
3m 27s   remaining: 4m 36s
429:    learn: 0.0876968        test: 0.3600985 best: 0.3451640 (189)   total:
3m 28s   remaining: 4m 36s
430:    learn: 0.0874217        test: 0.3602411 best: 0.3451640 (189)   total:
3m 28s   remaining: 4m 35s
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431:    learn: 0.0871922        test: 0.3604135 best: 0.3451640 (189)   total:
3m 29s   remaining: 4m 35s
432:    learn: 0.0869350        test: 0.3606651 best: 0.3451640 (189)   total:
3m 29s   remaining: 4m 34s
433:    learn: 0.0866979        test: 0.3606480 best: 0.3451640 (189)   total:
3m 30s   remaining: 4m 34s
434:    learn: 0.0864164        test: 0.3607386 best: 0.3451640 (189)   total:
3m 30s   remaining: 4m 33s
435:    learn: 0.0862065        test: 0.3607556 best: 0.3451640 (189)   total:
3m 31s   remaining: 4m 33s
436:    learn: 0.0859711        test: 0.3607557 best: 0.3451640 (189)   total:
3m 31s   remaining: 4m 32s
437:    learn: 0.0856941        test: 0.3607783 best: 0.3451640 (189)   total:
3m 32s   remaining: 4m 32s
438:    learn: 0.0854761        test: 0.3608348 best: 0.3451640 (189)   total:
3m 32s   remaining: 4m 31s
439:    learn: 0.0852403        test: 0.3608717 best: 0.3451640 (189)   total:
3m 33s   remaining: 4m 31s
440:    learn: 0.0849581        test: 0.3610837 best: 0.3451640 (189)   total:
3m 33s   remaining: 4m 30s
441:    learn: 0.0847385        test: 0.3612722 best: 0.3451640 (189)   total:
3m 34s   remaining: 4m 30s
442:    learn: 0.0845009        test: 0.3613632 best: 0.3451640 (189)   total:
3m 34s   remaining: 4m 29s
443:    learn: 0.0842123        test: 0.3616406 best: 0.3451640 (189)   total:
3m 35s   remaining: 4m 29s
444:    learn: 0.0840168        test: 0.3616928 best: 0.3451640 (189)   total:
3m 35s   remaining: 4m 28s
445:    learn: 0.0837478        test: 0.3618169 best: 0.3451640 (189)   total:
3m 36s   remaining: 4m 28s
446:    learn: 0.0834495        test: 0.3619546 best: 0.3451640 (189)   total:
3m 36s   remaining: 4m 28s
447:    learn: 0.0832623        test: 0.3620386 best: 0.3451640 (189)   total:
3m 37s   remaining: 4m 27s
448:    learn: 0.0829603        test: 0.3620751 best: 0.3451640 (189)   total:
3m 37s   remaining: 4m 27s
449:    learn: 0.0827474        test: 0.3623243 best: 0.3451640 (189)   total:
3m 38s   remaining: 4m 26s
450:    learn: 0.0824038        test: 0.3622404 best: 0.3451640 (189)   total:
3m 38s   remaining: 4m 26s
451:    learn: 0.0821615        test: 0.3623532 best: 0.3451640 (189)   total:
3m 39s   remaining: 4m 25s
452:    learn: 0.0818868        test: 0.3625212 best: 0.3451640 (189)   total:
3m 39s   remaining: 4m 25s
453:    learn: 0.0816209        test: 0.3627420 best: 0.3451640 (189)   total:
3m 40s   remaining: 4m 24s
454:    learn: 0.0813556        test: 0.3627998 best: 0.3451640 (189)   total:
3m 40s   remaining: 4m 24s
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455:    learn: 0.0811272        test: 0.3626302 best: 0.3451640 (189)   total:
3m 41s   remaining: 4m 23s
456:    learn: 0.0808820        test: 0.3628026 best: 0.3451640 (189)   total:
3m 41s   remaining: 4m 23s
457:    learn: 0.0806656        test: 0.3630158 best: 0.3451640 (189)   total:
3m 42s   remaining: 4m 23s
458:    learn: 0.0804522        test: 0.3631364 best: 0.3451640 (189)   total:
3m 42s   remaining: 4m 22s
459:    learn: 0.0802366        test: 0.3631828 best: 0.3451640 (189)   total:
3m 43s   remaining: 4m 22s
460:    learn: 0.0800271        test: 0.3632683 best: 0.3451640 (189)   total:
3m 43s   remaining: 4m 21s
461:    learn: 0.0798261        test: 0.3633911 best: 0.3451640 (189)   total:
3m 44s   remaining: 4m 21s
462:    learn: 0.0795623        test: 0.3636364 best: 0.3451640 (189)   total:
3m 44s   remaining: 4m 20s
463:    learn: 0.0793657        test: 0.3637555 best: 0.3451640 (189)   total:
3m 45s   remaining: 4m 20s
464:    learn: 0.0791639        test: 0.3640606 best: 0.3451640 (189)   total:
3m 45s   remaining: 4m 19s
465:    learn: 0.0789723        test: 0.3641930 best: 0.3451640 (189)   total:
3m 46s   remaining: 4m 19s
466:    learn: 0.0787571        test: 0.3642937 best: 0.3451640 (189)   total:
3m 46s   remaining: 4m 19s
467:    learn: 0.0785778        test: 0.3645191 best: 0.3451640 (189)   total:
3m 47s   remaining: 4m 18s
468:    learn: 0.0783848        test: 0.3647291 best: 0.3451640 (189)   total:
3m 47s   remaining: 4m 18s
469:    learn: 0.0782018        test: 0.3646371 best: 0.3451640 (189)   total:
3m 48s   remaining: 4m 17s
470:    learn: 0.0779942        test: 0.3647445 best: 0.3451640 (189)   total:
3m 48s   remaining: 4m 16s
471:    learn: 0.0778150        test: 0.3648126 best: 0.3451640 (189)   total:
3m 49s   remaining: 4m 16s
472:    learn: 0.0775874        test: 0.3651044 best: 0.3451640 (189)   total:
3m 49s   remaining: 4m 16s
473:    learn: 0.0773322        test: 0.3652977 best: 0.3451640 (189)   total:
3m 50s   remaining: 4m 15s
474:    learn: 0.0771379        test: 0.3653394 best: 0.3451640 (189)   total:
3m 50s   remaining: 4m 15s
475:    learn: 0.0769773        test: 0.3654428 best: 0.3451640 (189)   total:
3m 51s   remaining: 4m 14s
476:    learn: 0.0767519        test: 0.3655148 best: 0.3451640 (189)   total:
3m 52s   remaining: 4m 14s
477:    learn: 0.0765916        test: 0.3656490 best: 0.3451640 (189)   total:
3m 52s   remaining: 4m 14s
478:    learn: 0.0764002        test: 0.3657551 best: 0.3451640 (189)   total:
3m 53s   remaining: 4m 13s
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479:    learn: 0.0761777        test: 0.3658413 best: 0.3451640 (189)   total:
3m 53s   remaining: 4m 13s
480:    learn: 0.0759349        test: 0.3659034 best: 0.3451640 (189)   total:
3m 54s   remaining: 4m 12s
481:    learn: 0.0757257        test: 0.3658765 best: 0.3451640 (189)   total:
3m 54s   remaining: 4m 12s
482:    learn: 0.0755307        test: 0.3660569 best: 0.3451640 (189)   total:
3m 55s   remaining: 4m 11s
483:    learn: 0.0753343        test: 0.3662177 best: 0.3451640 (189)   total:
3m 55s   remaining: 4m 11s
484:    learn: 0.0751602        test: 0.3663342 best: 0.3451640 (189)   total:
3m 56s   remaining: 4m 10s
485:    learn: 0.0749335        test: 0.3664848 best: 0.3451640 (189)   total:
3m 56s   remaining: 4m 10s
486:    learn: 0.0747739        test: 0.3665123 best: 0.3451640 (189)   total:
3m 57s   remaining: 4m 10s
487:    learn: 0.0746200        test: 0.3665548 best: 0.3451640 (189)   total:
3m 57s   remaining: 4m 9s
488:    learn: 0.0744589        test: 0.3667366 best: 0.3451640 (189)   total:
3m 58s   remaining: 4m 9s
489:    learn: 0.0742917        test: 0.3668662 best: 0.3451640 (189)   total:
3m 58s   remaining: 4m 8s
490:    learn: 0.0740969        test: 0.3669940 best: 0.3451640 (189)   total:
3m 59s   remaining: 4m 8s
491:    learn: 0.0739093        test: 0.3671503 best: 0.3451640 (189)   total:
3m 59s   remaining: 4m 7s
492:    learn: 0.0736732        test: 0.3671836 best: 0.3451640 (189)   total:
4m       remaining: 4m 7s
493:    learn: 0.0734994        test: 0.3674259 best: 0.3451640 (189)   total:
4m       remaining: 4m 6s
494:    learn: 0.0733358        test: 0.3674965 best: 0.3451640 (189)   total:
4m 1s    remaining: 4m 6s
495:    learn: 0.0731178        test: 0.3677511 best: 0.3451640 (189)   total:
4m 1s    remaining: 4m 5s
496:    learn: 0.0728923        test: 0.3677895 best: 0.3451640 (189)   total:
4m 2s    remaining: 4m 5s
497:    learn: 0.0727173        test: 0.3679427 best: 0.3451640 (189)   total:
4m 3s    remaining: 4m 4s
498:    learn: 0.0725196        test: 0.3679837 best: 0.3451640 (189)   total:
4m 3s    remaining: 4m 4s
499:    learn: 0.0722928        test: 0.3681487 best: 0.3451640 (189)   total:
4m 3s    remaining: 4m 3s
500:    learn: 0.0721041        test: 0.3681549 best: 0.3451640 (189)   total:
4m 4s    remaining: 4m 3s
501:    learn: 0.0719093        test: 0.3683107 best: 0.3451640 (189)   total:
4m 5s    remaining: 4m 3s
502:    learn: 0.0717182        test: 0.3684610 best: 0.3451640 (189)   total:
4m 5s    remaining: 4m 2s
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503:    learn: 0.0715176        test: 0.3685676 best: 0.3451640 (189)   total:
4m 6s    remaining: 4m 2s
504:    learn: 0.0713732        test: 0.3686772 best: 0.3451640 (189)   total:
4m 6s    remaining: 4m 1s
505:    learn: 0.0711373        test: 0.3688626 best: 0.3451640 (189)   total:
4m 7s    remaining: 4m 1s
506:    learn: 0.0709659        test: 0.3690622 best: 0.3451640 (189)   total:
4m 7s    remaining: 4m
507:    learn: 0.0707954        test: 0.3691367 best: 0.3451640 (189)   total:
4m 8s    remaining: 4m
508:    learn: 0.0706172        test: 0.3690545 best: 0.3451640 (189)   total:
4m 8s    remaining: 3m 59s
509:    learn: 0.0704208        test: 0.3690688 best: 0.3451640 (189)   total:
4m 9s    remaining: 3m 59s
510:    learn: 0.0702671        test: 0.3694199 best: 0.3451640 (189)   total:
4m 9s    remaining: 3m 58s
511:    learn: 0.0701053        test: 0.3695431 best: 0.3451640 (189)   total:
4m 9s    remaining: 3m 58s
512:    learn: 0.0699123        test: 0.3696238 best: 0.3451640 (189)   total:
4m 10s   remaining: 3m 57s
513:    learn: 0.0697729        test: 0.3696714 best: 0.3451640 (189)   total:
4m 10s   remaining: 3m 57s
514:    learn: 0.0695714        test: 0.3698466 best: 0.3451640 (189)   total:
4m 11s   remaining: 3m 56s
515:    learn: 0.0693686        test: 0.3699600 best: 0.3451640 (189)   total:
4m 11s   remaining: 3m 56s
516:    learn: 0.0691396        test: 0.3698619 best: 0.3451640 (189)   total:
4m 12s   remaining: 3m 55s
517:    learn: 0.0689644        test: 0.3700694 best: 0.3451640 (189)   total:
4m 12s   remaining: 3m 55s
518:    learn: 0.0687852        test: 0.3703032 best: 0.3451640 (189)   total:
4m 13s   remaining: 3m 54s
519:    learn: 0.0686413        test: 0.3704520 best: 0.3451640 (189)   total:
4m 13s   remaining: 3m 54s
520:    learn: 0.0684601        test: 0.3706638 best: 0.3451640 (189)   total:
4m 14s   remaining: 3m 53s
521:    learn: 0.0683368        test: 0.3708036 best: 0.3451640 (189)   total:
4m 14s   remaining: 3m 53s
522:    learn: 0.0681386        test: 0.3709531 best: 0.3451640 (189)   total:
4m 15s   remaining: 3m 52s
523:    learn: 0.0679739        test: 0.3710214 best: 0.3451640 (189)   total:
4m 15s   remaining: 3m 52s
524:    learn: 0.0677752        test: 0.3712827 best: 0.3451640 (189)   total:
4m 16s   remaining: 3m 51s
525:    learn: 0.0676173        test: 0.3713670 best: 0.3451640 (189)   total:
4m 16s   remaining: 3m 51s
526:    learn: 0.0675070        test: 0.3713692 best: 0.3451640 (189)   total:
4m 17s   remaining: 3m 50s
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527:    learn: 0.0673145        test: 0.3715297 best: 0.3451640 (189)   total:
4m 17s   remaining: 3m 50s
528:    learn: 0.0671556        test: 0.3714709 best: 0.3451640 (189)   total:
4m 18s   remaining: 3m 49s
529:    learn: 0.0670142        test: 0.3715263 best: 0.3451640 (189)   total:
4m 18s   remaining: 3m 49s
530:    learn: 0.0668068        test: 0.3715102 best: 0.3451640 (189)   total:
4m 18s   remaining: 3m 48s
531:    learn: 0.0666416        test: 0.3716677 best: 0.3451640 (189)   total:
4m 19s   remaining: 3m 48s
532:    learn: 0.0664506        test: 0.3719129 best: 0.3451640 (189)   total:
4m 20s   remaining: 3m 47s
533:    learn: 0.0662914        test: 0.3720018 best: 0.3451640 (189)   total:
4m 20s   remaining: 3m 47s
534:    learn: 0.0661206        test: 0.3721248 best: 0.3451640 (189)   total:
4m 21s   remaining: 3m 46s
535:    learn: 0.0659574        test: 0.3724396 best: 0.3451640 (189)   total:
4m 21s   remaining: 3m 46s
536:    learn: 0.0658263        test: 0.3724294 best: 0.3451640 (189)   total:
4m 22s   remaining: 3m 45s
537:    learn: 0.0656687        test: 0.3726050 best: 0.3451640 (189)   total:
4m 22s   remaining: 3m 45s
538:    learn: 0.0655227        test: 0.3726874 best: 0.3451640 (189)   total:
4m 23s   remaining: 3m 45s
539:    learn: 0.0653608        test: 0.3728069 best: 0.3451640 (189)   total:
4m 23s   remaining: 3m 44s
540:    learn: 0.0652191        test: 0.3727959 best: 0.3451640 (189)   total:
4m 24s   remaining: 3m 44s
541:    learn: 0.0650599        test: 0.3728786 best: 0.3451640 (189)   total:
4m 24s   remaining: 3m 43s
542:    learn: 0.0648685        test: 0.3729819 best: 0.3451640 (189)   total:
4m 25s   remaining: 3m 43s
543:    learn: 0.0646843        test: 0.3731150 best: 0.3451640 (189)   total:
4m 25s   remaining: 3m 42s
544:    learn: 0.0645253        test: 0.3732286 best: 0.3451640 (189)   total:
4m 26s   remaining: 3m 42s
545:    learn: 0.0643441        test: 0.3733400 best: 0.3451640 (189)   total:
4m 26s   remaining: 3m 41s
546:    learn: 0.0641785        test: 0.3736658 best: 0.3451640 (189)   total:
4m 27s   remaining: 3m 41s
547:    learn: 0.0640429        test: 0.3737704 best: 0.3451640 (189)   total:
4m 27s   remaining: 3m 40s
548:    learn: 0.0638718        test: 0.3739022 best: 0.3451640 (189)   total:
4m 28s   remaining: 3m 40s
549:    learn: 0.0637186        test: 0.3740369 best: 0.3451640 (189)   total:
4m 28s   remaining: 3m 39s
550:    learn: 0.0635535        test: 0.3741751 best: 0.3451640 (189)   total:
4m 28s   remaining: 3m 39s
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551:    learn: 0.0634114        test: 0.3742901 best: 0.3451640 (189)   total:
4m 29s   remaining: 3m 38s
552:    learn: 0.0632692        test: 0.3743241 best: 0.3451640 (189)   total:
4m 29s   remaining: 3m 38s
553:    learn: 0.0630836        test: 0.3746000 best: 0.3451640 (189)   total:
4m 30s   remaining: 3m 37s
554:    learn: 0.0629363        test: 0.3747264 best: 0.3451640 (189)   total:
4m 30s   remaining: 3m 37s
555:    learn: 0.0627741        test: 0.3748799 best: 0.3451640 (189)   total:
4m 31s   remaining: 3m 36s
556:    learn: 0.0626234        test: 0.3749931 best: 0.3451640 (189)   total:
4m 32s   remaining: 3m 36s
557:    learn: 0.0624928        test: 0.3751952 best: 0.3451640 (189)   total:
4m 32s   remaining: 3m 35s
558:    learn: 0.0623336        test: 0.3754901 best: 0.3451640 (189)   total:
4m 33s   remaining: 3m 35s
559:    learn: 0.0621818        test: 0.3755391 best: 0.3451640 (189)   total:
4m 33s   remaining: 3m 34s
560:    learn: 0.0620320        test: 0.3756393 best: 0.3451640 (189)   total:
4m 34s   remaining: 3m 34s
561:    learn: 0.0619055        test: 0.3758093 best: 0.3451640 (189)   total:
4m 35s   remaining: 3m 34s
562:    learn: 0.0617776        test: 0.3759027 best: 0.3451640 (189)   total:
4m 35s   remaining: 3m 34s
563:    learn: 0.0616407        test: 0.3758938 best: 0.3451640 (189)   total:
4m 36s   remaining: 3m 33s
564:    learn: 0.0614729        test: 0.3760844 best: 0.3451640 (189)   total:
4m 36s   remaining: 3m 33s
565:    learn: 0.0613607        test: 0.3761804 best: 0.3451640 (189)   total:
4m 37s   remaining: 3m 32s
566:    learn: 0.0612163        test: 0.3761520 best: 0.3451640 (189)   total:
4m 37s   remaining: 3m 32s
567:    learn: 0.0610930        test: 0.3762204 best: 0.3451640 (189)   total:
4m 38s   remaining: 3m 31s
568:    learn: 0.0609256        test: 0.3762781 best: 0.3451640 (189)   total:
4m 38s   remaining: 3m 31s
569:    learn: 0.0607775        test: 0.3764992 best: 0.3451640 (189)   total:
4m 39s   remaining: 3m 30s
570:    learn: 0.0605944        test: 0.3766725 best: 0.3451640 (189)   total:
4m 39s   remaining: 3m 30s
571:    learn: 0.0604293        test: 0.3766189 best: 0.3451640 (189)   total:
4m 40s   remaining: 3m 29s
572:    learn: 0.0602755        test: 0.3767764 best: 0.3451640 (189)   total:
4m 40s   remaining: 3m 29s
573:    learn: 0.0601700        test: 0.3769747 best: 0.3451640 (189)   total:
4m 41s   remaining: 3m 28s
574:    learn: 0.0600200        test: 0.3770042 best: 0.3451640 (189)   total:
4m 41s   remaining: 3m 28s
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575:    learn: 0.0598474        test: 0.3769995 best: 0.3451640 (189)   total:
4m 42s   remaining: 3m 27s
576:    learn: 0.0597078        test: 0.3769395 best: 0.3451640 (189)   total:
4m 42s   remaining: 3m 27s
577:    learn: 0.0595281        test: 0.3772482 best: 0.3451640 (189)   total:
4m 43s   remaining: 3m 26s
578:    learn: 0.0594083        test: 0.3773612 best: 0.3451640 (189)   total:
4m 43s   remaining: 3m 26s
579:    learn: 0.0592713        test: 0.3775625 best: 0.3451640 (189)   total:
4m 44s   remaining: 3m 25s
580:    learn: 0.0591095        test: 0.3775886 best: 0.3451640 (189)   total:
4m 45s   remaining: 3m 25s
581:    learn: 0.0589702        test: 0.3777882 best: 0.3451640 (189)   total:
4m 45s   remaining: 3m 25s
582:    learn: 0.0588350        test: 0.3779743 best: 0.3451640 (189)   total:
4m 45s   remaining: 3m 24s
583:    learn: 0.0586885        test: 0.3781691 best: 0.3451640 (189)   total:
4m 46s   remaining: 3m 24s
584:    learn: 0.0585604        test: 0.3783033 best: 0.3451640 (189)   total:
4m 46s   remaining: 3m 23s
585:    learn: 0.0584490        test: 0.3784927 best: 0.3451640 (189)   total:
4m 47s   remaining: 3m 23s
586:    learn: 0.0583622        test: 0.3787127 best: 0.3451640 (189)   total:
4m 47s   remaining: 3m 22s
587:    learn: 0.0581962        test: 0.3787997 best: 0.3451640 (189)   total:
4m 48s   remaining: 3m 22s
588:    learn: 0.0580058        test: 0.3790706 best: 0.3451640 (189)   total:
4m 49s   remaining: 3m 21s
589:    learn: 0.0578641        test: 0.3792473 best: 0.3451640 (189)   total:
4m 49s   remaining: 3m 21s
590:    learn: 0.0577292        test: 0.3793352 best: 0.3451640 (189)   total:
4m 49s   remaining: 3m 20s
591:    learn: 0.0576150        test: 0.3795368 best: 0.3451640 (189)   total:
4m 50s   remaining: 3m 20s
592:    learn: 0.0574887        test: 0.3797112 best: 0.3451640 (189)   total:
4m 50s   remaining: 3m 19s
593:    learn: 0.0573853        test: 0.3797616 best: 0.3451640 (189)   total:
4m 51s   remaining: 3m 19s
594:    learn: 0.0572477        test: 0.3798751 best: 0.3451640 (189)   total:
4m 51s   remaining: 3m 18s
595:    learn: 0.0570729        test: 0.3801231 best: 0.3451640 (189)   total:
4m 52s   remaining: 3m 18s
596:    learn: 0.0569393        test: 0.3802269 best: 0.3451640 (189)   total:
4m 52s   remaining: 3m 17s
597:    learn: 0.0568023        test: 0.3803959 best: 0.3451640 (189)   total:
4m 53s   remaining: 3m 17s
598:    learn: 0.0566524        test: 0.3805096 best: 0.3451640 (189)   total:
4m 53s   remaining: 3m 16s
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599:    learn: 0.0565551        test: 0.3807710 best: 0.3451640 (189)   total:
4m 54s   remaining: 3m 16s
600:    learn: 0.0564461        test: 0.3809429 best: 0.3451640 (189)   total:
4m 54s   remaining: 3m 15s
601:    learn: 0.0563046        test: 0.3811027 best: 0.3451640 (189)   total:
4m 55s   remaining: 3m 15s
602:    learn: 0.0561754        test: 0.3811082 best: 0.3451640 (189)   total:
4m 55s   remaining: 3m 14s
603:    learn: 0.0560223        test: 0.3811194 best: 0.3451640 (189)   total:
4m 56s   remaining: 3m 14s
604:    learn: 0.0559232        test: 0.3811384 best: 0.3451640 (189)   total:
4m 56s   remaining: 3m 13s
605:    learn: 0.0557451        test: 0.3813837 best: 0.3451640 (189)   total:
4m 57s   remaining: 3m 13s
606:    learn: 0.0556016        test: 0.3814037 best: 0.3451640 (189)   total:
4m 57s   remaining: 3m 12s
607:    learn: 0.0554994        test: 0.3815210 best: 0.3451640 (189)   total:
4m 58s   remaining: 3m 12s
608:    learn: 0.0553980        test: 0.3816097 best: 0.3451640 (189)   total:
4m 58s   remaining: 3m 11s
609:    learn: 0.0552808        test: 0.3817417 best: 0.3451640 (189)   total:
4m 59s   remaining: 3m 11s
610:    learn: 0.0551469        test: 0.3818707 best: 0.3451640 (189)   total:
4m 59s   remaining: 3m 10s
611:    learn: 0.0550344        test: 0.3819431 best: 0.3451640 (189)   total:
5m       remaining: 3m 10s
612:    learn: 0.0549040        test: 0.3819542 best: 0.3451640 (189)   total:
5m       remaining: 3m 10s
613:    learn: 0.0547765        test: 0.3820278 best: 0.3451640 (189)   total:
5m 1s    remaining: 3m 9s
614:    learn: 0.0546495        test: 0.3822194 best: 0.3451640 (189)   total:
5m 1s    remaining: 3m 9s
615:    learn: 0.0545178        test: 0.3826201 best: 0.3451640 (189)   total:
5m 2s    remaining: 3m 8s
616:    learn: 0.0543578        test: 0.3828569 best: 0.3451640 (189)   total:
5m 2s    remaining: 3m 8s
617:    learn: 0.0542413        test: 0.3829269 best: 0.3451640 (189)   total:
5m 3s    remaining: 3m 7s
618:    learn: 0.0541236        test: 0.3830660 best: 0.3451640 (189)   total:
5m 3s    remaining: 3m 7s
619:    learn: 0.0539511        test: 0.3832255 best: 0.3451640 (189)   total:
5m 4s    remaining: 3m 6s
620:    learn: 0.0538335        test: 0.3832935 best: 0.3451640 (189)   total:
5m 4s    remaining: 3m 6s
621:    learn: 0.0536932        test: 0.3834611 best: 0.3451640 (189)   total:
5m 5s    remaining: 3m 5s
622:    learn: 0.0535604        test: 0.3835646 best: 0.3451640 (189)   total:
5m 5s    remaining: 3m 5s
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623:    learn: 0.0534195        test: 0.3837260 best: 0.3451640 (189)   total:
5m 6s    remaining: 3m 4s
624:    learn: 0.0532720        test: 0.3837858 best: 0.3451640 (189)   total:
5m 7s    remaining: 3m 4s
625:    learn: 0.0531426        test: 0.3840485 best: 0.3451640 (189)   total:
5m 7s    remaining: 3m 3s
626:    learn: 0.0530180        test: 0.3842466 best: 0.3451640 (189)   total:
5m 8s    remaining: 3m 3s
627:    learn: 0.0528858        test: 0.3842059 best: 0.3451640 (189)   total:
5m 8s    remaining: 3m 2s
628:    learn: 0.0527636        test: 0.3843465 best: 0.3451640 (189)   total:
5m 9s    remaining: 3m 2s
629:    learn: 0.0526571        test: 0.3845737 best: 0.3451640 (189)   total:
5m 9s    remaining: 3m 1s
630:    learn: 0.0525408        test: 0.3848038 best: 0.3451640 (189)   total:
5m 9s    remaining: 3m 1s
631:    learn: 0.0524487        test: 0.3848394 best: 0.3451640 (189)   total:
5m 10s   remaining: 3m
632:    learn: 0.0523121        test: 0.3848182 best: 0.3451640 (189)   total:
5m 10s   remaining: 3m
633:    learn: 0.0521902        test: 0.3848406 best: 0.3451640 (189)   total:
5m 11s   remaining: 2m 59s
634:    learn: 0.0520987        test: 0.3848768 best: 0.3451640 (189)   total:
5m 11s   remaining: 2m 59s
635:    learn: 0.0519800        test: 0.3850596 best: 0.3451640 (189)   total:
5m 12s   remaining: 2m 58s
636:    learn: 0.0518719        test: 0.3852694 best: 0.3451640 (189)   total:
5m 12s   remaining: 2m 58s
637:    learn: 0.0517747        test: 0.3854211 best: 0.3451640 (189)   total:
5m 13s   remaining: 2m 57s
638:    learn: 0.0516699        test: 0.3854606 best: 0.3451640 (189)   total:
5m 13s   remaining: 2m 57s
639:    learn: 0.0515691        test: 0.3853909 best: 0.3451640 (189)   total:
5m 14s   remaining: 2m 56s
640:    learn: 0.0514121        test: 0.3856974 best: 0.3451640 (189)   total:
5m 14s   remaining: 2m 56s
641:    learn: 0.0513080        test: 0.3857872 best: 0.3451640 (189)   total:
5m 15s   remaining: 2m 55s
642:    learn: 0.0511981        test: 0.3859390 best: 0.3451640 (189)   total:
5m 15s   remaining: 2m 55s
643:    learn: 0.0510921        test: 0.3860373 best: 0.3451640 (189)   total:
5m 16s   remaining: 2m 54s
644:    learn: 0.0509648        test: 0.3862056 best: 0.3451640 (189)   total:
5m 16s   remaining: 2m 54s
645:    learn: 0.0508484        test: 0.3864327 best: 0.3451640 (189)   total:
5m 17s   remaining: 2m 53s
646:    learn: 0.0507328        test: 0.3864797 best: 0.3451640 (189)   total:
5m 17s   remaining: 2m 53s
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647:    learn: 0.0505979        test: 0.3864061 best: 0.3451640 (189)   total:
5m 18s   remaining: 2m 52s
648:    learn: 0.0504801        test: 0.3866040 best: 0.3451640 (189)   total:
5m 18s   remaining: 2m 52s
649:    learn: 0.0503550        test: 0.3867847 best: 0.3451640 (189)   total:
5m 19s   remaining: 2m 51s
650:    learn: 0.0502605        test: 0.3868420 best: 0.3451640 (189)   total:
5m 19s   remaining: 2m 51s
651:    learn: 0.0501602        test: 0.3869388 best: 0.3451640 (189)   total:
5m 20s   remaining: 2m 50s
652:    learn: 0.0500596        test: 0.3869389 best: 0.3451640 (189)   total:
5m 20s   remaining: 2m 50s
653:    learn: 0.0499377        test: 0.3870395 best: 0.3451640 (189)   total:
5m 20s   remaining: 2m 49s
654:    learn: 0.0498222        test: 0.3871991 best: 0.3451640 (189)   total:
5m 21s   remaining: 2m 49s
655:    learn: 0.0497296        test: 0.3873901 best: 0.3451640 (189)   total:
5m 22s   remaining: 2m 49s
656:    learn: 0.0496241        test: 0.3874371 best: 0.3451640 (189)   total:
5m 23s   remaining: 2m 48s
657:    learn: 0.0495091        test: 0.3875348 best: 0.3451640 (189)   total:
5m 23s   remaining: 2m 48s
658:    learn: 0.0494073        test: 0.3875760 best: 0.3451640 (189)   total:
5m 24s   remaining: 2m 47s
659:    learn: 0.0492818        test: 0.3875648 best: 0.3451640 (189)   total:
5m 24s   remaining: 2m 47s
660:    learn: 0.0491995        test: 0.3876007 best: 0.3451640 (189)   total:
5m 25s   remaining: 2m 46s
661:    learn: 0.0490748        test: 0.3878560 best: 0.3451640 (189)   total:
5m 25s   remaining: 2m 46s
662:    learn: 0.0489662        test: 0.3879043 best: 0.3451640 (189)   total:
5m 26s   remaining: 2m 45s
663:    learn: 0.0488598        test: 0.3880147 best: 0.3451640 (189)   total:
5m 26s   remaining: 2m 45s
664:    learn: 0.0487361        test: 0.3879907 best: 0.3451640 (189)   total:
5m 27s   remaining: 2m 44s
665:    learn: 0.0486434        test: 0.3881705 best: 0.3451640 (189)   total:
5m 27s   remaining: 2m 44s
666:    learn: 0.0485377        test: 0.3882435 best: 0.3451640 (189)   total:
5m 28s   remaining: 2m 43s
667:    learn: 0.0484236        test: 0.3883900 best: 0.3451640 (189)   total:
5m 28s   remaining: 2m 43s
668:    learn: 0.0483290        test: 0.3885453 best: 0.3451640 (189)   total:
5m 29s   remaining: 2m 42s
669:    learn: 0.0482411        test: 0.3886633 best: 0.3451640 (189)   total:
5m 29s   remaining: 2m 42s
670:    learn: 0.0481475        test: 0.3887606 best: 0.3451640 (189)   total:
5m 30s   remaining: 2m 41s
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671:    learn: 0.0480657        test: 0.3888404 best: 0.3451640 (189)   total:
5m 30s   remaining: 2m 41s
672:    learn: 0.0479601        test: 0.3889495 best: 0.3451640 (189)   total:
5m 31s   remaining: 2m 40s
673:    learn: 0.0478452        test: 0.3889576 best: 0.3451640 (189)   total:
5m 31s   remaining: 2m 40s
674:    learn: 0.0477361        test: 0.3890195 best: 0.3451640 (189)   total:
5m 32s   remaining: 2m 40s
675:    learn: 0.0476109        test: 0.3889692 best: 0.3451640 (189)   total:
5m 32s   remaining: 2m 39s
676:    learn: 0.0474990        test: 0.3891825 best: 0.3451640 (189)   total:
5m 33s   remaining: 2m 38s
677:    learn: 0.0473988        test: 0.3894246 best: 0.3451640 (189)   total:
5m 33s   remaining: 2m 38s
678:    learn: 0.0473023        test: 0.3894808 best: 0.3451640 (189)   total:
5m 34s   remaining: 2m 37s
679:    learn: 0.0471953        test: 0.3895932 best: 0.3451640 (189)   total:
5m 34s   remaining: 2m 37s
680:    learn: 0.0470935        test: 0.3897643 best: 0.3451640 (189)   total:
5m 35s   remaining: 2m 36s
681:    learn: 0.0470022        test: 0.3897449 best: 0.3451640 (189)   total:
5m 35s   remaining: 2m 36s
682:    learn: 0.0469089        test: 0.3899628 best: 0.3451640 (189)   total:
5m 36s   remaining: 2m 35s
683:    learn: 0.0468151        test: 0.3901862 best: 0.3451640 (189)   total:
5m 36s   remaining: 2m 35s
684:    learn: 0.0467159        test: 0.3902260 best: 0.3451640 (189)   total:
5m 37s   remaining: 2m 35s
685:    learn: 0.0466024        test: 0.3902802 best: 0.3451640 (189)   total:
5m 37s   remaining: 2m 34s
686:    learn: 0.0465103        test: 0.3904601 best: 0.3451640 (189)   total:
5m 38s   remaining: 2m 34s
687:    learn: 0.0464386        test: 0.3905730 best: 0.3451640 (189)   total:
5m 38s   remaining: 2m 33s
688:    learn: 0.0463655        test: 0.3906168 best: 0.3451640 (189)   total:
5m 39s   remaining: 2m 33s
689:    learn: 0.0462303        test: 0.3906256 best: 0.3451640 (189)   total:
5m 39s   remaining: 2m 32s
690:    learn: 0.0461237        test: 0.3907751 best: 0.3451640 (189)   total:
5m 40s   remaining: 2m 32s
691:    learn: 0.0460222        test: 0.3909120 best: 0.3451640 (189)   total:
5m 40s   remaining: 2m 31s
692:    learn: 0.0459290        test: 0.3910423 best: 0.3451640 (189)   total:
5m 41s   remaining: 2m 31s
693:    learn: 0.0458325        test: 0.3911457 best: 0.3451640 (189)   total:
5m 41s   remaining: 2m 30s
694:    learn: 0.0457429        test: 0.3912436 best: 0.3451640 (189)   total:
5m 42s   remaining: 2m 30s
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695:    learn: 0.0456496        test: 0.3913054 best: 0.3451640 (189)   total:
5m 42s   remaining: 2m 29s
696:    learn: 0.0455611        test: 0.3914049 best: 0.3451640 (189)   total:
5m 43s   remaining: 2m 29s
697:    learn: 0.0454980        test: 0.3915085 best: 0.3451640 (189)   total:
5m 43s   remaining: 2m 28s
698:    learn: 0.0453640        test: 0.3915551 best: 0.3451640 (189)   total:
5m 44s   remaining: 2m 28s
699:    learn: 0.0452639        test: 0.3916453 best: 0.3451640 (189)   total:
5m 44s   remaining: 2m 27s
700:    learn: 0.0451648        test: 0.3917139 best: 0.3451640 (189)   total:
5m 45s   remaining: 2m 27s
701:    learn: 0.0450568        test: 0.3917761 best: 0.3451640 (189)   total:
5m 45s   remaining: 2m 26s
702:    learn: 0.0449606        test: 0.3919517 best: 0.3451640 (189)   total:
5m 46s   remaining: 2m 26s
703:    learn: 0.0448673        test: 0.3920845 best: 0.3451640 (189)   total:
5m 46s   remaining: 2m 25s
704:    learn: 0.0447651        test: 0.3921151 best: 0.3451640 (189)   total:
5m 47s   remaining: 2m 25s
705:    learn: 0.0446762        test: 0.3922961 best: 0.3451640 (189)   total:
5m 47s   remaining: 2m 24s
706:    learn: 0.0445758        test: 0.3924641 best: 0.3451640 (189)   total:
5m 48s   remaining: 2m 24s
707:    learn: 0.0444910        test: 0.3926280 best: 0.3451640 (189)   total:
5m 48s   remaining: 2m 23s
708:    learn: 0.0444030        test: 0.3926877 best: 0.3451640 (189)   total:
5m 49s   remaining: 2m 23s
709:    learn: 0.0442744        test: 0.3927673 best: 0.3451640 (189)   total:
5m 49s   remaining: 2m 22s
710:    learn: 0.0441779        test: 0.3928933 best: 0.3451640 (189)   total:
5m 50s   remaining: 2m 22s
711:    learn: 0.0440854        test: 0.3929018 best: 0.3451640 (189)   total:
5m 50s   remaining: 2m 21s
712:    learn: 0.0439894        test: 0.3929788 best: 0.3451640 (189)   total:
5m 51s   remaining: 2m 21s
713:    learn: 0.0438804        test: 0.3931450 best: 0.3451640 (189)   total:
5m 51s   remaining: 2m 20s
714:    learn: 0.0438234        test: 0.3931954 best: 0.3451640 (189)   total:
5m 52s   remaining: 2m 20s
715:    learn: 0.0437397        test: 0.3932789 best: 0.3451640 (189)   total:
5m 52s   remaining: 2m 20s
716:    learn: 0.0436632        test: 0.3934237 best: 0.3451640 (189)   total:
5m 53s   remaining: 2m 19s
717:    learn: 0.0435845        test: 0.3936694 best: 0.3451640 (189)   total:
5m 53s   remaining: 2m 19s
718:    learn: 0.0434896        test: 0.3937892 best: 0.3451640 (189)   total:
5m 54s   remaining: 2m 18s
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719:    learn: 0.0433759        test: 0.3938422 best: 0.3451640 (189)   total:
5m 55s   remaining: 2m 18s
720:    learn: 0.0432808        test: 0.3940015 best: 0.3451640 (189)   total:
5m 55s   remaining: 2m 17s
721:    learn: 0.0431825        test: 0.3940908 best: 0.3451640 (189)   total:
5m 55s   remaining: 2m 17s
722:    learn: 0.0430898        test: 0.3939127 best: 0.3451640 (189)   total:
5m 56s   remaining: 2m 16s
723:    learn: 0.0430006        test: 0.3939828 best: 0.3451640 (189)   total:
5m 57s   remaining: 2m 16s
724:    learn: 0.0428945        test: 0.3941754 best: 0.3451640 (189)   total:
5m 57s   remaining: 2m 15s
725:    learn: 0.0428277        test: 0.3942051 best: 0.3451640 (189)   total:
5m 58s   remaining: 2m 15s
726:    learn: 0.0427308        test: 0.3944564 best: 0.3451640 (189)   total:
5m 58s   remaining: 2m 14s
727:    learn: 0.0426454        test: 0.3947379 best: 0.3451640 (189)   total:
5m 59s   remaining: 2m 14s
728:    learn: 0.0425664        test: 0.3949350 best: 0.3451640 (189)   total:
5m 59s   remaining: 2m 13s
729:    learn: 0.0424839        test: 0.3949333 best: 0.3451640 (189)   total:
6m       remaining: 2m 13s
730:    learn: 0.0424169        test: 0.3950219 best: 0.3451640 (189)   total:
6m       remaining: 2m 12s
731:    learn: 0.0423445        test: 0.3951779 best: 0.3451640 (189)   total:
6m       remaining: 2m 12s
732:    learn: 0.0422746        test: 0.3951970 best: 0.3451640 (189)   total:
6m 1s    remaining: 2m 11s
733:    learn: 0.0421552        test: 0.3953290 best: 0.3451640 (189)   total:
6m 2s    remaining: 2m 11s
734:    learn: 0.0420834        test: 0.3953688 best: 0.3451640 (189)   total:
6m 2s    remaining: 2m 10s
735:    learn: 0.0420181        test: 0.3953945 best: 0.3451640 (189)   total:
6m 3s    remaining: 2m 10s
736:    learn: 0.0419239        test: 0.3954663 best: 0.3451640 (189)   total:
6m 3s    remaining: 2m 9s
737:    learn: 0.0418387        test: 0.3956223 best: 0.3451640 (189)   total:
6m 4s    remaining: 2m 9s
738:    learn: 0.0417661        test: 0.3956830 best: 0.3451640 (189)   total:
6m 4s    remaining: 2m 8s
739:    learn: 0.0417010        test: 0.3958023 best: 0.3451640 (189)   total:
6m 5s    remaining: 2m 8s
740:    learn: 0.0416198        test: 0.3958400 best: 0.3451640 (189)   total:
6m 5s    remaining: 2m 7s
741:    learn: 0.0415384        test: 0.3959950 best: 0.3451640 (189)   total:
6m 5s    remaining: 2m 7s
742:    learn: 0.0414433        test: 0.3962271 best: 0.3451640 (189)   total:
6m 6s    remaining: 2m 6s
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743:    learn: 0.0413711        test: 0.3963510 best: 0.3451640 (189)   total:
6m 7s    remaining: 2m 6s
744:    learn: 0.0412941        test: 0.3964147 best: 0.3451640 (189)   total:
6m 7s    remaining: 2m 5s
745:    learn: 0.0412241        test: 0.3966009 best: 0.3451640 (189)   total:
6m 8s    remaining: 2m 5s
746:    learn: 0.0411374        test: 0.3966202 best: 0.3451640 (189)   total:
6m 8s    remaining: 2m 4s
747:    learn: 0.0410159        test: 0.3967196 best: 0.3451640 (189)   total:
6m 9s    remaining: 2m 4s
748:    learn: 0.0409431        test: 0.3967685 best: 0.3451640 (189)   total:
6m 9s    remaining: 2m 3s
749:    learn: 0.0408563        test: 0.3966981 best: 0.3451640 (189)   total:
6m 10s   remaining: 2m 3s
750:    learn: 0.0407656        test: 0.3968440 best: 0.3451640 (189)   total:
6m 10s   remaining: 2m 2s
751:    learn: 0.0407060        test: 0.3970219 best: 0.3451640 (189)   total:
6m 10s   remaining: 2m 2s
752:    learn: 0.0406579        test: 0.3971485 best: 0.3451640 (189)   total:
6m 11s   remaining: 2m 1s
753:    learn: 0.0405638        test: 0.3974788 best: 0.3451640 (189)   total:
6m 11s   remaining: 2m 1s
754:    learn: 0.0404854        test: 0.3976248 best: 0.3451640 (189)   total:
6m 12s   remaining: 2m
755:    learn: 0.0404013        test: 0.3978987 best: 0.3451640 (189)   total:
6m 12s   remaining: 2m
756:    learn: 0.0403395        test: 0.3979817 best: 0.3451640 (189)   total:
6m 13s   remaining: 1m 59s
757:    learn: 0.0402632        test: 0.3981109 best: 0.3451640 (189)   total:
6m 14s   remaining: 1m 59s
758:    learn: 0.0401876        test: 0.3982371 best: 0.3451640 (189)   total:
6m 14s   remaining: 1m 58s
759:    learn: 0.0401120        test: 0.3984003 best: 0.3451640 (189)   total:
6m 15s   remaining: 1m 58s
760:    learn: 0.0400503        test: 0.3983910 best: 0.3451640 (189)   total:
6m 15s   remaining: 1m 57s
761:    learn: 0.0399889        test: 0.3984045 best: 0.3451640 (189)   total:
6m 15s   remaining: 1m 57s
762:    learn: 0.0399246        test: 0.3985117 best: 0.3451640 (189)   total:
6m 16s   remaining: 1m 56s
763:    learn: 0.0398436        test: 0.3987259 best: 0.3451640 (189)   total:
6m 16s   remaining: 1m 56s
764:    learn: 0.0397685        test: 0.3990122 best: 0.3451640 (189)   total:
6m 17s   remaining: 1m 55s
765:    learn: 0.0396929        test: 0.3990674 best: 0.3451640 (189)   total:
6m 18s   remaining: 1m 55s
766:    learn: 0.0396233        test: 0.3991158 best: 0.3451640 (189)   total:
6m 18s   remaining: 1m 54s
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767:    learn: 0.0395518        test: 0.3992528 best: 0.3451640 (189)   total:
6m 19s   remaining: 1m 54s
768:    learn: 0.0394729        test: 0.3995181 best: 0.3451640 (189)   total:
6m 20s   remaining: 1m 54s
769:    learn: 0.0394076        test: 0.3997477 best: 0.3451640 (189)   total:
6m 20s   remaining: 1m 53s
770:    learn: 0.0393383        test: 0.3999514 best: 0.3451640 (189)   total:
6m 21s   remaining: 1m 53s
771:    learn: 0.0392816        test: 0.3999225 best: 0.3451640 (189)   total:
6m 21s   remaining: 1m 52s
772:    learn: 0.0392038        test: 0.3999032 best: 0.3451640 (189)   total:
6m 22s   remaining: 1m 52s
773:    learn: 0.0391230        test: 0.4000719 best: 0.3451640 (189)   total:
6m 22s   remaining: 1m 51s
774:    learn: 0.0390665        test: 0.4001213 best: 0.3451640 (189)   total:
6m 23s   remaining: 1m 51s
775:    learn: 0.0389966        test: 0.4001583 best: 0.3451640 (189)   total:
6m 23s   remaining: 1m 50s
776:    learn: 0.0389167        test: 0.4003445 best: 0.3451640 (189)   total:
6m 24s   remaining: 1m 50s
777:    learn: 0.0388296        test: 0.4003778 best: 0.3451640 (189)   total:
6m 24s   remaining: 1m 49s
778:    learn: 0.0387513        test: 0.4003947 best: 0.3451640 (189)   total:
6m 25s   remaining: 1m 49s
779:    learn: 0.0386923        test: 0.4003786 best: 0.3451640 (189)   total:
6m 25s   remaining: 1m 48s
780:    learn: 0.0386271        test: 0.4003792 best: 0.3451640 (189)   total:
6m 26s   remaining: 1m 48s
781:    learn: 0.0385405        test: 0.4004516 best: 0.3451640 (189)   total:
6m 26s   remaining: 1m 47s
782:    learn: 0.0384614        test: 0.4004928 best: 0.3451640 (189)   total:
6m 27s   remaining: 1m 47s
783:    learn: 0.0383837        test: 0.4005952 best: 0.3451640 (189)   total:
6m 28s   remaining: 1m 46s
784:    learn: 0.0383098        test: 0.4006966 best: 0.3451640 (189)   total:
6m 28s   remaining: 1m 46s
785:    learn: 0.0382472        test: 0.4007489 best: 0.3451640 (189)   total:
6m 28s   remaining: 1m 45s
786:    learn: 0.0381500        test: 0.4009125 best: 0.3451640 (189)   total:
6m 29s   remaining: 1m 45s
787:    learn: 0.0380606        test: 0.4010110 best: 0.3451640 (189)   total:
6m 29s   remaining: 1m 44s
788:    learn: 0.0379861        test: 0.4010494 best: 0.3451640 (189)   total:
6m 30s   remaining: 1m 44s
789:    learn: 0.0379076        test: 0.4011017 best: 0.3451640 (189)   total:
6m 31s   remaining: 1m 43s
790:    learn: 0.0378500        test: 0.4011990 best: 0.3451640 (189)   total:
6m 31s   remaining: 1m 43s
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791:    learn: 0.0377779        test: 0.4013574 best: 0.3451640 (189)   total:
6m 32s   remaining: 1m 42s
792:    learn: 0.0377093        test: 0.4014126 best: 0.3451640 (189)   total:
6m 32s   remaining: 1m 42s
793:    learn: 0.0376378        test: 0.4015264 best: 0.3451640 (189)   total:
6m 33s   remaining: 1m 42s
794:    learn: 0.0375564        test: 0.4015161 best: 0.3451640 (189)   total:
6m 33s   remaining: 1m 41s
795:    learn: 0.0374970        test: 0.4017531 best: 0.3451640 (189)   total:
6m 33s   remaining: 1m 40s
796:    learn: 0.0374165        test: 0.4018421 best: 0.3451640 (189)   total:
6m 34s   remaining: 1m 40s
797:    learn: 0.0373673        test: 0.4019671 best: 0.3451640 (189)   total:
6m 34s   remaining: 1m 39s
798:    learn: 0.0372919        test: 0.4021029 best: 0.3451640 (189)   total:
6m 35s   remaining: 1m 39s
799:    learn: 0.0372107        test: 0.4023349 best: 0.3451640 (189)   total:
6m 36s   remaining: 1m 39s
800:    learn: 0.0371540        test: 0.4024159 best: 0.3451640 (189)   total:
6m 36s   remaining: 1m 38s
801:    learn: 0.0371011        test: 0.4025129 best: 0.3451640 (189)   total:
6m 37s   remaining: 1m 38s
802:    learn: 0.0370293        test: 0.4025880 best: 0.3451640 (189)   total:
6m 37s   remaining: 1m 37s
803:    learn: 0.0369609        test: 0.4026751 best: 0.3451640 (189)   total:
6m 38s   remaining: 1m 37s
804:    learn: 0.0368860        test: 0.4027858 best: 0.3451640 (189)   total:
6m 38s   remaining: 1m 36s
805:    learn: 0.0368175        test: 0.4028945 best: 0.3451640 (189)   total:
6m 39s   remaining: 1m 36s
806:    learn: 0.0367484        test: 0.4032164 best: 0.3451640 (189)   total:
6m 39s   remaining: 1m 35s
807:    learn: 0.0366878        test: 0.4033011 best: 0.3451640 (189)   total:
6m 40s   remaining: 1m 35s
808:    learn: 0.0366342        test: 0.4033519 best: 0.3451640 (189)   total:
6m 40s   remaining: 1m 34s
809:    learn: 0.0365632        test: 0.4033967 best: 0.3451640 (189)   total:
6m 41s   remaining: 1m 34s
810:    learn: 0.0365043        test: 0.4033388 best: 0.3451640 (189)   total:
6m 41s   remaining: 1m 33s
811:    learn: 0.0364546        test: 0.4034155 best: 0.3451640 (189)   total:
6m 42s   remaining: 1m 33s
812:    learn: 0.0363902        test: 0.4035048 best: 0.3451640 (189)   total:
6m 42s   remaining: 1m 32s
813:    learn: 0.0363376        test: 0.4036378 best: 0.3451640 (189)   total:
6m 43s   remaining: 1m 32s
814:    learn: 0.0362578        test: 0.4038286 best: 0.3451640 (189)   total:
6m 43s   remaining: 1m 31s
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815:    learn: 0.0361701        test: 0.4039506 best: 0.3451640 (189)   total:
6m 44s   remaining: 1m 31s
816:    learn: 0.0360976        test: 0.4040041 best: 0.3451640 (189)   total:
6m 44s   remaining: 1m 30s
817:    learn: 0.0360257        test: 0.4041532 best: 0.3451640 (189)   total:
6m 45s   remaining: 1m 30s
818:    learn: 0.0359653        test: 0.4043244 best: 0.3451640 (189)   total:
6m 45s   remaining: 1m 29s
819:    learn: 0.0359068        test: 0.4045924 best: 0.3451640 (189)   total:
6m 46s   remaining: 1m 29s
820:    learn: 0.0358390        test: 0.4047518 best: 0.3451640 (189)   total:
6m 46s   remaining: 1m 28s
821:    learn: 0.0357701        test: 0.4048067 best: 0.3451640 (189)   total:
6m 47s   remaining: 1m 28s
822:    learn: 0.0357133        test: 0.4049140 best: 0.3451640 (189)   total:
6m 47s   remaining: 1m 27s
823:    learn: 0.0356499        test: 0.4050668 best: 0.3451640 (189)   total:
6m 48s   remaining: 1m 27s
824:    learn: 0.0355909        test: 0.4051546 best: 0.3451640 (189)   total:
6m 48s   remaining: 1m 26s
825:    learn: 0.0355364        test: 0.4051167 best: 0.3451640 (189)   total:
6m 49s   remaining: 1m 26s
826:    learn: 0.0354702        test: 0.4052062 best: 0.3451640 (189)   total:
6m 50s   remaining: 1m 25s
827:    learn: 0.0354203        test: 0.4053361 best: 0.3451640 (189)   total:
6m 50s   remaining: 1m 25s
828:    learn: 0.0353567        test: 0.4054040 best: 0.3451640 (189)   total:
6m 51s   remaining: 1m 24s
829:    learn: 0.0353034        test: 0.4054435 best: 0.3451640 (189)   total:
6m 51s   remaining: 1m 24s
830:    learn: 0.0352391        test: 0.4055987 best: 0.3451640 (189)   total:
6m 52s   remaining: 1m 23s
831:    learn: 0.0351646        test: 0.4056158 best: 0.3451640 (189)   total:
6m 52s   remaining: 1m 23s
832:    learn: 0.0351018        test: 0.4056813 best: 0.3451640 (189)   total:
6m 53s   remaining: 1m 22s
833:    learn: 0.0350494        test: 0.4056370 best: 0.3451640 (189)   total:
6m 53s   remaining: 1m 22s
834:    learn: 0.0349892        test: 0.4058187 best: 0.3451640 (189)   total:
6m 54s   remaining: 1m 21s
835:    learn: 0.0349182        test: 0.4060603 best: 0.3451640 (189)   total:
6m 54s   remaining: 1m 21s
836:    learn: 0.0348550        test: 0.4061379 best: 0.3451640 (189)   total:
6m 55s   remaining: 1m 20s
837:    learn: 0.0347847        test: 0.4062740 best: 0.3451640 (189)   total:
6m 55s   remaining: 1m 20s
838:    learn: 0.0347271        test: 0.4063463 best: 0.3451640 (189)   total:
6m 56s   remaining: 1m 19s
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839:    learn: 0.0346813        test: 0.4064409 best: 0.3451640 (189)   total:
6m 56s   remaining: 1m 19s
840:    learn: 0.0346245        test: 0.4066462 best: 0.3451640 (189)   total:
6m 57s   remaining: 1m 18s
841:    learn: 0.0345778        test: 0.4069218 best: 0.3451640 (189)   total:
6m 57s   remaining: 1m 18s
842:    learn: 0.0345218        test: 0.4070240 best: 0.3451640 (189)   total:
6m 58s   remaining: 1m 17s
843:    learn: 0.0344513        test: 0.4072803 best: 0.3451640 (189)   total:
6m 58s   remaining: 1m 17s
844:    learn: 0.0343867        test: 0.4072939 best: 0.3451640 (189)   total:
6m 59s   remaining: 1m 16s
845:    learn: 0.0343221        test: 0.4074373 best: 0.3451640 (189)   total:
6m 59s   remaining: 1m 16s
846:    learn: 0.0342609        test: 0.4075622 best: 0.3451640 (189)   total:
7m       remaining: 1m 15s
847:    learn: 0.0341994        test: 0.4076417 best: 0.3451640 (189)   total:
7m       remaining: 1m 15s
848:    learn: 0.0341248        test: 0.4078339 best: 0.3451640 (189)   total:
7m       remaining: 1m 14s
849:    learn: 0.0340610        test: 0.4078604 best: 0.3451640 (189)   total:
7m 1s    remaining: 1m 14s
850:    learn: 0.0340080        test: 0.4080173 best: 0.3451640 (189)   total:
7m 2s    remaining: 1m 13s
851:    learn: 0.0339619        test: 0.4081397 best: 0.3451640 (189)   total:
7m 2s    remaining: 1m 13s
852:    learn: 0.0339028        test: 0.4083932 best: 0.3451640 (189)   total:
7m 3s    remaining: 1m 12s
853:    learn: 0.0338360        test: 0.4085133 best: 0.3451640 (189)   total:
7m 3s    remaining: 1m 12s
854:    learn: 0.0337734        test: 0.4085666 best: 0.3451640 (189)   total:
7m 4s    remaining: 1m 11s
855:    learn: 0.0337055        test: 0.4087585 best: 0.3451640 (189)   total:
7m 4s    remaining: 1m 11s
856:    learn: 0.0336409        test: 0.4088683 best: 0.3451640 (189)   total:
7m 5s    remaining: 1m 10s
857:    learn: 0.0335764        test: 0.4089254 best: 0.3451640 (189)   total:
7m 5s    remaining: 1m 10s
858:    learn: 0.0335212        test: 0.4089642 best: 0.3451640 (189)   total:
7m 6s    remaining: 1m 9s
859:    learn: 0.0334582        test: 0.4092064 best: 0.3451640 (189)   total:
7m 6s    remaining: 1m 9s
860:    learn: 0.0333893        test: 0.4093991 best: 0.3451640 (189)   total:
7m 7s    remaining: 1m 8s
861:    learn: 0.0333284        test: 0.4096315 best: 0.3451640 (189)   total:
7m 8s    remaining: 1m 8s
862:    learn: 0.0332683        test: 0.4096653 best: 0.3451640 (189)   total:
7m 8s    remaining: 1m 8s
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863:    learn: 0.0331839        test: 0.4098346 best: 0.3451640 (189)   total:
7m 9s    remaining: 1m 7s
864:    learn: 0.0331302        test: 0.4098874 best: 0.3451640 (189)   total:
7m 9s    remaining: 1m 7s
865:    learn: 0.0330853        test: 0.4099594 best: 0.3451640 (189)   total:
7m 10s   remaining: 1m 6s
866:    learn: 0.0330234        test: 0.4099611 best: 0.3451640 (189)   total:
7m 10s   remaining: 1m 6s
867:    learn: 0.0329620        test: 0.4100874 best: 0.3451640 (189)   total:
7m 11s   remaining: 1m 5s
868:    learn: 0.0329118        test: 0.4103171 best: 0.3451640 (189)   total:
7m 12s   remaining: 1m 5s
869:    learn: 0.0328441        test: 0.4104003 best: 0.3451640 (189)   total:
7m 12s   remaining: 1m 4s
870:    learn: 0.0327921        test: 0.4105621 best: 0.3451640 (189)   total:
7m 13s   remaining: 1m 4s
871:    learn: 0.0327319        test: 0.4107619 best: 0.3451640 (189)   total:
7m 13s   remaining: 1m 3s
872:    learn: 0.0326898        test: 0.4108304 best: 0.3451640 (189)   total:
7m 14s   remaining: 1m 3s
873:    learn: 0.0326455        test: 0.4109522 best: 0.3451640 (189)   total:
7m 14s   remaining: 1m 2s
874:    learn: 0.0325925        test: 0.4110825 best: 0.3451640 (189)   total:
7m 15s   remaining: 1m 2s
875:    learn: 0.0325525        test: 0.4111150 best: 0.3451640 (189)   total:
7m 15s   remaining: 1m 1s
876:    learn: 0.0324995        test: 0.4111375 best: 0.3451640 (189)   total:
7m 16s   remaining: 1m 1s
877:    learn: 0.0324488        test: 0.4112433 best: 0.3451640 (189)   total:
7m 17s   remaining: 1m
878:    learn: 0.0323930        test: 0.4113714 best: 0.3451640 (189)   total:
7m 17s   remaining: 1m
879:    learn: 0.0323476        test: 0.4114955 best: 0.3451640 (189)   total:
7m 18s   remaining: 59.7s
880:    learn: 0.0322940        test: 0.4114751 best: 0.3451640 (189)   total:
7m 18s   remaining: 59.3s
881:    learn: 0.0322467        test: 0.4115665 best: 0.3451640 (189)   total:
7m 19s   remaining: 58.7s
882:    learn: 0.0322099        test: 0.4115866 best: 0.3451640 (189)   total:
7m 19s   remaining: 58.3s
883:    learn: 0.0321456        test: 0.4116897 best: 0.3451640 (189)   total:
7m 20s   remaining: 57.8s
884:    learn: 0.0320835        test: 0.4117388 best: 0.3451640 (189)   total:
7m 20s   remaining: 57.3s
885:    learn: 0.0320273        test: 0.4119303 best: 0.3451640 (189)   total:
7m 21s   remaining: 56.8s
886:    learn: 0.0319770        test: 0.4119758 best: 0.3451640 (189)   total:
7m 21s   remaining: 56.3s
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887:    learn: 0.0319278        test: 0.4119905 best: 0.3451640 (189)   total:
7m 22s   remaining: 55.8s
888:    learn: 0.0318767        test: 0.4120923 best: 0.3451640 (189)   total:
7m 22s   remaining: 55.3s
889:    learn: 0.0318129        test: 0.4123798 best: 0.3451640 (189)   total:
7m 23s   remaining: 54.8s
890:    learn: 0.0317625        test: 0.4124190 best: 0.3451640 (189)   total:
7m 24s   remaining: 54.3s
891:    learn: 0.0317049        test: 0.4124804 best: 0.3451640 (189)   total:
7m 24s   remaining: 53.8s
892:    learn: 0.0316516        test: 0.4125611 best: 0.3451640 (189)   total:
7m 25s   remaining: 53.3s
893:    learn: 0.0316011        test: 0.4127485 best: 0.3451640 (189)   total:
7m 25s   remaining: 52.8s
894:    learn: 0.0315483        test: 0.4127112 best: 0.3451640 (189)   total:
7m 25s   remaining: 52.3s
895:    learn: 0.0314975        test: 0.4128173 best: 0.3451640 (189)   total:
7m 26s   remaining: 51.8s
896:    learn: 0.0314383        test: 0.4128619 best: 0.3451640 (189)   total:
7m 26s   remaining: 51.3s
897:    learn: 0.0313795        test: 0.4129812 best: 0.3451640 (189)   total:
7m 27s   remaining: 50.8s
898:    learn: 0.0313298        test: 0.4131182 best: 0.3451640 (189)   total:
7m 28s   remaining: 50.3s
899:    learn: 0.0312795        test: 0.4132726 best: 0.3451640 (189)   total:
7m 28s   remaining: 49.8s
900:    learn: 0.0312223        test: 0.4133325 best: 0.3451640 (189)   total:
7m 29s   remaining: 49.4s
901:    learn: 0.0311521        test: 0.4133515 best: 0.3451640 (189)   total:
7m 29s   remaining: 48.8s
902:    learn: 0.0311036        test: 0.4134698 best: 0.3451640 (189)   total:
7m 30s   remaining: 48.4s
903:    learn: 0.0310618        test: 0.4135671 best: 0.3451640 (189)   total:
7m 30s   remaining: 47.9s
904:    learn: 0.0310122        test: 0.4137684 best: 0.3451640 (189)   total:
7m 31s   remaining: 47.4s
905:    learn: 0.0309385        test: 0.4139746 best: 0.3451640 (189)   total:
7m 31s   remaining: 46.9s
906:    learn: 0.0308765        test: 0.4142275 best: 0.3451640 (189)   total:
7m 32s   remaining: 46.4s
907:    learn: 0.0308292        test: 0.4144511 best: 0.3451640 (189)   total:
7m 32s   remaining: 45.9s
908:    learn: 0.0307732        test: 0.4145059 best: 0.3451640 (189)   total:
7m 33s   remaining: 45.4s
909:    learn: 0.0307183        test: 0.4146972 best: 0.3451640 (189)   total:
7m 33s   remaining: 44.9s
910:    learn: 0.0306732        test: 0.4147515 best: 0.3451640 (189)   total:
7m 34s   remaining: 44.4s
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911:    learn: 0.0306165        test: 0.4147904 best: 0.3451640 (189)   total:
7m 34s   remaining: 43.9s
912:    learn: 0.0305636        test: 0.4147931 best: 0.3451640 (189)   total:
7m 35s   remaining: 43.4s
913:    learn: 0.0305181        test: 0.4149961 best: 0.3451640 (189)   total:
7m 35s   remaining: 42.9s
914:    learn: 0.0304765        test: 0.4150248 best: 0.3451640 (189)   total:
7m 36s   remaining: 42.4s
915:    learn: 0.0304195        test: 0.4151037 best: 0.3451640 (189)   total:
7m 36s   remaining: 41.9s
916:    learn: 0.0303764        test: 0.4151862 best: 0.3451640 (189)   total:
7m 37s   remaining: 41.4s
917:    learn: 0.0303287        test: 0.4152791 best: 0.3451640 (189)   total:
7m 37s   remaining: 40.9s
918:    learn: 0.0302766        test: 0.4153629 best: 0.3451640 (189)   total:
7m 38s   remaining: 40.4s
919:    learn: 0.0302333        test: 0.4154801 best: 0.3451640 (189)   total:
7m 38s   remaining: 39.9s
920:    learn: 0.0301692        test: 0.4155849 best: 0.3451640 (189)   total:
7m 39s   remaining: 39.4s
921:    learn: 0.0301145        test: 0.4157221 best: 0.3451640 (189)   total:
7m 39s   remaining: 38.9s
922:    learn: 0.0300572        test: 0.4158054 best: 0.3451640 (189)   total:
7m 40s   remaining: 38.4s
923:    learn: 0.0300117        test: 0.4158576 best: 0.3451640 (189)   total:
7m 41s   remaining: 37.9s
924:    learn: 0.0299583        test: 0.4160330 best: 0.3451640 (189)   total:
7m 41s   remaining: 37.4s
925:    learn: 0.0298988        test: 0.4162223 best: 0.3451640 (189)   total:
7m 42s   remaining: 36.9s
926:    learn: 0.0298435        test: 0.4163236 best: 0.3451640 (189)   total:
7m 42s   remaining: 36.4s
927:    learn: 0.0298070        test: 0.4164546 best: 0.3451640 (189)   total:
7m 43s   remaining: 35.9s
928:    learn: 0.0297553        test: 0.4166349 best: 0.3451640 (189)   total:
7m 43s   remaining: 35.4s
929:    learn: 0.0297038        test: 0.4167035 best: 0.3451640 (189)   total:
7m 44s   remaining: 34.9s
930:    learn: 0.0296542        test: 0.4167817 best: 0.3451640 (189)   total:
7m 44s   remaining: 34.4s
931:    learn: 0.0296089        test: 0.4169239 best: 0.3451640 (189)   total:
7m 45s   remaining: 33.9s
932:    learn: 0.0295610        test: 0.4171531 best: 0.3451640 (189)   total:
7m 45s   remaining: 33.4s
933:    learn: 0.0295162        test: 0.4173175 best: 0.3451640 (189)   total:
7m 46s   remaining: 32.9s
934:    learn: 0.0294541        test: 0.4173574 best: 0.3451640 (189)   total:
7m 46s   remaining: 32.4s
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935:    learn: 0.0294072        test: 0.4175628 best: 0.3451640 (189)   total:
7m 47s   remaining: 31.9s
936:    learn: 0.0293668        test: 0.4177227 best: 0.3451640 (189)   total:
7m 47s   remaining: 31.4s
937:    learn: 0.0293147        test: 0.4177891 best: 0.3451640 (189)   total:
7m 48s   remaining: 30.9s
938:    learn: 0.0292697        test: 0.4180067 best: 0.3451640 (189)   total:
7m 48s   remaining: 30.5s
939:    learn: 0.0292278        test: 0.4180555 best: 0.3451640 (189)   total:
7m 49s   remaining: 30s
940:    learn: 0.0291790        test: 0.4181816 best: 0.3451640 (189)   total:
7m 49s   remaining: 29.4s
941:    learn: 0.0291376        test: 0.4181713 best: 0.3451640 (189)   total:
7m 50s   remaining: 29s
942:    learn: 0.0290954        test: 0.4184033 best: 0.3451640 (189)   total:
7m 50s   remaining: 28.5s
943:    learn: 0.0290390        test: 0.4185721 best: 0.3451640 (189)   total:
7m 51s   remaining: 28s
944:    learn: 0.0289877        test: 0.4186258 best: 0.3451640 (189)   total:
7m 51s   remaining: 27.5s
945:    learn: 0.0289293        test: 0.4187227 best: 0.3451640 (189)   total:
7m 52s   remaining: 27s
946:    learn: 0.0288775        test: 0.4188043 best: 0.3451640 (189)   total:
7m 53s   remaining: 26.5s
947:    learn: 0.0288447        test: 0.4188496 best: 0.3451640 (189)   total:
7m 53s   remaining: 26s
948:    learn: 0.0287908        test: 0.4190175 best: 0.3451640 (189)   total:
7m 54s   remaining: 25.5s
949:    learn: 0.0287546        test: 0.4190719 best: 0.3451640 (189)   total:
7m 54s   remaining: 25s
950:    learn: 0.0286966        test: 0.4192439 best: 0.3451640 (189)   total:
7m 55s   remaining: 24.5s
951:    learn: 0.0286560        test: 0.4193326 best: 0.3451640 (189)   total:
7m 55s   remaining: 24s
952:    learn: 0.0286149        test: 0.4193533 best: 0.3451640 (189)   total:
7m 56s   remaining: 23.5s
953:    learn: 0.0285610        test: 0.4193708 best: 0.3451640 (189)   total:
7m 56s   remaining: 23s
954:    learn: 0.0285176        test: 0.4194417 best: 0.3451640 (189)   total:
7m 57s   remaining: 22.5s
955:    learn: 0.0284789        test: 0.4195126 best: 0.3451640 (189)   total:
7m 57s   remaining: 22s
956:    learn: 0.0284367        test: 0.4196815 best: 0.3451640 (189)   total:
7m 58s   remaining: 21.5s
957:    learn: 0.0283946        test: 0.4196517 best: 0.3451640 (189)   total:
7m 58s   remaining: 21s
958:    learn: 0.0283507        test: 0.4196259 best: 0.3451640 (189)   total:
7m 59s   remaining: 20.5s
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959:    learn: 0.0283060        test: 0.4197298 best: 0.3451640 (189)   total:
7m 59s   remaining: 20s
960:    learn: 0.0282624        test: 0.4199571 best: 0.3451640 (189)   total:
8m       remaining: 19.5s
961:    learn: 0.0282305        test: 0.4200593 best: 0.3451640 (189)   total:
8m       remaining: 19s
962:    learn: 0.0281937        test: 0.4202161 best: 0.3451640 (189)   total:
8m 1s    remaining: 18.5s
963:    learn: 0.0281505        test: 0.4203153 best: 0.3451640 (189)   total:
8m 1s    remaining: 18s
964:    learn: 0.0281100        test: 0.4204464 best: 0.3451640 (189)   total:
8m 2s    remaining: 17.5s
965:    learn: 0.0280709        test: 0.4205395 best: 0.3451640 (189)   total:
8m 2s    remaining: 17s
966:    learn: 0.0280236        test: 0.4206148 best: 0.3451640 (189)   total:
8m 3s    remaining: 16.5s
967:    learn: 0.0279775        test: 0.4206706 best: 0.3451640 (189)   total:
8m 3s    remaining: 16s
968:    learn: 0.0279375        test: 0.4208191 best: 0.3451640 (189)   total:
8m 4s    remaining: 15.5s
969:    learn: 0.0278906        test: 0.4208863 best: 0.3451640 (189)   total:
8m 5s    remaining: 15s
970:    learn: 0.0278449        test: 0.4210816 best: 0.3451640 (189)   total:
8m 5s    remaining: 14.5s
971:    learn: 0.0277935        test: 0.4212506 best: 0.3451640 (189)   total:
8m 6s    remaining: 14s
972:    learn: 0.0277535        test: 0.4213756 best: 0.3451640 (189)   total:
8m 7s    remaining: 13.5s
973:    learn: 0.0277022        test: 0.4214573 best: 0.3451640 (189)   total:
8m 7s    remaining: 13s
974:    learn: 0.0276586        test: 0.4215681 best: 0.3451640 (189)   total:
8m 8s    remaining: 12.5s
975:    learn: 0.0276249        test: 0.4216286 best: 0.3451640 (189)   total:
8m 8s    remaining: 12s
976:    learn: 0.0275862        test: 0.4216554 best: 0.3451640 (189)   total:
8m 9s    remaining: 11.5s
977:    learn: 0.0275269        test: 0.4218383 best: 0.3451640 (189)   total:
8m 9s    remaining: 11s
978:    learn: 0.0274765        test: 0.4218045 best: 0.3451640 (189)   total:
8m 10s   remaining: 10.5s
979:    learn: 0.0274353        test: 0.4219590 best: 0.3451640 (189)   total:
8m 10s   remaining: 10s
980:    learn: 0.0273908        test: 0.4218992 best: 0.3451640 (189)   total:
8m 11s   remaining: 9.51s
981:    learn: 0.0273545        test: 0.4218985 best: 0.3451640 (189)   total:
8m 11s   remaining: 9.01s
982:    learn: 0.0272996        test: 0.4220318 best: 0.3451640 (189)   total:
8m 12s   remaining: 8.51s
```

```
983:    learn: 0.0272641        test: 0.4221588 best: 0.3451640 (189)   total:
8m 12s   remaining: 8.01s
984:    learn: 0.0272259        test: 0.4222753 best: 0.3451640 (189)   total:
8m 13s   remaining: 7.51s
985:    learn: 0.0271849        test: 0.4223555 best: 0.3451640 (189)   total:
8m 13s   remaining: 7.01s
986:    learn: 0.0271308        test: 0.4224969 best: 0.3451640 (189)   total:
8m 14s   remaining: 6.51s
987:    learn: 0.0270930        test: 0.4225265 best: 0.3451640 (189)   total:
8m 14s   remaining: 6.01s
988:    learn: 0.0270574        test: 0.4225669 best: 0.3451640 (189)   total:
8m 15s   remaining: 5.51s
989:    learn: 0.0270161        test: 0.4226492 best: 0.3451640 (189)   total:
8m 15s   remaining: 5.01s
990:    learn: 0.0269810        test: 0.4227576 best: 0.3451640 (189)   total:
8m 16s   remaining: 4.51s
991:    learn: 0.0269395        test: 0.4228075 best: 0.3451640 (189)   total:
8m 16s   remaining: 4.01s
992:    learn: 0.0269058        test: 0.4228815 best: 0.3451640 (189)   total:
8m 17s   remaining: 3.51s
993:    learn: 0.0268638        test: 0.4230957 best: 0.3451640 (189)   total:
8m 18s   remaining: 3.01s
994:    learn: 0.0268283        test: 0.4231735 best: 0.3451640 (189)   total:
8m 18s   remaining: 2.5s
995:    learn: 0.0267771        test: 0.4232267 best: 0.3451640 (189)   total:
8m 19s   remaining: 2s
996:    learn: 0.0267233        test: 0.4233080 best: 0.3451640 (189)   total:
8m 19s   remaining: 1.5s
997:    learn: 0.0266916        test: 0.4234219 best: 0.3451640 (189)   total:
8m 20s   remaining: 1s
998:    learn: 0.0266528        test: 0.4236120 best: 0.3451640 (189)   total:
8m 20s   remaining: 501ms
999:    learn: 0.0266080        test: 0.4235866 best: 0.3451640 (189)   total:
8m 21s   remaining: 0us
```

2.3 Training Model Results

[93]:
```
models = pd.DataFrame({
    'Model': ['Logistic Regression','SVM','Linear SVC','KNN','Naive␣
 ↪Bayes','Perceptron',
              'Stochastic Gradient Decent','Decision Tree', 'Gradient Boosting␣
 ↪Trees','Random Forest',
              'CatBoost'],
    'Score': [
        acc_log,
        acc_svc,
        acc_linear_svc,
```

```
        acc_knn,
        acc_gaussian,
        acc_perceptron,
        acc_sgd,
        acc_dt,
        acc_gbt,
        acc_rf,
        acc_catboost
    ]})
models.sort_values(by='Score', ascending=False)
```

[93]:

	Model	Score
7	Decision Tree	100.00
9	Random Forest	100.00
10	CatBoost	95.82
8	Gradient Boosting Trees	93.00
0	Logistic Regression	89.89
2	Linear SVC	89.50
3	KNN	89.21
1	SVM	87.76
5	Perceptron	87.27
6	Stochastic Gradient Decent	86.78
4	Naive Bayes	80.17

[94]:
```
cv_models = pd.DataFrame({
    'Model': ['Logistic Regression','SVM','Linear SVC','KNN','Naive␣
 ↪Bayes','Perceptron',
              'Stochastic Gradient Decent','Decision Tree', 'Gradient Boosting␣
 ↪Trees','Random Forest',
              'CatBoost'],
    'Score': [
        acc_cv_log,
        acc_cv_svc,
        acc_cv_linear_svc,
        acc_cv_knn,
        acc_cv_gaussian,
        acc_cv_perceptron,
        acc_cv_sgd,
        acc_cv_dt,
        acc_cv_gbt,
        acc_cv_rf,
        acc_cv_catboost
    ]})
cv_models.sort_values(by='Score', ascending=False)
```

[94]:

	Model	Score
0	Logistic Regression	87.66

```
2                   Linear SVC  87.27
8       Gradient Boosting Trees  87.17
10                     CatBoost  86.49
1                           SVM  86.10
9                 Random Forest  85.33
6   Stochastic Gradient Decent  83.97
3                           KNN  83.28
5                    Perceptron  82.12
7                 Decision Tree  78.62
4                   Naive Bayes  77.45
```

3 Predict Data using Logistic Regression

[95]:
```
model = LogisticRegression().fit(X_train, y_train)
```

[96]:
```
predictions = model.predict(X_test)
```

[97]:
```
pred_df = pd.DataFrame(index=X_test.index)
```

[98]:
```
pred_df['Attrition'] = predictions
pred_df.head()
```

[98]:
```
      Attrition
71            0
464           0
294           0
1230          0
1181          0
```

[99]:
```
# Cross-validation accuracy metric
score = round(metrics.accuracy_score(y_test, predictions) * 100, 2)
```

[100]:
```
print("Accuracy: %s" % score)
```

```
Accuracy: 87.76
```

[101]:
```
print(classification_report(y_test, predictions))
```

```
              precision    recall  f1-score   support

           0       0.90      0.96      0.93       375
           1       0.64      0.42      0.51        66

    accuracy                           0.88       441
   macro avg       0.77      0.69      0.72       441
```

```
weighted avg       0.86      0.88      0.87       441
```

[102]:
```
# get importance
importance = model.coef_[0]
# summarize feature importance
for i,v in enumerate(importance):
    print('Feature: %0d, Score: %.5f' % (i,v))
# plot feature importance
plt.bar([x for x in range(len(importance))], importance)
plt.show()
```

```
Feature: 0, Score: -0.83977
Feature: 1, Score: 0.78917
Feature: 2, Score: 0.05069
Feature: 3, Score: -0.02039
Feature: 4, Score: 0.11335
Feature: 5, Score: 0.02325
Feature: 6, Score: 0.01159
Feature: 7, Score: -0.12771
Feature: 8, Score: 0.20678
Feature: 9, Score: -0.28549
Feature: 10, Score: 0.12482
Feature: 11, Score: -0.28421
Feature: 12, Score: -0.39745
Feature: 13, Score: 0.63564
Feature: 14, Score: 0.13060
Feature: 15, Score: -0.13052
Feature: 16, Score: -0.29474
Feature: 17, Score: 0.11663
Feature: 18, Score: 0.17819
Feature: 19, Score: -0.92836
Feature: 20, Score: 0.92844
Feature: 21, Score: 0.70871
Feature: 22, Score: -0.35084
Feature: 23, Score: -0.43281
Feature: 24, Score: 0.07503
Feature: 25, Score: 0.89239
Feature: 26, Score: -0.12934
Feature: 27, Score: 0.04080
Feature: 28, Score: -0.24705
Feature: 29, Score: 0.27531
Feature: 30, Score: -0.46624
Feature: 31, Score: -0.36578
Feature: 32, Score: 0.05549
Feature: 33, Score: -0.27119
Feature: 34, Score: -1.16726
Feature: 35, Score: 0.83722
```

```
Feature: 36, Score: 0.26956
Feature: 37, Score: -0.91975
Feature: 38, Score: 0.81994
Feature: 39, Score: 0.84985
Feature: 40, Score: 0.27492
Feature: 41, Score: 0.83162
Feature: 42, Score: 0.80548
Feature: 43, Score: 0.36834
Feature: 44, Score: 0.42694
Feature: 45, Score: -0.01816
Feature: 46, Score: -0.43036
Feature: 47, Score: 0.92481
```