```python
import pandas as pd
import numpy as np
import matplotlib.pyplot as plt
import seaborn as sns
import warnings
warnings.filterwarnings('ignore')
```

```python
# load data
df = pd.read_csv('/content/heart.csv')
df.head()
```

	Age	Sex	ChestPainType	RestingBP	Cholesterol	FastingBS	RestingECG	Ma
0	40	M	ATA	140	289	0	Normal	
1	49	F	NAP	160	180	0	Normal	
2	37	M	ATA	130	283	0	ST	
3	48	F	ASY	138	214	0	Normal	
4	54	M	NAP	150	195	0	Normal	

```python
# data shape
df.shape
```

```
(918, 12)
```

```
df.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 918 entries, 0 to 917
Data columns (total 12 columns):
 #   Column          Non-Null Count  Dtype
---  ------          --------------  -----
 0   Age             918 non-null    int64
 1   Sex             918 non-null    object
 2   ChestPainType   918 non-null    object
 3   RestingBP       918 non-null    int64
 4   Cholesterol     918 non-null    int64
 5   FastingBS       918 non-null    int64
 6   RestingECG      918 non-null    object
 7   MaxHR           918 non-null    int64
 8   ExerciseAngina  918 non-null    object
 9   Oldpeak         918 non-null    float64
 10  ST_Slope        918 non-null    object
 11  HeartDisease    918 non-null    int64
dtypes: float64(1), int64(6), object(5)
memory usage: 86.2+ KB
```

```
# show unique values
df.nunique()
```

	0
Age	50
Sex	2
ChestPainType	4
RestingBP	67
Cholesterol	222
FastingBS	2
RestingECG	3
MaxHR	119
ExerciseAngina	2
Oldpeak	53
ST_Slope	3
HeartDisease	2

dtype: int64

```
# data basic statistics
df.describe()
```

	Age	RestingBP	Cholesterol	FastingBS	MaxHR	Oldpeak	Hea
count	918.000000	918.000000	918.000000	918.000000	918.000000	918.000000	
mean	53.510893	132.396514	198.799564	0.233115	136.809368	0.887364	
std	9.432617	18.514154	109.384145	0.423046	25.460334	1.066570	
min	28.000000	0.000000	0.000000	0.000000	60.000000	-2.600000	
25%	47.000000	120.000000	173.250000	0.000000	120.000000	0.000000	
50%	54.000000	130.000000	223.000000	0.000000	138.000000	0.600000	
75%	60.000000	140.000000	267.000000	0.000000	156.000000	1.500000	
max	77.000000	200.000000	603.000000	1.000000	202.000000	6.200000	

```
# missing values in decerding order
df.isnull().sum().sort_values(ascending=False)
```

	0
Age	0
Sex	0
ChestPainType	0
RestingBP	0
Cholesterol	0
FastingBS	0
RestingECG	0
MaxHR	0
ExerciseAngina	0
Oldpeak	0
ST_Slope	0
HeartDisease	0

dtype: int64

```
# duplicated values
df.duplicated().sum()
```

0

```python
# numerical and categorical features
Categorical = df.select_dtypes(include=['object'])
Numerical = df.select_dtypes(include=['int64', 'float64'])
print('Categorical features:\n', Categorical)
print('Numerical features:\n', Numerical)
```

```
Categorical features:
     Sex ChestPainType RestingECG ExerciseAngina ST_Slope
0     M           ATA     Normal              N       Up
1     F           NAP     Normal              N     Flat
2     M           ATA         ST              N       Up
3     F           ASY     Normal              Y     Flat
4     M           NAP     Normal              N       Up
..   ..           ...        ...            ...      ...
913   M            TA     Normal              N     Flat
914   M           ASY     Normal              N     Flat
915   M           ASY     Normal              Y     Flat
916   F           ATA        LVH              N     Flat
917   M           NAP     Normal              N       Up

[918 rows x 5 columns]
Numerical features:
     Age  RestingBP  Cholesterol  FastingBS  MaxHR  Oldpeak  HeartDisease
0     40        140          289          0    172      0.0             0
1     49        160          180          0    156      1.0             1
2     37        130          283          0     98      0.0             0
3     48        138          214          0    108      1.5             1
4     54        150          195          0    122      0.0             0
..   ...        ...          ...        ...    ...      ...           ...
913   45        110          264          0    132      1.2             1
914   68        144          193          1    141      3.4             1
915   57        130          131          0    115      1.2             1
916   57        130          236          0    174      0.0             1
917   38        138          175          0    173      0.0             0

[918 rows x 7 columns]
```
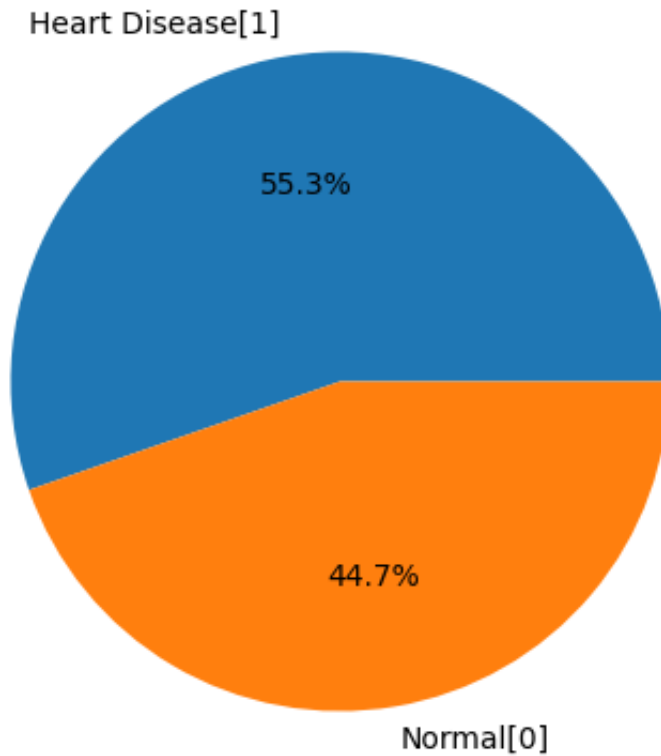
```python
# count target variable
df['HeartDisease'].value_counts()
```

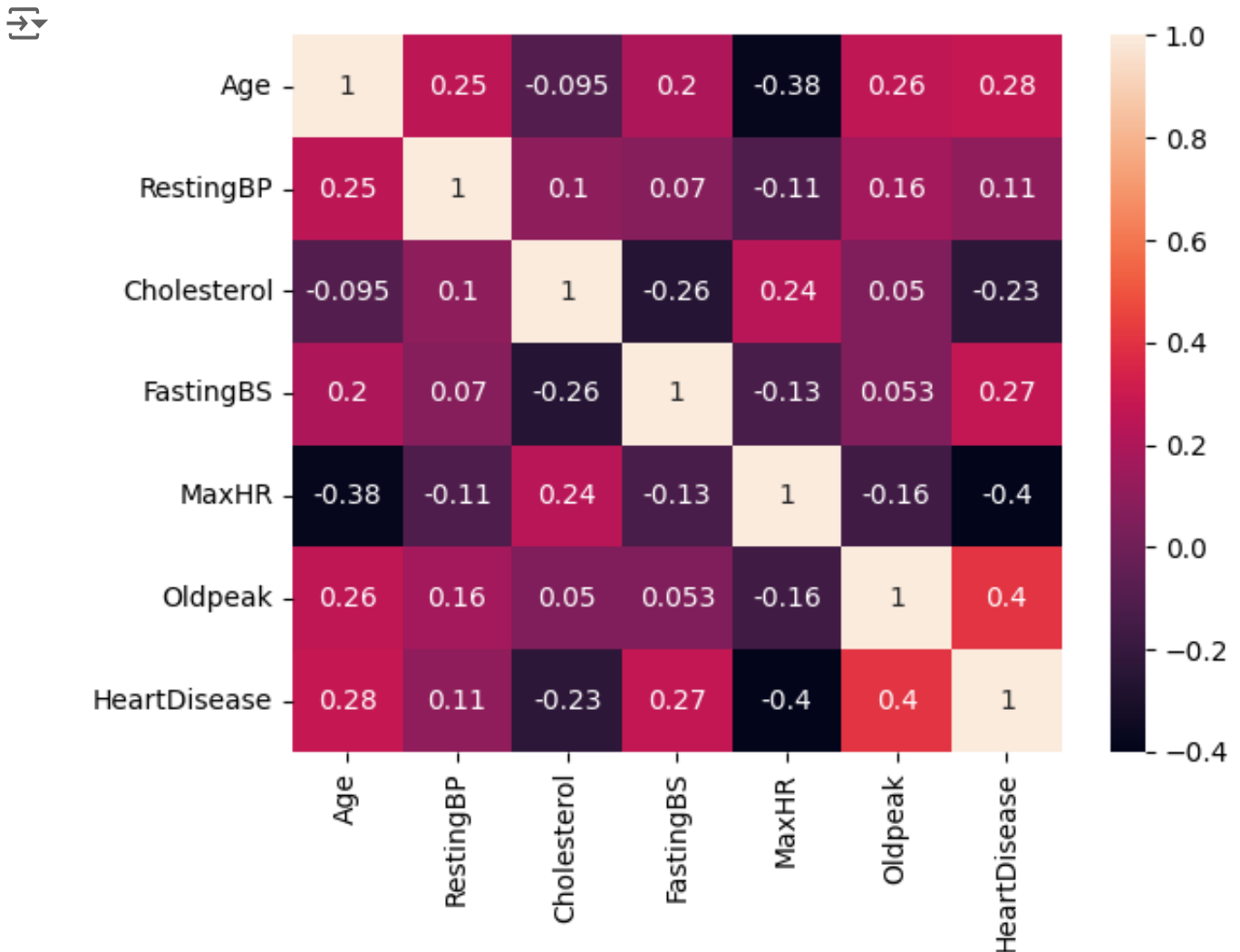| HeartDisease	count
1	508
0	410

dtype: int64

```
# Normal and Heart Disease with target column
plt.figure(figsize=(10,5))
plt.pie(df['HeartDisease'].value_counts(), labels=['Heart Disease[1]', 'Normal|
plt.show()
```

```python
numeric_df = df.select_dtypes(include=[np.number])

# Plot the correlation matrix
sns.heatmap(numeric_df.corr(), annot=True)
plt.show()
```



```python
# ploting numerical features with target
for i in Numerical:
    plt.figure(figsize=(10,5))
    sns.countplot(x=i, data=df, hue='HeartDisease')
    plt.legend(['Normal', 'Heart Disease'])
    plt.title(i)
    plt.show()
```

RestingBP

Cholesterol

Cholesterol

FastingBS

MaxHR

Oldpeak
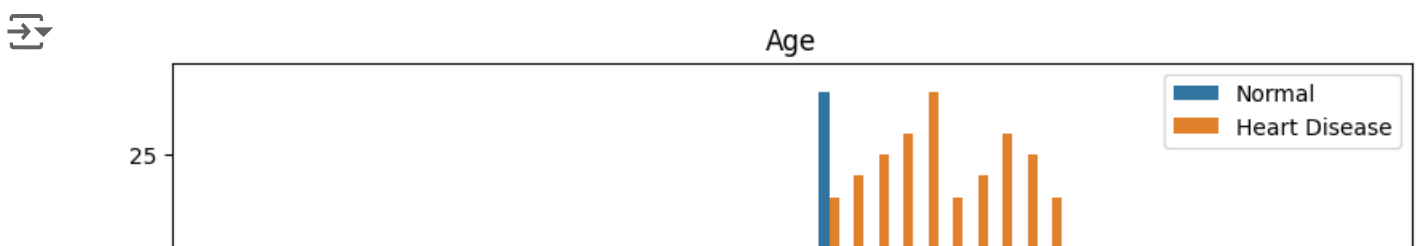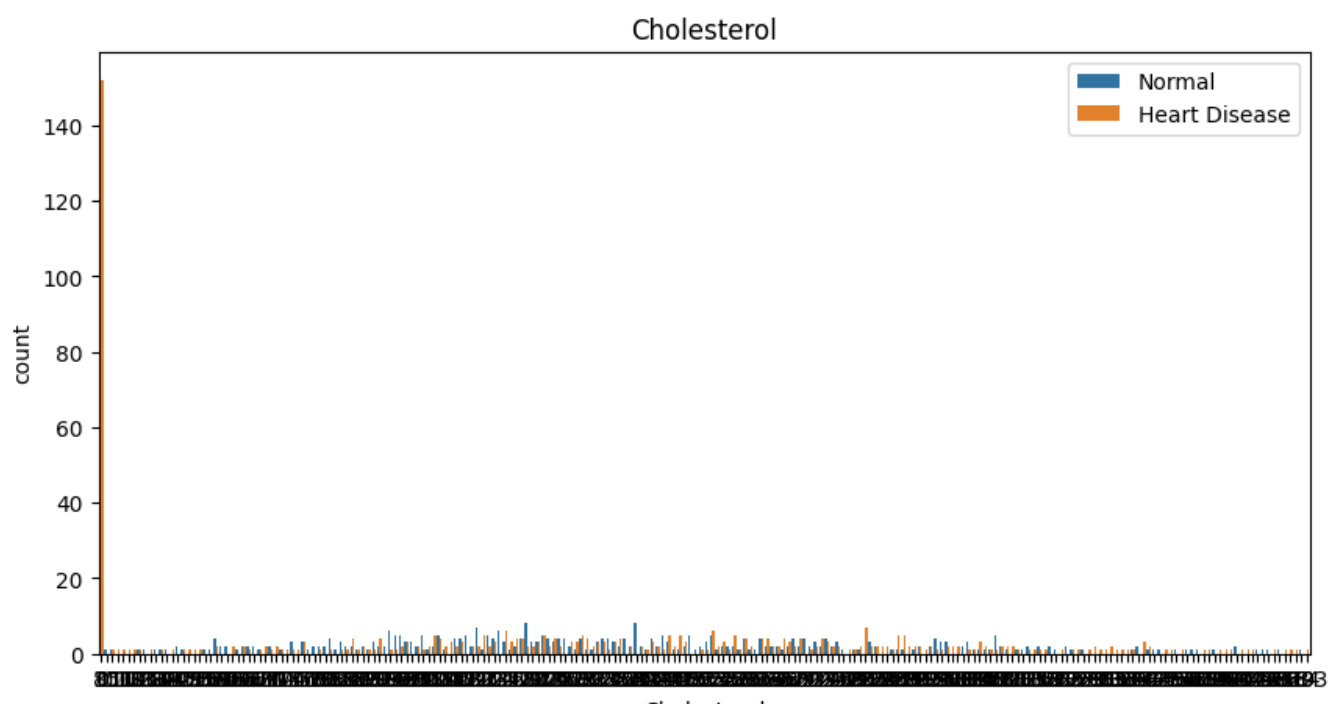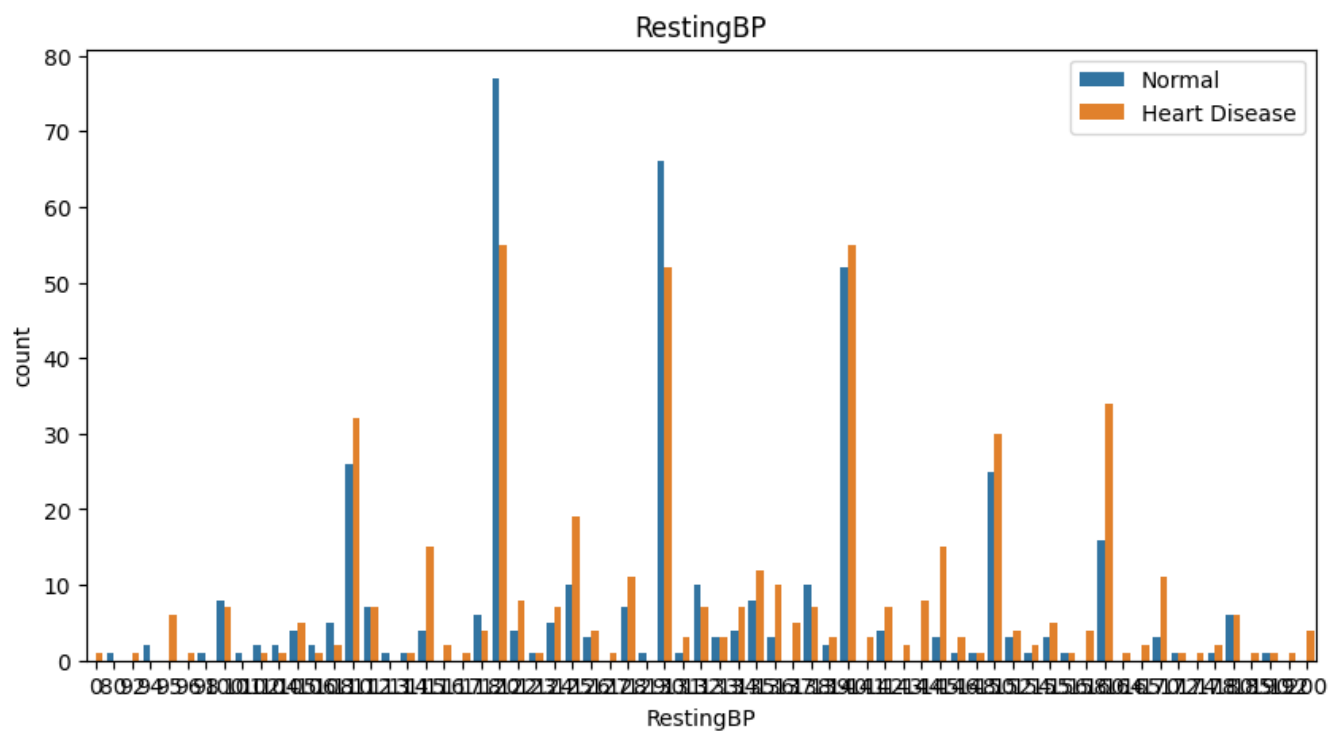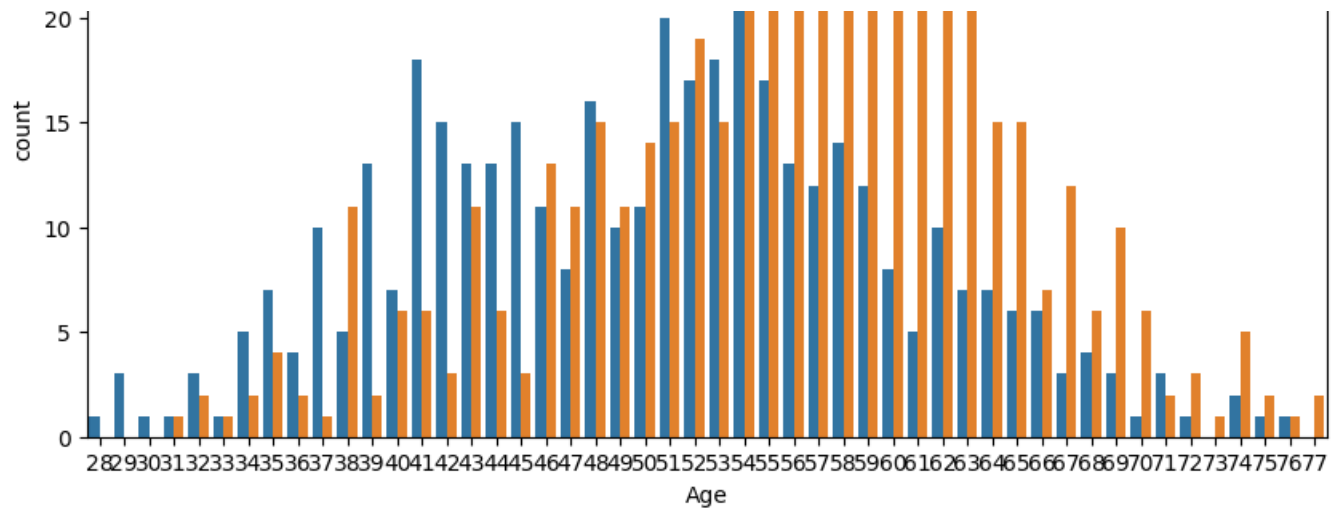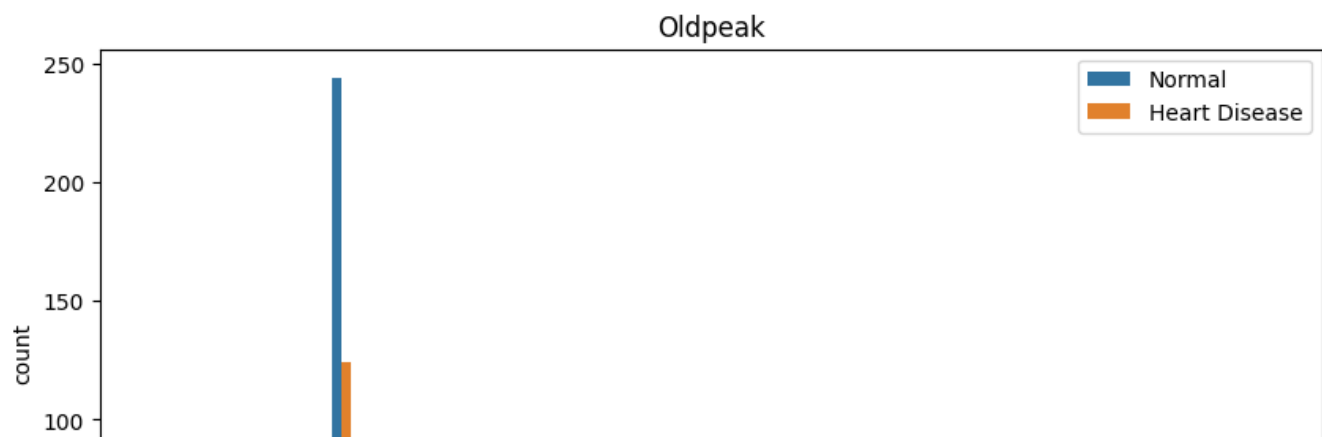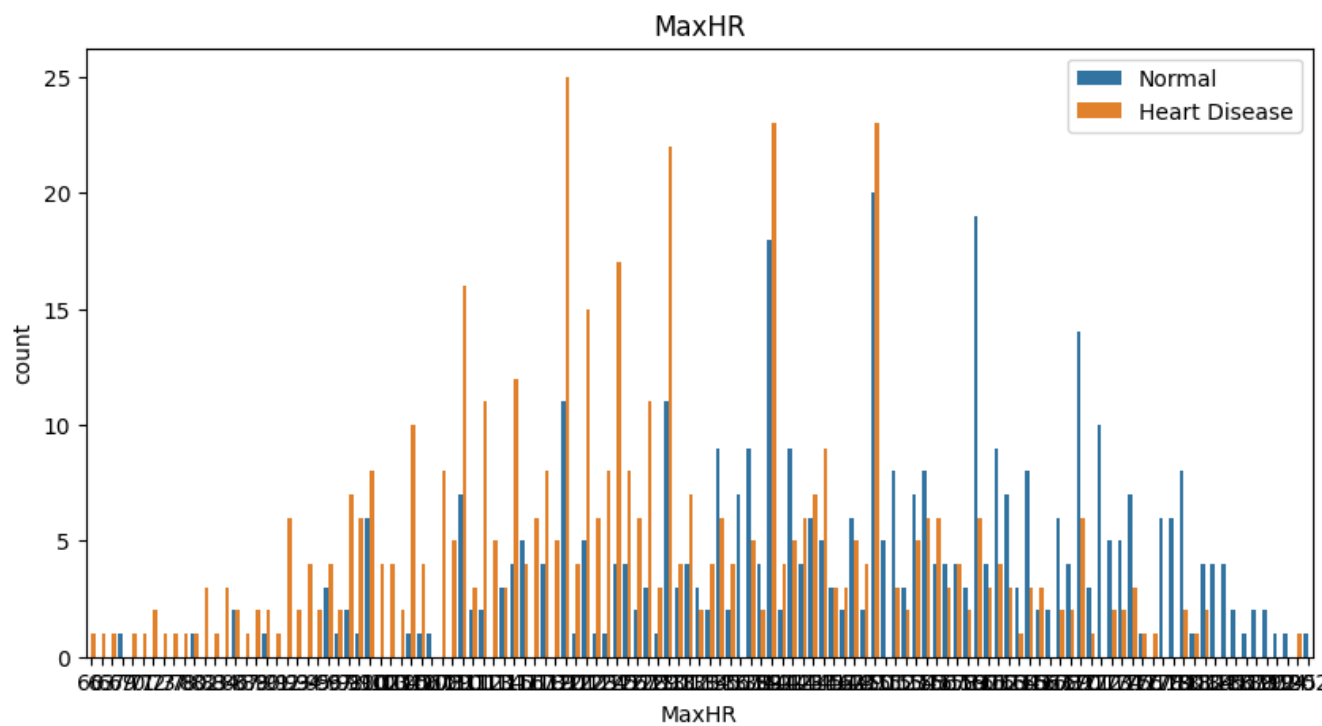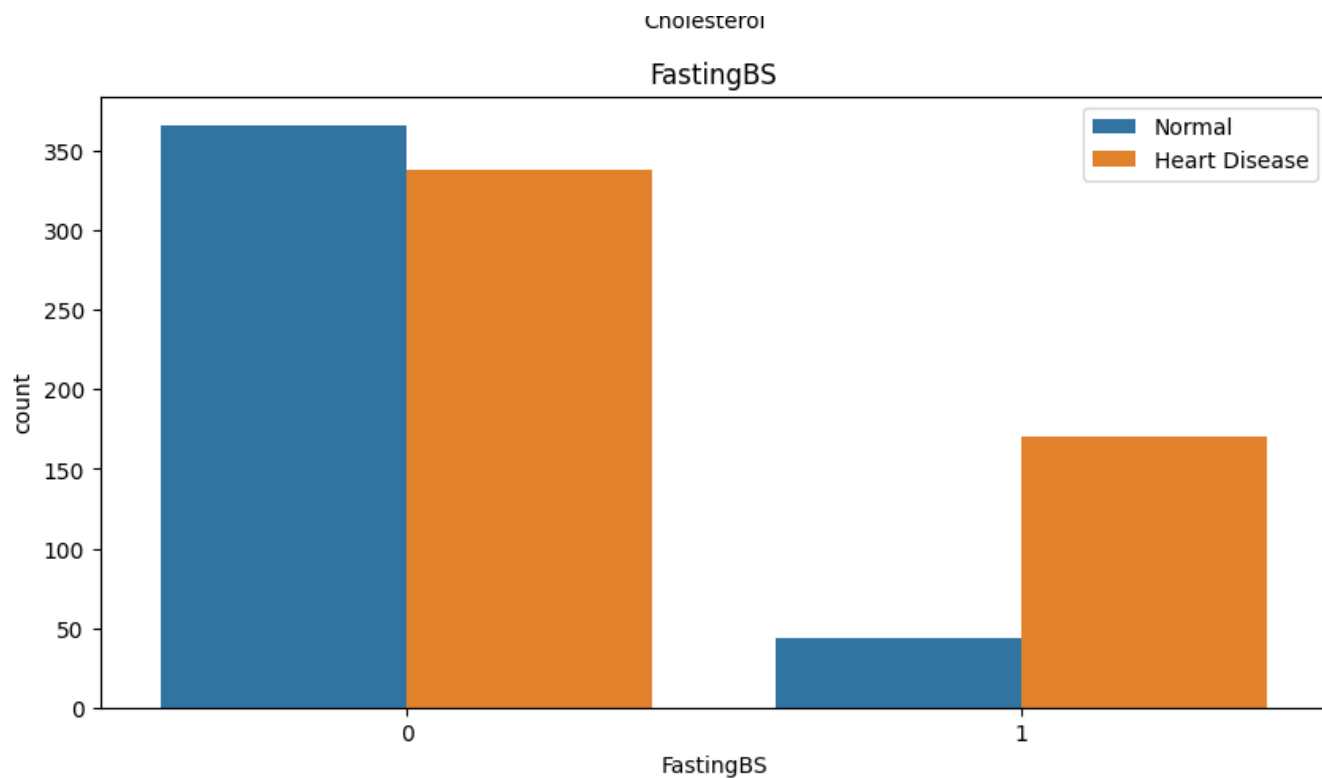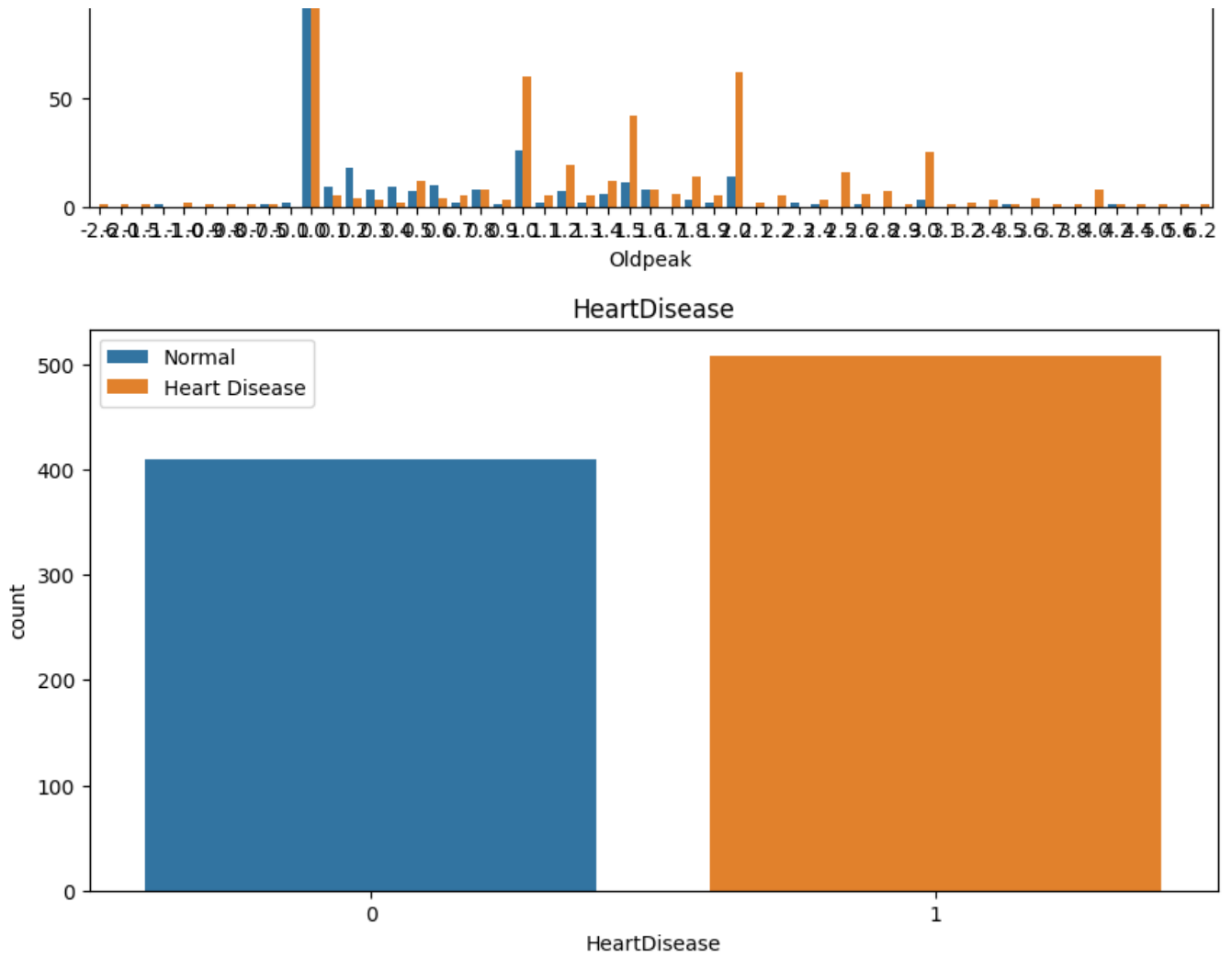
```
#ploting categorical features with target
for i in Categorical:
    plt.figure(figsize=(10,5))
    sns.countplot(x=i, data=df, hue='HeartDisease', edgecolor='black')
    plt.legend(['Normal', 'Heart Disease'])
    plt.title(i)
    plt.show()
```

ST_Slope
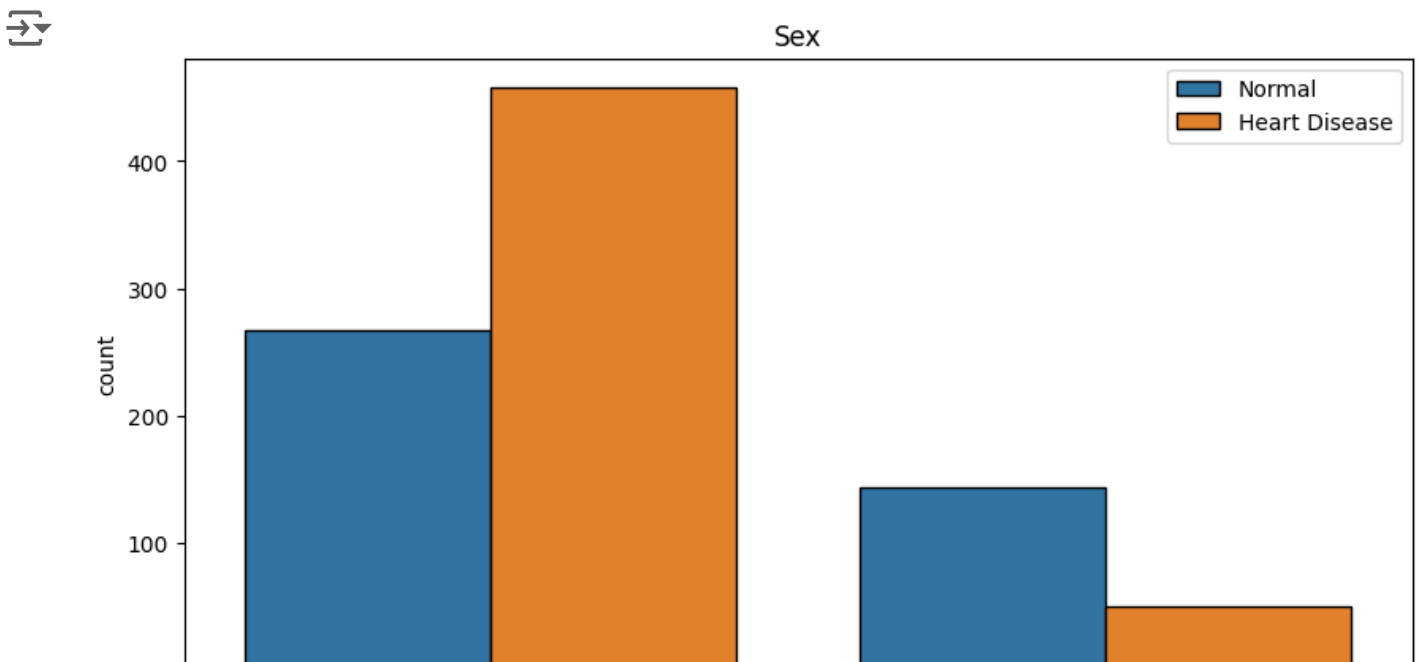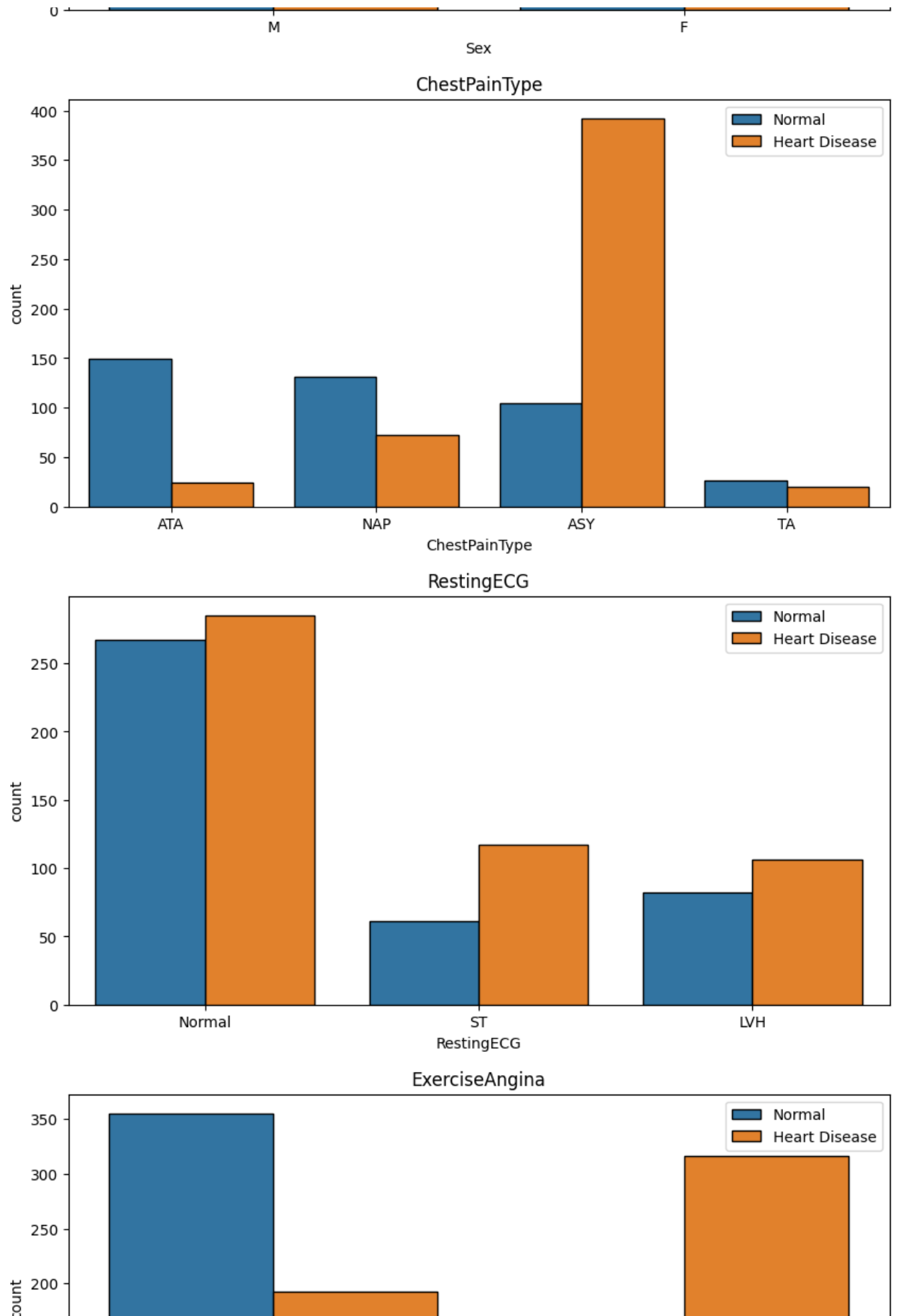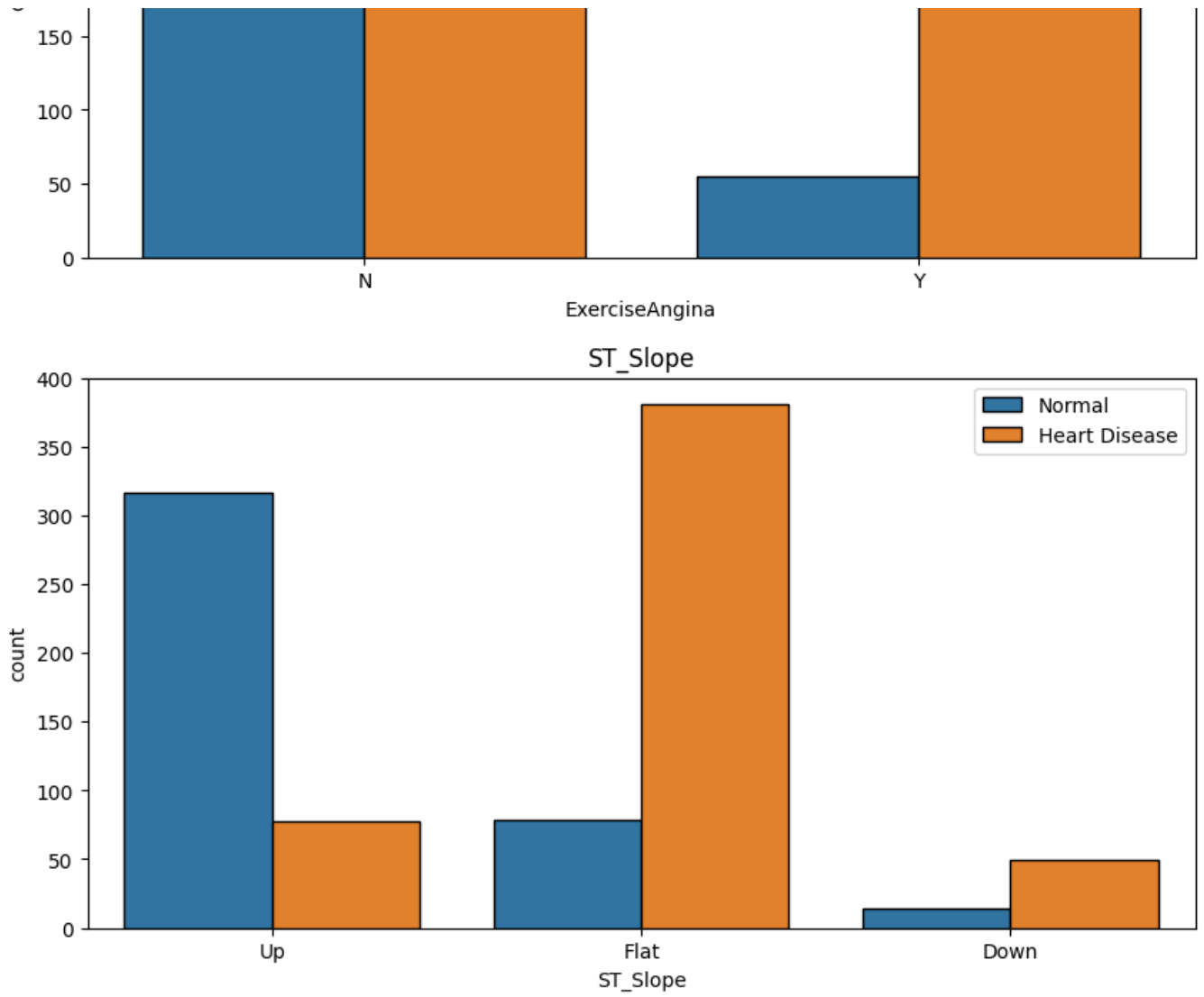
DATA PREPROCESSING

```python
# select numerical features and encoding it
from sklearn.preprocessing import LabelEncoder
le = LabelEncoder()
# select numerical features
numerical_features = df.select_dtypes(include=['int64', 'float64'])
# apply label encoding
numerical_features = numerical_features.apply(LabelEncoder().fit_transform)
numerical_features.head()
```

	Age	RestingBP	Cholesterol	FastingBS	MaxHR	Oldpeak	HeartDisease
0	12	41	147	0	98	10	0
1	21	55	40	0	82	20	1
2	9	31	141	0	25	10	0
3	20	39	72	0	34	25	1
4	26	49	53	0	48	10	0

```
# One-Hot encoding the categorical features using get_dummies()
# select categorical features
categorical_features = df.select_dtypes(include=['object'])
# apply get_dummies encoding
categorical_features = pd.get_dummies(categorical_features)
categorical_features.head()
```

	Sex_F	Sex_M	ChestPainType_ASY	ChestPainType_ATA	ChestPainType_NAP	Ch
0	False	True	False	True	False	
1	True	False	False	False	True	
2	False	True	False	True	False	
3	True	False	True	False	False	
4	False	True	False	False	True	

```
# combine numerical and categorical features
combined = pd.concat([numerical_features, categorical_features], axis=1)
combined.head()
```

	Age	RestingBP	Cholesterol	FastingBS	MaxHR	Oldpeak	HeartDisease	Sex_
0	12	41	147	0	98	10	0	Fals
1	21	55	40	0	82	20	1	Tru
2	9	31	141	0	25	10	0	Fals
3	20	39	72	0	34	25	1	Tru
4	26	49	53	0	48	10	0	Fals

5 rows × 21 columns

```
# separet features and target
X = combined.drop(['HeartDisease'], axis=1)
y = combined['HeartDisease']
```

```
X.head()
```

	Age	RestingBP	Cholesterol	FastingBS	MaxHR	Oldpeak	Sex_F	Sex_M	Ches
0	12	41	147	0	98	10	False	True	
1	21	55	40	0	82	20	True	False	
2	9	31	141	0	25	10	False	True	
3	20	39	72	0	34	25	True	False	
4	26	49	53	0	48	10	False	True	

```
y.head()
```

	HeartDisease
0	0
1	1
2	0
3	1
4	0

dtype: int64

```
# train test split
from sklearn.model_selection import train_test_split
X_train, X_test, y_train, y_test = train_test_split(X, y, test_size=0.2, randon
```

MODEL 1 XGBOOST

```python
# model building xgboost
from xgboost import XGBClassifier
model = XGBClassifier(n_estimators=590)
model.fit(X_train, y_train)
# predict
y_pred = model.predict(X_test)
# accuracy
from sklearn.metrics import accuracy_score
print('Accuracy:', accuracy_score(y_test, y_pred))
```

Accuracy: 0.8586956521739131

```python
# Finding the best parameters using loop
accuracy = []
for i in range(550, 600):
    model = XGBClassifier(n_estimators=i)
    model.fit(X_train, y_train)
    y_pred = model.predict(X_test)
    accuracy.append(accuracy_score(y_test, y_pred))
# ploting accuracy graph
plt.plot(range(550, 600), accuracy)
plt.ylabel('Accuracy')
plt.xlabel('Range')
plt.show()
```
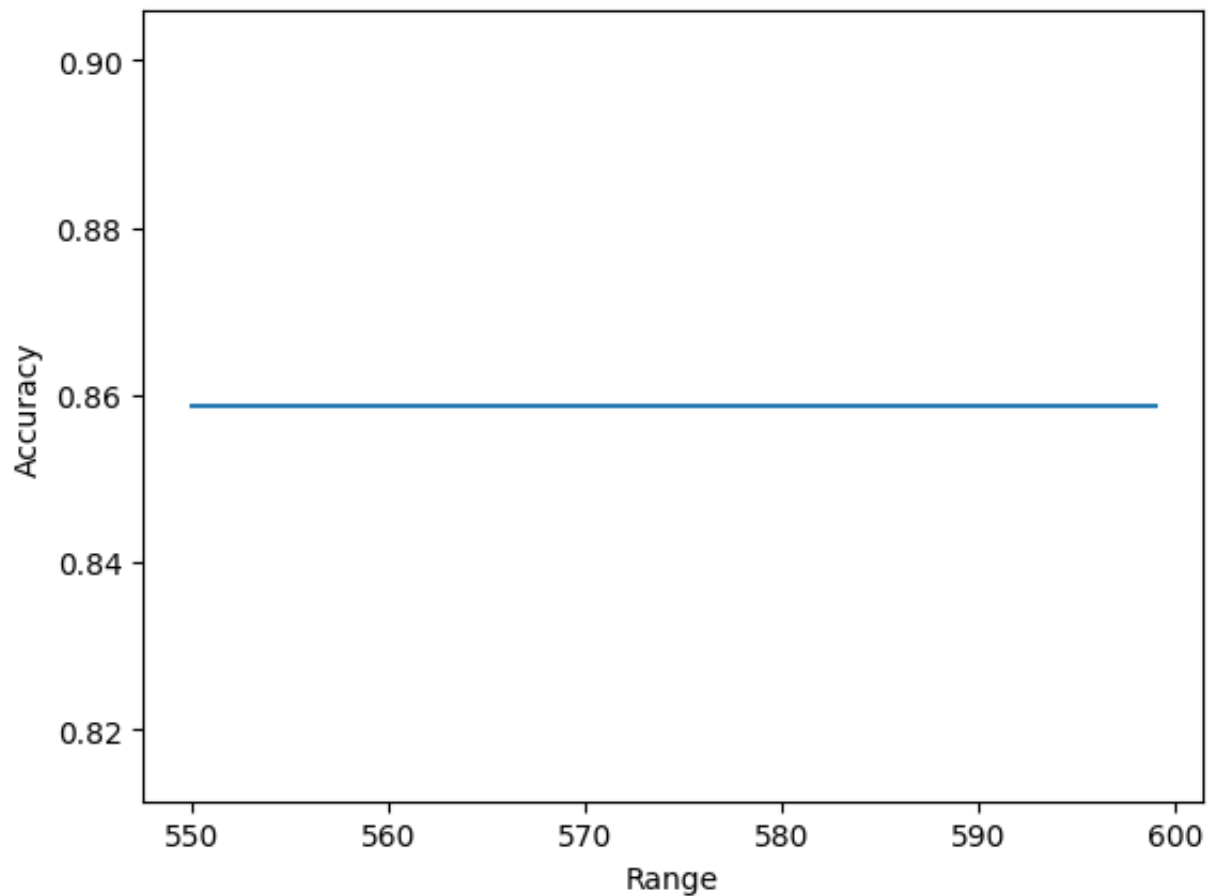
```
# print precetion, recall, f1 score
from sklearn.metrics import classification_report
print(classification_report(y_test, y_pred))
```

```
              precision    recall  f1-score   support

           0       0.81      0.87      0.84        77
           1       0.90      0.85      0.88       107

    accuracy                           0.86       184
   macro avg       0.85      0.86      0.86       184
weighted avg       0.86      0.86      0.86       184
```

```
# confusion matrix
from sklearn.metrics import confusion_matrix
cm = confusion_matrix(y_test, y_pred)
plt.figure(figsize=(5,3))
sns.heatmap(cm, annot=True)
```

<Axes: >
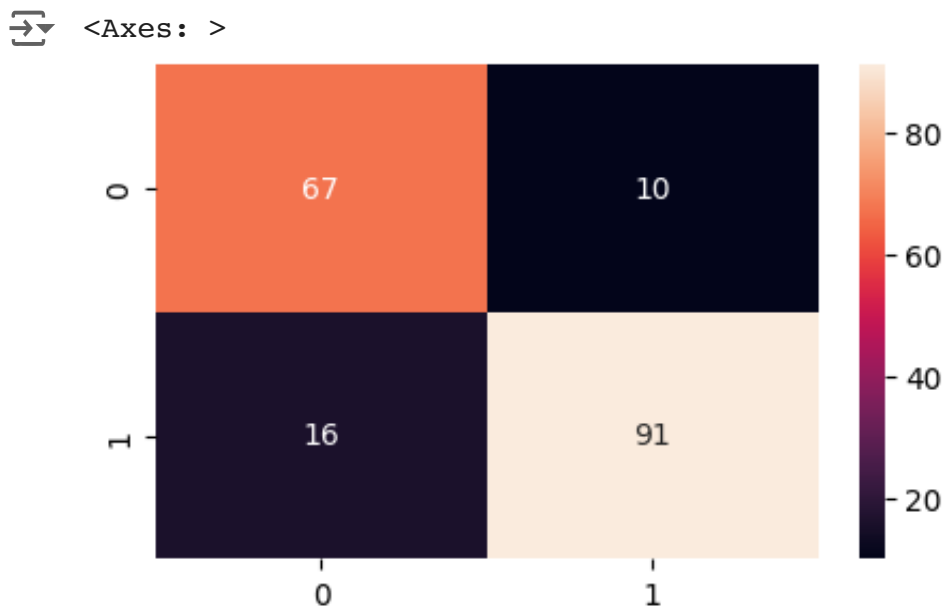
```
# Feature importance for xgboost
feat_importances = pd.Series(model.feature_importances_, index=X.columns)
feat_importances.nlargest(10).plot(kind='barh')
plt.xlabel('Relative Importance')
plt.ylabel('Features')
plt.title('Feature Importances')
plt.show()
```
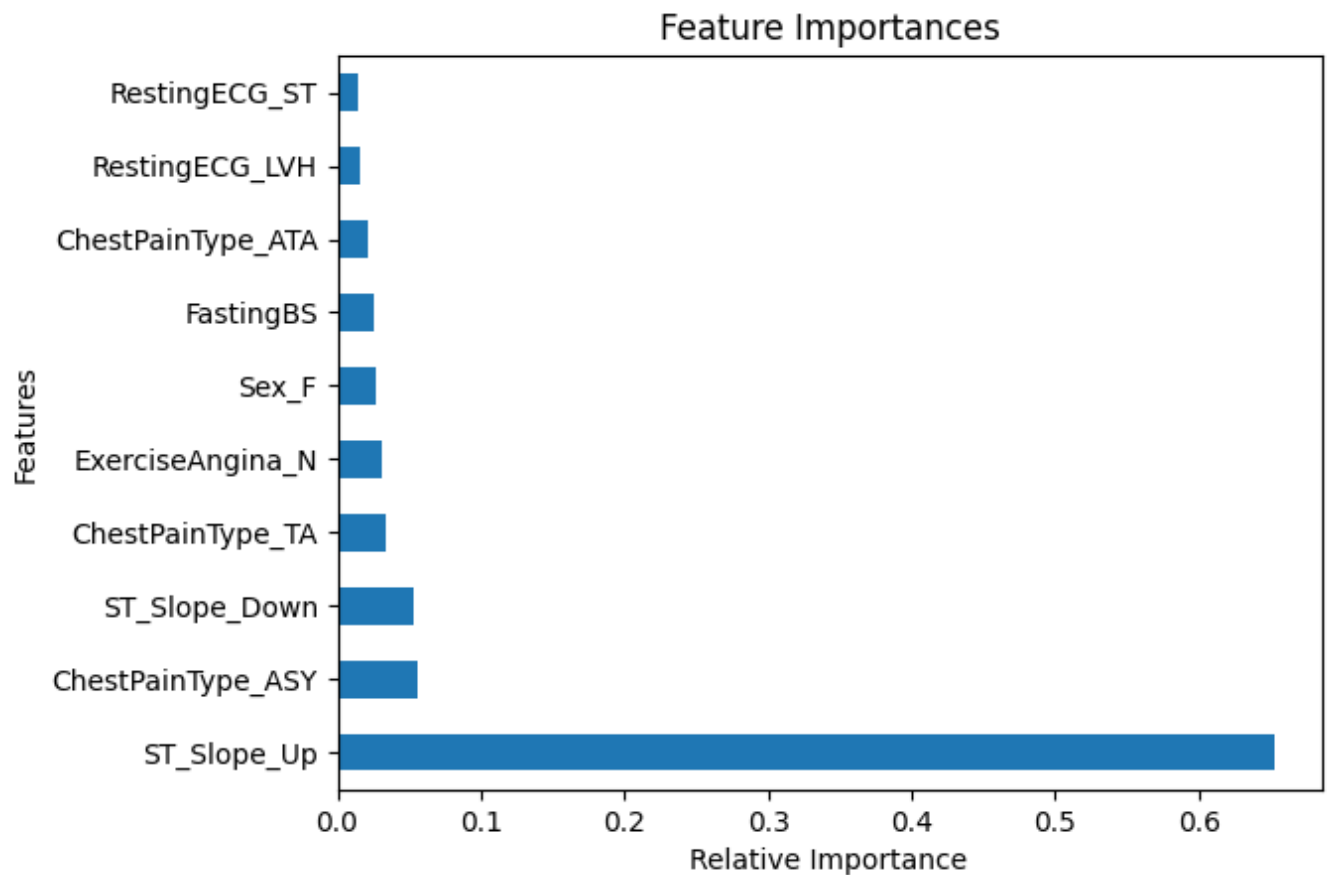

MODEL 2 CATBOOST

```
!pip install catboost
```

Collecting catboost
    Downloading catboost-1.2.7-cp310-cp310-manylinux2014_x86_64.whl.metadata
    Requirement already satisfied: graphviz in /usr/local/lib/python3.10/dist-p
    Requirement already satisfied: matplotlib in /usr/local/lib/python3.10/dist
    Requirement already satisfied: numpy<2.0,>=1.16.0 in /usr/local/lib/python3
    Requirement already satisfied: pandas>=0.24 in /usr/local/lib/python3.10/di
    Requirement already satisfied: scipy in /usr/local/lib/python3.10/dist-pack
    Requirement already satisfied: plotly in /usr/local/lib/python3.10/dist-pac
    Requirement already satisfied: six in /usr/local/lib/python3.10/dist-packag
    Requirement already satisfied: python-dateutil>=2.8.2 in /usr/local/lib/pyt
    Requirement already satisfied: pytz>=2020.1 in /usr/local/lib/python3.10/di
    Requirement already satisfied: tzdata>=2022.7 in /usr/local/lib/python3.10/
    Requirement already satisfied: contourpy>=1.0.1 in /usr/local/lib/python3.1
    Requirement already satisfied: cycler>=0.10 in /usr/local/lib/python3.10/di
    Requirement already satisfied: fonttools>=4.22.0 in /usr/local/lib/python3.
    Requirement already satisfied: kiwisolver>=1.0.1 in /usr/local/lib/python3.
    Requirement already satisfied: packaging>=20.0 in /usr/local/lib/python3.10
    Requirement already satisfied: pillow>=6.2.0 in /usr/local/lib/python3.10/d
    Requirement already satisfied: pyparsing>=2.3.1 in /usr/local/lib/python3.1
    Requirement already satisfied: tenacity>=6.2.0 in /usr/local/lib/python3.10
    Downloading catboost-1.2.7-cp310-cp310-manylinux2014_x86_64.whl (98.7 MB)
                                              98.7/98.7 MB 6.3 MB/s eta 0:00:

    Installing collected packages: catboost
    Successfully installed catboost-1.2.7

```
# model building catboost
from catboost import CatBoostClassifier
model2 = CatBoostClassifier(iterations=107)
model2.fit(X_train, y_train)
# predict
y_pred = model2.predict(X_test)
# Print accuracy
from sklearn.metrics import accuracy_score
print('Accuracy:', accuracy_score(y_test, y_pred))
# print classification report
from sklearn.metrics import classification_report
print('Classification report\n',classification_report(y_test, y_pred))
```

Learning rate set to 0.070088
0:      learn: 0.6331763   total: 53.8ms   remaining: 5.7s
1:      learn: 0.5995431   total: 56ms   remaining: 2.94s
2:      learn: 0.5514355   total: 58.8ms   remaining: 2.04s
3:      learn: 0.5155648   total: 64.5ms   remaining: 1.66s
4:      learn: 0.4791158   total: 70.6ms   remaining: 1.44s
5:      learn: 0.4544186   total: 73.5ms   remaining: 1.24s
6:      learn: 0.4304883   total: 78.1ms   remaining: 1.12s
7:      learn: 0.4094613   total: 82.3ms   remaining: 1.02s

```
8:        learn: 0.3956577       total: 86.3ms       remaining: 940ms
9:        learn: 0.3754515       total: 90.9ms       remaining: 882ms
10:       learn: 0.3628197       total: 93.8ms       remaining: 819ms
11:       learn: 0.3521139       total: 98ms         remaining: 776ms
12:       learn: 0.3404626       total: 103ms        remaining: 743ms
13:       learn: 0.3329384       total: 106ms        remaining: 705ms
14:       learn: 0.3258527       total: 110ms        remaining: 676ms
15:       learn: 0.3172249       total: 114ms        remaining: 648ms
16:       learn: 0.3133727       total: 120ms        remaining: 635ms
17:       learn: 0.3090709       total: 123ms        remaining: 607ms
18:       learn: 0.3049903       total: 131ms        remaining: 604ms
19:       learn: 0.2994874       total: 135ms        remaining: 588ms
20:       learn: 0.2901661       total: 138ms        remaining: 564ms
21:       learn: 0.2846539       total: 142ms        remaining: 550ms
22:       learn: 0.2830099       total: 144ms        remaining: 527ms
23:       learn: 0.2777912       total: 152ms        remaining: 524ms
24:       learn: 0.2741095       total: 157ms        remaining: 515ms
25:       learn: 0.2687931       total: 159ms        remaining: 496ms
26:       learn: 0.2652492       total: 164ms        remaining: 487ms
27:       learn: 0.2609616       total: 167ms        remaining: 471ms
28:       learn: 0.2577226       total: 179ms        remaining: 480ms
29:       learn: 0.2559300       total: 183ms        remaining: 469ms
30:       learn: 0.2513244       total: 194ms        remaining: 475ms
31:       learn: 0.2473110       total: 199ms        remaining: 466ms
32:       learn: 0.2455458       total: 204ms        remaining: 457ms
33:       learn: 0.2418409       total: 210ms        remaining: 451ms
34:       learn: 0.2402896       total: 214ms        remaining: 439ms
35:       learn: 0.2400162       total: 215ms        remaining: 424ms
36:       learn: 0.2368425       total: 220ms        remaining: 416ms
37:       learn: 0.2342402       total: 224ms        remaining: 407ms
38:       learn: 0.2303558       total: 229ms        remaining: 399ms
39:       learn: 0.2296646       total: 234ms        remaining: 392ms
40:       learn: 0.2270548       total: 242ms        remaining: 390ms
41:       learn: 0.2243682       total: 246ms        remaining: 381ms
42:       learn: 0.2214109       total: 254ms        remaining: 378ms
43:       learn: 0.2194343       total: 266ms        remaining: 381ms
44:       learn: 0.2182301       total: 272ms        remaining: 375ms
45:       learn: 0.2157138       total: 281ms        remaining: 373ms
46:       learn: 0.2135517       total: 304ms        remaining: 388ms
47:       learn: 0.2109160       total: 308ms        remaining: 379ms
48:       learn: 0.2091971       total: 314ms        remaining: 372ms
49:       learn: 0.2079887       total: 317ms        remaining: 361ms
50:       learn: 0.2059917       total: 323ms        remaining: 355ms
51:       learn: 0.2023840       total: 328ms        remaining: 346ms
52:       learn: 0.2003819       total: 338ms        remaining: 345ms
53:       learn: 0.1981988       total: 347ms        remaining: 340ms
54:       learn: 0.1957656       total: 351ms        remaining: 331ms
55:       learn: 0.1936887       total: 355ms        remaining: 324ms
56:       learn: 0.1919379       total: 398ms        remaining: 349ms
57:       learn: 0.1915428       total: 402ms        remaining: 340ms
```

```
# Simple parameter tuning using loop
accuracy = []
```

```python
for i in range(100, 115):
    model2 = CatBoostClassifier(iterations=i)
    model2.fit(X_train, y_train)
    y_pred = model2.predict(X_test)
    accuracy.append(accuracy_score(y_test, y_pred))
# ploting accuracy graph
plt.plot(range(100, 115), accuracy)
plt.ylabel('Accuracy')
plt.xlabel('Range')
plt.show()
```

```
Learning rate set to 0.074574
0:      learn: 0.6296151      total: 5.81ms    remaining: 576ms
1:      learn: 0.5944451      total: 19.6ms    remaining: 958ms
2:      learn: 0.5444231      total: 23.1ms    remaining: 746ms
3:      learn: 0.5075946      total: 27.1ms    remaining: 651ms
4:      learn: 0.4726533      total: 34.4ms    remaining: 653ms
5:      learn: 0.4475321      total: 39.7ms    remaining: 623ms
6:      learn: 0.4233308      total: 44.2ms    remaining: 587ms
7:      learn: 0.4022525      total: 48.4ms    remaining: 557ms
8:      learn: 0.3885637      total: 52.5ms    remaining: 531ms
9:      learn: 0.3727882      total: 56.7ms    remaining: 510ms
10:     learn: 0.3619667      total: 60.8ms    remaining: 492ms
11:     learn: 0.3498995      total: 64.8ms    remaining: 476ms
12:     learn: 0.3339893      total: 69.6ms    remaining: 466ms
13:     learn: 0.3284279      total: 74.1ms    remaining: 455ms
14:     learn: 0.3172913      total: 78.9ms    remaining: 447ms
15:     learn: 0.3089918      total: 83.6ms    remaining: 439ms
16:     learn: 0.2984843      total: 89.5ms    remaining: 437ms
17:     learn: 0.2934859      total: 93.9ms    remaining: 428ms
18:     learn: 0.2881667      total: 98.3ms    remaining: 419ms
19:     learn: 0.2807150      total: 103ms     remaining: 412ms
20:     learn: 0.2759214      total: 121ms     remaining: 455ms
21:     learn: 0.2719780      total: 126ms     remaining: 445ms
22:     learn: 0.2683758      total: 136ms     remaining: 456ms
23:     learn: 0.2640506      total: 141ms     remaining: 445ms
24:     learn: 0.2615202      total: 145ms     remaining: 435ms
25:     learn: 0.2585887      total: 149ms     remaining: 425ms
26:     learn: 0.2574087      total: 153ms     remaining: 415ms
27:     learn: 0.2538579      total: 158ms     remaining: 406ms
28:     learn: 0.2507685      total: 163ms     remaining: 398ms
29:     learn: 0.2477257      total: 164ms     remaining: 383ms
30:     learn: 0.2449856      total: 166ms     remaining: 369ms
31:     learn: 0.2412333      total: 168ms     remaining: 357ms
32:     learn: 0.2377434      total: 169ms     remaining: 344ms
33:     learn: 0.2336276      total: 171ms     remaining: 332ms
34:     learn: 0.2292262      total: 175ms     remaining: 324ms
35:     learn: 0.2266108      total: 176ms     remaining: 313ms
36:     learn: 0.2248298      total: 178ms     remaining: 303ms
37:     learn: 0.2215823      total: 180ms     remaining: 293ms
38:     learn: 0.2202676      total: 181ms     remaining: 284ms
39:     learn: 0.2173955      total: 184ms     remaining: 275ms
40:     learn: 0.2142623      total: 185ms     remaining: 266ms
```

```
          learn: 0.2122359          total: 187ms          remaining: 259ms
41:       learn: 0.2122359          total: 187ms          remaining: 259ms
42:       learn: 0.2097827          total: 189ms          remaining: 251ms
43:       learn: 0.2076575          total: 191ms          remaining: 243ms
44:       learn: 0.2047081          total: 192ms          remaining: 235ms
45:       learn: 0.2013570          total: 195ms          remaining: 228ms
46:       learn: 0.1988529          total: 197ms          remaining: 222ms
47:       learn: 0.1974644          total: 198ms          remaining: 215ms
48:       learn: 0.1956334          total: 200ms          remaining: 208ms
49:       learn: 0.1945563          total: 216ms          remaining: 216ms
50:       learn: 0.1931844          total: 222ms          remaining: 213ms
51:       learn: 0.1917689          total: 224ms          remaining: 207ms
52:       learn: 0.1894165          total: 225ms          remaining: 200ms
53:       learn: 0.1869555          total: 228ms          remaining: 194ms
54:       learn: 0.1854872          total: 235ms          remaining: 192ms
55:       learn: 0.1834086          total: 236ms          remaining: 186ms
56:       learn: 0.1818974          total: 238ms          remaining: 179ms
57:       learn: 0.1796864          total: 245ms          remaining: 178ms
58:       learn: 0.1787506          total: 247ms          remaining: 172ms
59:       learn: 0.1764196          total: 253ms          remaining: 169ms
60:       learn: 0.1741368          total: 261ms          remaining: 167ms
61:       learn: 0.1734610          total: 267ms          remaining: 164ms
62:       learn: 0.1719640          total: 269ms          remaining: 158ms
63:       learn: 0.1696323          total: 270ms          remaining: 152ms
64:       learn: 0.1673675          total: 272ms          remaining: 146ms
65:       learn: 0.1666238          total: 274ms          remaining: 141ms
66:       learn: 0.1650099          total: 276ms          remaining: 136ms
67:       learn: 0.1640122          total: 277ms          remaining: 131ms
68:       learn: 0.1627094          total: 279ms          remaining: 125ms
69:       learn: 0.1610063          total: 280ms          remaining: 120ms
70:       learn: 0.1600393          total: 282ms          remaining: 115ms
71:       learn: 0.1587358          total: 283ms          remaining: 110ms
72:       learn: 0.1574423          total: 285ms          remaining: 105ms
73:       learn: 0.1557551          total: 291ms          remaining: 102ms
74:       learn: 0.1538524          total: 293ms          remaining: 97.6ms
75:       learn: 0.1521937          total: 294ms          remaining: 93ms
76:       learn: 0.1512655          total: 296ms          remaining: 88.5ms
77:       learn: 0.1495818          total: 298ms          remaining: 84ms
78:       learn: 0.1481094          total: 302ms          remaining: 80.3ms
79:       learn: 0.1473831          total: 304ms          remaining: 75.9ms
80:       learn: 0.1463655          total: 305ms          remaining: 71.6ms
81:       learn: 0.1448046          total: 307ms          remaining: 67.3ms
82:       learn: 0.1440781          total: 309ms          remaining: 63.2ms
83:       learn: 0.1430138          total: 312ms          remaining: 59.5ms
84:       learn: 0.1414251          total: 314ms          remaining: 55.4ms
85:       learn: 0.1405891          total: 315ms          remaining: 51.3ms
86:       learn: 0.1397275          total: 318ms          remaining: 47.5ms
87:       learn: 0.1388127          total: 320ms          remaining: 43.6ms
88:       learn: 0.1376337          total: 321ms          remaining: 39.7ms
89:       learn: 0.1364380          total: 323ms          remaining: 35.9ms
90:       learn: 0.1349107          total: 325ms          remaining: 32.1ms
91:       learn: 0.1333211          total: 326ms          remaining: 28.4ms
92:       learn: 0.1314582          total: 340ms          remaining: 25.6ms
93:       learn: 0.1304814          total: 342ms          remaining: 21.8ms
94:       learn: 0.1299693          total: 343ms          remaining: 18.1ms
```

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91:         learn: 0.1299099        total: 345ms        remaining: 18.1ms
95:         learn: 0.1294716        total: 345ms        remaining: 14.4ms
96:         learn: 0.1288448        total: 347ms        remaining: 10.7ms
97:         learn: 0.1278699        total: 349ms        remaining: 7.13ms
98:         learn: 0.1266455        total: 351ms        remaining: 3.54ms
99:         learn: 0.1261149        total: 352ms        remaining: 0us
Learning rate set to 0.073896
0:          learn: 0.6301523        total: 2.52ms       remaining: 252ms
1:          learn: 0.5952094        total: 4.2ms        remaining: 208ms
2:          learn: 0.5454696        total: 5.85ms       remaining: 191ms
3:          learn: 0.5087783        total: 10.2ms       remaining: 246ms
4:          learn: 0.4717560        total: 14.3ms       remaining: 275ms
5:          learn: 0.4468011        total: 18.6ms       remaining: 295ms
6:          learn: 0.4227772        total: 22.6ms       remaining: 304ms
7:          learn: 0.4018617        total: 24.9ms       remaining: 289ms
8:          learn: 0.3882674        total: 28.4ms       remaining: 290ms
9:          learn: 0.3682339        total: 34.9ms       remaining: 317ms
10:         learn: 0.3556789        total: 36.6ms       remaining: 300ms
11:         learn: 0.3451979        total: 42.7ms       remaining: 316ms
12:         learn: 0.3337318        total: 44.4ms       remaining: 301ms
13:         learn: 0.3262925        total: 46ms         remaining: 286ms
14:         learn: 0.3155588        total: 47.9ms       remaining: 274ms
15:         learn: 0.3076316        total: 49.4ms       remaining: 263ms
16:         learn: 0.3037552        total: 55.7ms       remaining: 275ms
17:         learn: 0.2989657        total: 57.3ms       remaining: 264ms
18:         learn: 0.2933886        total: 58.9ms       remaining: 254ms
19:         learn: 0.2882739        total: 60.3ms       remaining: 244ms
20:         learn: 0.2813620        total: 61.8ms       remaining: 236ms
21:         learn: 0.2778914        total: 70.8ms       remaining: 254ms
22:         learn: 0.2734897        total: 72.5ms       remaining: 246ms
23:         learn: 0.2692903        total: 74.1ms       remaining: 238ms
24:         learn: 0.2667595        total: 75.6ms       remaining: 230ms
25:         learn: 0.2638219        total: 78.1ms       remaining: 225ms
26:         learn: 0.2628900        total: 80.1ms       remaining: 220ms
27:         learn: 0.2607941        total: 81.6ms       remaining: 213ms
28:         learn: 0.2576315        total: 83ms         remaining: 206ms
29:         learn: 0.2535884        total: 84.5ms       remaining: 200ms
30:         learn: 0.2503672        total: 86.3ms       remaining: 195ms
31:         learn: 0.2464915        total: 87.9ms       remaining: 189ms
32:         learn: 0.2429558        total: 90.1ms       remaining: 186ms
33:         learn: 0.2385812        total: 112ms        remaining: 220ms
34:         learn: 0.2352366        total: 120ms        remaining: 226ms
35:         learn: 0.2324806        total: 122ms        remaining: 220ms
36:         learn: 0.2304970        total: 129ms        remaining: 223ms
37:         learn: 0.2262274        total: 135ms        remaining: 223ms
38:         learn: 0.2244523        total: 136ms        remaining: 216ms
39:         learn: 0.2220750        total: 142ms        remaining: 217ms
40:         learn: 0.2192362        total: 144ms        remaining: 210ms
41:         learn: 0.2168877        total: 145ms        remaining: 204ms
42:         learn: 0.2144069        total: 152ms        remaining: 205ms
43:         learn: 0.2122965        total: 154ms        remaining: 199ms
44:         learn: 0.2093489        total: 155ms        remaining: 193ms
45:         learn: 0.2072748        total: 162ms        remaining: 194ms
46:         learn: 0.2046084        total: 165ms        remaining: 190ms
47:         learn: 0.2033141        total: 167ms        remaining: 184ms
```

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47:     learn: 0.2033141      total: 167ms      remaining: 184ms
48:     learn: 0.2015288      total: 168ms      remaining: 179ms
49:     learn: 0.2004233      total: 170ms      remaining: 174ms
50:     learn: 0.1989516      total: 172ms      remaining: 169ms
51:     learn: 0.1976754      total: 174ms      remaining: 164ms
52:     learn: 0.1952749      total: 176ms      remaining: 159ms
53:     learn: 0.1927612      total: 180ms      remaining: 157ms
54:     learn: 0.1906855      total: 182ms      remaining: 152ms
55:     learn: 0.1885064      total: 184ms      remaining: 148ms
56:     learn: 0.1864202      total: 185ms      remaining: 143ms
57:     learn: 0.1827106      total: 187ms      remaining: 139ms
58:     learn: 0.1819010      total: 189ms      remaining: 134ms
59:     learn: 0.1804790      total: 190ms      remaining: 130ms
60:     learn: 0.1780918      total: 191ms      remaining: 126ms
61:     learn: 0.1774217      total: 194ms      remaining: 122ms
62:     learn: 0.1757112      total: 196ms      remaining: 118ms
63:     learn: 0.1740404      total: 197ms      remaining: 114ms
64:     learn: 0.1720227      total: 199ms      remaining: 110ms
65:     learn: 0.1711765      total: 200ms      remaining: 106ms
66:     learn: 0.1695874      total: 202ms      remaining: 103ms
67:     learn: 0.1684361      total: 204ms      remaining: 99.2ms
68:     learn: 0.1670060      total: 209ms      remaining: 96.9ms
69:     learn: 0.1652124      total: 220ms      remaining: 97.6ms
70:     learn: 0.1646158      total: 223ms      remaining: 94.3ms
71:     learn: 0.1632718      total: 228ms      remaining: 91.9ms
72:     learn: 0.1612215      total: 233ms      remaining: 89.2ms
73:     learn: 0.1587643      total: 237ms      remaining: 86.4ms
74:     learn: 0.1574289      total: 244ms      remaining: 84.7ms
75:     learn: 0.1559305      total: 249ms      remaining: 82ms
76:     learn: 0.1543368      total: 255ms      remaining: 79.5ms
77:     learn: 0.1526428      total: 258ms      remaining: 76ms
78:     learn: 0.1519207      total: 262ms      remaining: 73ms
79:     learn: 0.1510165      total: 266ms      remaining: 69.9ms
80:     learn: 0.1502317      total: 271ms      remaining: 67ms
81:     learn: 0.1484162      total: 274ms      remaining: 63.5ms
82:     learn: 0.1475950      total: 279ms      remaining: 60.6ms
83:     learn: 0.1466704      total: 282ms      remaining: 57.1ms
84:     learn: 0.1456657      total: 290ms      remaining: 54.6ms
85:     learn: 0.1438574      total: 296ms      remaining: 51.6ms
86:     learn: 0.1429933      total: 300ms      remaining: 48.3ms
87:     learn: 0.1421093      total: 302ms      remaining: 44.7ms
88:     learn: 0.1403521      total: 305ms      remaining: 41.1ms
89:     learn: 0.1393994      total: 307ms      remaining: 37.6ms
90:     learn: 0.1384658      total: 310ms      remaining: 34.1ms
91:     learn: 0.1375770      total: 312ms      remaining: 30.6ms
92:     learn: 0.1355416      total: 314ms      remaining: 27ms
93:     learn: 0.1345370      total: 316ms      remaining: 23.5ms
94:     learn: 0.1338282      total: 317ms      remaining: 20ms
95:     learn: 0.1325740      total: 319ms      remaining: 16.6ms
96:     learn: 0.1315600      total: 320ms      remaining: 13.2ms
97:     learn: 0.1309402      total: 322ms      remaining: 9.86ms
98:     learn: 0.1294202      total: 324ms      remaining: 6.54ms
99:     learn: 0.1284994      total: 328ms      remaining: 3.28ms
100:    learn: 0.1267951      total: 330ms      remaining: 0us
Learning rate set to 0.073232
```

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Learning rate set to 0.073232
0:      learn: 0.6306776       total: 4.45ms    remaining: 450ms
1:      learn: 0.5959585       total: 7.18ms    remaining: 359ms
2:      learn: 0.5464986       total: 9.53ms    remaining: 315ms
3:      learn: 0.5099448       total: 11.1ms    remaining: 272ms
4:      learn: 0.4730156       total: 12.6ms    remaining: 245ms
5:      learn: 0.4481020       total: 14.4ms    remaining: 230ms
6:      learn: 0.4240905       total: 16.2ms    remaining: 220ms
7:      learn: 0.4031528       total: 19.4ms    remaining: 228ms
8:      learn: 0.3895204       total: 22.5ms    remaining: 232ms
9:      learn: 0.3694548       total: 25.5ms    remaining: 234ms
10:     learn: 0.3568861       total: 27.2ms    remaining: 225ms
11:     learn: 0.3463660       total: 28.8ms    remaining: 216ms
12:     learn: 0.3348672       total: 31.2ms    remaining: 214ms
13:     learn: 0.3274125       total: 36.4ms    remaining: 229ms
14:     learn: 0.3166276       total: 42.7ms    remaining: 247ms
15:     learn: 0.3086514       total: 44.3ms    remaining: 238ms
16:     learn: 0.3047462       total: 49ms      remaining: 245ms
17:     learn: 0.2999245       total: 54.8ms    remaining: 256ms
18:     learn: 0.2943276       total: 56.3ms    remaining: 246ms
19:     learn: 0.2891973       total: 58.3ms    remaining: 239ms
20:     learn: 0.2822670       total: 61.8ms    remaining: 238ms
21:     learn: 0.2787880       total: 63.4ms    remaining: 230ms
22:     learn: 0.2743608       total: 64.8ms    remaining: 223ms
23:     learn: 0.2701459       total: 71.7ms    remaining: 233ms
24:     learn: 0.2675972       total: 73.3ms    remaining: 226ms
25:     learn: 0.2646583       total: 74.8ms    remaining: 219ms
26:     learn: 0.2637197       total: 78.1ms    remaining: 217ms
27:     learn: 0.2616138       total: 79.8ms    remaining: 211ms
28:     learn: 0.2584606       total: 84.9ms    remaining: 214ms
29:     learn: 0.2544083       total: 86.6ms    remaining: 208ms
30:     learn: 0.2511823       total: 88.2ms    remaining: 202ms
31:     learn: 0.2473095       total: 89.8ms    remaining: 196ms
32:     learn: 0.2437748       total: 91.5ms    remaining: 191ms
33:     learn: 0.2393991       total: 93.7ms    remaining: 187ms
34:     learn: 0.2360552       total: 95.6ms    remaining: 183ms
35:     learn: 0.2333152       total: 97.2ms    remaining: 178ms
36:     learn: 0.2313338       total: 98.7ms    remaining: 173ms
37:     learn: 0.2270544       total: 100ms     remaining: 169ms
38:     learn: 0.2252728       total: 102ms     remaining: 166ms
39:     learn: 0.2228976       total: 104ms     remaining: 162ms
40:     learn: 0.2200693       total: 106ms     remaining: 157ms
41:     learn: 0.2177270       total: 107ms     remaining: 153ms
42:     learn: 0.2152501       total: 109ms     remaining: 149ms
43:     learn: 0.2131508       total: 110ms     remaining: 145ms
44:     learn: 0.2102037       total: 112ms     remaining: 142ms
45:     learn: 0.2081268       total: 114ms     remaining: 139ms
46:     learn: 0.2054630       total: 116ms     remaining: 136ms
47:     learn: 0.2041729       total: 117ms     remaining: 132ms
48:     learn: 0.2023847       total: 119ms     remaining: 129ms
49:     learn: 0.2012812       total: 120ms     remaining: 125ms
50:     learn: 0.1998121       total: 123ms     remaining: 123ms
51:     learn: 0.1985311       total: 124ms     remaining: 119ms
52:     learn: 0.1961375       total: 126ms     remaining: 116ms
53:     learn: 0.1936396       total: 128ms     remaining: 113ms
```

```
53:       learn: 0.1936306      total: 128ms      remaining: 113ms
54:       learn: 0.1915599      total: 130ms      remaining: 111ms
55:       learn: 0.1893794      total: 131ms      remaining: 108ms
56:       learn: 0.1872946      total: 132ms      remaining: 105ms
57:       learn: 0.1835894      total: 134ms      remaining: 102ms
58:       learn: 0.1827787      total: 135ms      remaining: 98.7ms
59:       learn: 0.1813583      total: 138ms      remaining: 96.4ms
60:       learn: 0.1789777      total: 140ms      remaining: 93.9ms
61:       learn: 0.1783073      total: 141ms      remaining: 91.1ms
62:       learn: 0.1765993      total: 143ms      remaining: 88.3ms
63:       learn: 0.1749274      total: 144ms      remaining: 85.6ms
64:       learn: 0.1729127      total: 146ms      remaining: 83ms
65:       learn: 0.1720640      total: 148ms      remaining: 80.7ms
66:       learn: 0.1704742      total: 151ms      remaining: 79ms
67:       learn: 0.1693218      total: 156ms      remaining: 78.1ms
68:       learn: 0.1678910      total: 160ms      remaining: 76.6ms
69:       learn: 0.1661012      total: 165ms      remaining: 75.2ms
70:       learn: 0.1655113      total: 169ms      remaining: 73.8ms
71:       learn: 0.1641670      total: 173ms      remaining: 72.2ms
72:       learn: 0.1615265      total: 177ms      remaining: 70.5ms
73:       learn: 0.1593715      total: 182ms      remaining: 68.7ms
74:       learn: 0.1574948      total: 186ms      remaining: 66.9ms
75:       learn: 0.1560128      total: 191ms      remaining: 65.3ms
76:       learn: 0.1547959      total: 195ms      remaining: 63.2ms
77:       learn: 0.1531323      total: 200ms      remaining: 61.4ms
78:       learn: 0.1524082      total: 203ms      remaining: 59.2ms
79:       learn: 0.1514721      total: 206ms      remaining: 56.6ms
80:       learn: 0.1506804      total: 210ms      remaining: 54.4ms
81:       learn: 0.1488994      total: 214ms      remaining: 52.2ms
82:       learn: 0.1481226      total: 218ms      remaining: 49.9ms
83:       learn: 0.1465290      total: 222ms      remaining: 47.6ms
84:       learn: 0.1458255      total: 228ms      remaining: 45.6ms
85:       learn: 0.1440187      total: 231ms      remaining: 42.9ms
86:       learn: 0.1424909      total: 235ms      remaining: 40.6ms
87:       learn: 0.1416418      total: 239ms      remaining: 38.1ms
88:       learn: 0.1399262      total: 243ms      remaining: 35.6ms
89:       learn: 0.1389818      total: 248ms      remaining: 33ms
90:       learn: 0.1375179      total: 252ms      remaining: 30.4ms
91:       learn: 0.1369317      total: 256ms      remaining: 27.9ms
92:       learn: 0.1351418      total: 262ms      remaining: 25.3ms
93:       learn: 0.1340972      total: 266ms      remaining: 22.7ms
94:       learn: 0.1333789      total: 270ms      remaining: 19.9ms
95:       learn: 0.1321673      total: 277ms      remaining: 17.3ms
96:       learn: 0.1315645      total: 282ms      remaining: 14.5ms
97:       learn: 0.1312275      total: 286ms      remaining: 11.7ms
98:       learn: 0.1304250      total: 291ms      remaining: 8.8ms
99:       learn: 0.1295204      total: 295ms      remaining: 5.9ms
100:      learn: 0.1284390      total: 300ms      remaining: 2.97ms
101:      learn: 0.1274716      total: 304ms      remaining: 0us
Learning rate set to 0.07258
0:        learn: 0.6311942      total: 2.37ms     remaining: 242ms
1:        learn: 0.5966991      total: 7.73ms     remaining: 390ms
2:        learn: 0.5475147      total: 11.7ms     remaining: 390ms
3:        learn: 0.5110971      total: 15.7ms     remaining: 390ms
4:        learn: 0.4742631      total: 22.2ms     remaining: 456ms
```

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4:       learn: 0.4742621       total: 23.3ms     remaining: 456ms
5:       learn: 0.4493904       total: 25.7ms     remaining: 416ms
6:       learn: 0.4253924       total: 29.9ms     remaining: 410ms
7:       learn: 0.4044340       total: 33.9ms     remaining: 403ms
8:       learn: 0.3907649       total: 37.9ms     remaining: 396ms
9:       learn: 0.3706686       total: 42.2ms     remaining: 393ms
10:      learn: 0.3580874       total: 46.4ms     remaining: 388ms
11:      learn: 0.3475279       total: 50.3ms     remaining: 382ms
12:      learn: 0.3359974       total: 54.5ms     remaining: 377ms
13:      learn: 0.3285281       total: 60.3ms     remaining: 384ms
14:      learn: 0.3176921       total: 63.4ms     remaining: 372ms
15:      learn: 0.3096678       total: 66.1ms     remaining: 360ms
16:      learn: 0.3057336       total: 71ms       remaining: 359ms
17:      learn: 0.3018720       total: 77.1ms     remaining: 364ms
18:      learn: 0.2961765       total: 79.6ms     remaining: 352ms
19:      learn: 0.2909587       total: 85.1ms     remaining: 353ms
20:      learn: 0.2839310       total: 88ms       remaining: 344ms
21:      learn: 0.2803849       total: 92.6ms     remaining: 341ms
22:      learn: 0.2757693       total: 96.9ms     remaining: 337ms
23:      learn: 0.2714344       total: 105ms      remaining: 346ms
24:      learn: 0.2688277       total: 109ms      remaining: 341ms
25:      learn: 0.2658905       total: 115ms      remaining: 340ms
26:      learn: 0.2646685       total: 119ms      remaining: 334ms
27:      learn: 0.2625647       total: 123ms      remaining: 330ms
28:      learn: 0.2593632       total: 133ms      remaining: 339ms
29:      learn: 0.2552833       total: 138ms      remaining: 336ms
30:      learn: 0.2520761       total: 141ms      remaining: 329ms
31:      learn: 0.2482187       total: 145ms      remaining: 322ms
32:      learn: 0.2465468       total: 150ms      remaining: 318ms
33:      learn: 0.2419755       total: 154ms      remaining: 313ms
34:      learn: 0.2385619       total: 158ms      remaining: 308ms
35:      learn: 0.2358259       total: 163ms      remaining: 303ms
36:      learn: 0.2338196       total: 167ms      remaining: 298ms
37:      learn: 0.2293266       total: 173ms      remaining: 297ms
38:      learn: 0.2281220       total: 176ms      remaining: 289ms
39:      learn: 0.2259441       total: 179ms      remaining: 282ms
40:      learn: 0.2228519       total: 184ms      remaining: 278ms
41:      learn: 0.2208522       total: 187ms      remaining: 272ms
42:      learn: 0.2184760       total: 192ms      remaining: 268ms
43:      learn: 0.2151429       total: 198ms      remaining: 266ms
44:      learn: 0.2117639       total: 205ms      remaining: 264ms
45:      learn: 0.2084047       total: 209ms      remaining: 258ms
46:      learn: 0.2065649       total: 211ms      remaining: 252ms
47:      learn: 0.2052697       total: 215ms      remaining: 247ms
48:      learn: 0.2034302       total: 219ms      remaining: 242ms
49:      learn: 0.2023760       total: 223ms      remaining: 237ms
50:      learn: 0.2004845       total: 228ms      remaining: 232ms
51:      learn: 0.1983353       total: 232ms      remaining: 227ms
52:      learn: 0.1969789       total: 236ms      remaining: 223ms
53:      learn: 0.1944239       total: 243ms      remaining: 221ms
54:      learn: 0.1924776       total: 247ms      remaining: 216ms
55:      learn: 0.1895943       total: 251ms      remaining: 211ms
56:      learn: 0.1875781       total: 256ms      remaining: 206ms
57:      learn: 0.1864892       total: 260ms      remaining: 202ms
```

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58:      learn: 0.1854295      total: 264ms     remaining: 197ms
59:      learn: 0.1838344      total: 268ms     remaining: 192ms
60:      learn: 0.1815072      total: 272ms     remaining: 188ms
61:      learn: 0.1808520      total: 277ms     remaining: 183ms
62:      learn: 0.1780902      total: 281ms     remaining: 178ms
63:      learn: 0.1764968      total: 285ms     remaining: 174ms
64:      learn: 0.1744860      total: 289ms     remaining: 169ms
65:      learn: 0.1736310      total: 294ms     remaining: 165ms
66:      learn: 0.1719541      total: 298ms     remaining: 160ms
67:      learn: 0.1708289      total: 302ms     remaining: 156ms
68:      learn: 0.1693809      total: 307ms     remaining: 151ms
69:      learn: 0.1676614      total: 311ms     remaining: 146ms
70:      learn: 0.1668669      total: 315ms     remaining: 142ms
71:      learn: 0.1655421      total: 319ms     remaining: 137ms
72:      learn: 0.1638151      total: 334ms     remaining: 137ms
73:      learn: 0.1613536      total: 337ms     remaining: 132ms
74:      learn: 0.1594946      total: 343ms     remaining: 128ms
75:      learn: 0.1578660      total: 346ms     remaining: 123ms
76:      learn: 0.1566241      total: 350ms     remaining: 118ms
77:      learn: 0.1552275      total: 355ms     remaining: 114ms
78:      learn: 0.1536739      total: 363ms     remaining: 110ms
79:      learn: 0.1526853      total: 372ms     remaining: 107ms
80:      learn: 0.1518842      total: 378ms     remaining: 103ms
81:      learn: 0.1502025      total: 380ms     remaining: 97.4ms
82:      learn: 0.1490693      total: 385ms     remaining: 92.8ms
83:      learn: 0.1474911      total: 390ms     remaining: 88.1ms
84:      learn: 0.1467333      total: 394ms     remaining: 83.5ms
85:      learn: 0.1456367      total: 399ms     remaining: 78.8ms
86:      learn: 0.1447098      total: 430ms     remaining: 79.1ms
87:      learn: 0.1434984      total: 441ms     remaining: 75.2ms
88:      learn: 0.1418737      total: 445ms     remaining: 70.1ms
89:      learn: 0.1406340      total: 449ms     remaining: 64.9ms
90:      learn: 0.1390918      total: 456ms     remaining: 60.1ms
91:      learn: 0.1389638      total: 457ms     remaining: 54.6ms
92:      learn: 0.1384642      total: 464ms     remaining: 49.9ms
93:      learn: 0.1383989      total: 465ms     remaining: 44.5ms
94:      learn: 0.1370513      total: 467ms     remaining: 39.3ms
95:      learn: 0.1353381      total: 479ms     remaining: 34.9ms
96:      learn: 0.1337101      total: 484ms     remaining: 29.9ms
97:      learn: 0.1328782      total: 489ms     remaining: 25ms
98:      learn: 0.1314244      total: 495ms     remaining: 20ms
99:      learn: 0.1311624      total: 503ms     remaining: 15.1ms
100:     learn: 0.1305753      total: 507ms     remaining: 10ms
101:     learn: 0.1297241      total: 511ms     remaining: 5.01ms
102:     learn: 0.1289592      total: 518ms     remaining: 0us
Learning rate set to 0.071939
0:       learn: 0.6317026      total: 2.87ms    remaining: 296ms
1:       learn: 0.5974267      total: 6.93ms    remaining: 353ms
2:       learn: 0.5485163      total: 8.84ms    remaining: 298ms
3:       learn: 0.5122366      total: 13.2ms    remaining: 331ms
4:       learn: 0.4754970      total: 19.9ms    remaining: 394ms
5:       learn: 0.4506682      total: 27.7ms    remaining: 452ms
6:       learn: 0.4266849      total: 29.9ms    remaining: 415ms
7:       learn: 0.4057075      total: 36.4ms    remaining: 437ms
```

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8:      learn: 0.3920026    total: 38.4ms    remaining: 405ms
9:      learn: 0.3718768    total: 40.2ms    remaining: 378ms
10:     learn: 0.3592829    total: 42ms      remaining: 355ms
11:     learn: 0.3486856    total: 49.5ms    remaining: 379ms
12:     learn: 0.3371241    total: 52.1ms    remaining: 365ms
13:     learn: 0.3296399    total: 55.2ms    remaining: 355ms
14:     learn: 0.3187535    total: 61.1ms    remaining: 362ms
15:     learn: 0.3106817    total: 66ms      remaining: 363ms
16:     learn: 0.3067181    total: 70.5ms    remaining: 361ms
17:     learn: 0.3028318    total: 75ms      remaining: 358ms
18:     learn: 0.2971157    total: 79.6ms    remaining: 356ms
19:     learn: 0.2918823    total: 95.1ms    remaining: 399ms
20:     learn: 0.2848356    total: 108ms     remaining: 429ms
21:     learn: 0.2812815    total: 111ms     remaining: 415ms
22:     learn: 0.2766401    total: 117ms     remaining: 410ms
23:     learn: 0.2722893    total: 121ms     remaining: 403ms
24:     learn: 0.2696652    total: 136ms     remaining: 431ms
25:     learn: 0.2667269    total: 141ms     remaining: 422ms
26:     learn: 0.2654927    total: 145ms     remaining: 415ms
27:     learn: 0.2613442    total: 155ms     remaining: 420ms
28:     learn: 0.2582206    total: 159ms     remaining: 412ms
29:     learn: 0.2513880    total: 164ms     remaining: 403ms
30:     learn: 0.2482487    total: 168ms     remaining: 395ms
31:     learn: 0.2445231    total: 172ms     remaining: 387ms
32:     learn: 0.2428680    total: 177ms     remaining: 380ms
33:     learn: 0.2388558    total: 183ms     remaining: 378ms
34:     learn: 0.2345206    total: 194ms     remaining: 383ms
35:     learn: 0.2318769    total: 198ms     remaining: 374ms
36:     learn: 0.2299895    total: 201ms     remaining: 363ms
37:     learn: 0.2252738    total: 207ms     remaining: 359ms
38:     learn: 0.2240073    total: 211ms     remaining: 352ms
39:     learn: 0.2217555    total: 224ms     remaining: 359ms
40:     learn: 0.2176381    total: 227ms     remaining: 349ms
41:     learn: 0.2157316    total: 232ms     remaining: 342ms
42:     learn: 0.2125061    total: 236ms     remaining: 335ms
43:     learn: 0.2102272    total: 240ms     remaining: 327ms
44:     learn: 0.2071281    total: 247ms     remaining: 324ms
45:     learn: 0.2039120    total: 250ms     remaining: 316ms
46:     learn: 0.2020452    total: 255ms     remaining: 309ms
47:     learn: 0.2006047    total: 264ms     remaining: 308ms
48:     learn: 0.1988547    total: 269ms     remaining: 302ms
49:     learn: 0.1979458    total: 271ms     remaining: 293ms
50:     learn: 0.1960689    total: 277ms     remaining: 288ms
51:     learn: 0.1940618    total: 279ms     remaining: 279ms
52:     learn: 0.1928615    total: 284ms     remaining: 273ms
53:     learn: 0.1902998    total: 288ms     remaining: 267ms
54:     learn: 0.1883339    total: 293ms     remaining: 261ms
55:     learn: 0.1859836    total: 297ms     remaining: 254ms
56:     learn: 0.1840397    total: 301ms     remaining: 248ms
57:     learn: 0.1820326    total: 306ms     remaining: 242ms
58:     learn: 0.1809744    total: 310ms     remaining: 237ms
59:     learn: 0.1794983    total: 314ms     remaining: 231ms
60:     learn: 0.1779243    total: 319ms     remaining: 225ms
61:     learn: 0.1773120    total: 323ms     remaining: 219ms
```

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62:      learn: 0.1738815      total: 327ms      remaining: 213ms
63:      learn: 0.1723783      total: 331ms      remaining: 207ms
64:      learn: 0.1697466      total: 335ms      remaining: 201ms
65:      learn: 0.1689821      total: 339ms      remaining: 195ms
66:      learn: 0.1673041      total: 344ms      remaining: 190ms
67:      learn: 0.1662224      total: 348ms      remaining: 184ms
68:      learn: 0.1648001      total: 353ms      remaining: 179ms
69:      learn: 0.1631051      total: 359ms      remaining: 174ms
70:      learn: 0.1623498      total: 362ms      remaining: 168ms
71:      learn: 0.1609648      total: 369ms      remaining: 164ms
72:      learn: 0.1597123      total: 371ms      remaining: 158ms
73:      learn: 0.1581485      total: 376ms      remaining: 153ms
74:      learn: 0.1567447      total: 381ms      remaining: 147ms
75:      learn: 0.1553530      total: 385ms      remaining: 142ms
76:      learn: 0.1542051      total: 391ms      remaining: 137ms
77:      learn: 0.1525588      total: 407ms      remaining: 136ms
78:      learn: 0.1521576      total: 412ms      remaining: 130ms
79:      learn: 0.1512825      total: 415ms      remaining: 125ms
80:      learn: 0.1504837      total: 420ms      remaining: 119ms
81:      learn: 0.1484105      total: 424ms      remaining: 114ms
82:      learn: 0.1473140      total: 445ms      remaining: 112ms
83:      learn: 0.1463160      total: 451ms      remaining: 107ms
84:      learn: 0.1453484      total: 461ms      remaining: 103ms
85:      learn: 0.1436881      total: 466ms      remaining: 97.4ms
86:      learn: 0.1427537      total: 471ms      remaining: 92ms
87:      learn: 0.1416059      total: 484ms      remaining: 88ms
88:      learn: 0.1407040      total: 495ms      remaining: 83.4ms
89:      learn: 0.1395258      total: 501ms      remaining: 77.9ms
90:      learn: 0.1385345      total: 508ms      remaining: 72.5ms
91:      learn: 0.1379389      total: 510ms      remaining: 66.5ms
92:      learn: 0.1362780      total: 513ms      remaining: 60.7ms
93:      learn: 0.1352761      total: 516ms      remaining: 54.9ms
94:      learn: 0.1340905      total: 518ms      remaining: 49ms
95:      learn: 0.1333652      total: 520ms      remaining: 43.4ms
96:      learn: 0.1318368      total: 525ms      remaining: 37.9ms
97:      learn: 0.1314541      total: 529ms      remaining: 32.4ms
98:      learn: 0.1299942      total: 533ms      remaining: 26.9ms
99:      learn: 0.1292762      total: 537ms      remaining: 21.5ms
100:     learn: 0.1278341      total: 539ms      remaining: 16ms
101:     learn: 0.1268493      total: 541ms      remaining: 10.6ms
102:     learn: 0.1255223      total: 543ms      remaining: 5.27ms
103:     learn: 0.1248763      total: 545ms      remaining: 0us
Learning rate set to 0.071311
0:       learn: 0.6322020      total: 2.13ms     remaining: 221ms
1:       learn: 0.5981426      total: 4.71ms     remaining: 242ms
2:       learn: 0.5495026      total: 10.6ms     remaining: 361ms
3:       learn: 0.5133591      total: 14.7ms     remaining: 371ms
4:       learn: 0.4767167      total: 26.8ms     remaining: 535ms
5:       learn: 0.4519302      total: 29.5ms     remaining: 487ms
6:       learn: 0.4279635      total: 32.8ms     remaining: 460ms
7:       learn: 0.4069685      total: 43.3ms     remaining: 526ms
8:       learn: 0.3932292      total: 47.1ms     remaining: 502ms
9:       learn: 0.3730756      total: 62.3ms     remaining: 592ms
10:      learn: 0.3604682      total: 75.1ms     remaining: 642ms
```

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11:     learn: 0.3498344      total: 90ms      remaining: 698ms
12:     learn: 0.3382424      total: 92.7ms    remaining: 656ms
13:     learn: 0.3307444      total: 97.2ms    remaining: 632ms
14:     learn: 0.3198078      total: 109ms     remaining: 653ms
15:     learn: 0.3116888      total: 112ms     remaining: 624ms
16:     learn: 0.3076967      total: 116ms     remaining: 598ms
17:     learn: 0.3037856      total: 126ms     remaining: 607ms
18:     learn: 0.2980490      total: 135ms     remaining: 610ms
19:     learn: 0.2928001      total: 147ms     remaining: 623ms
20:     learn: 0.2857343      total: 161ms     remaining: 643ms
21:     learn: 0.2821718      total: 164ms     remaining: 619ms
22:     learn: 0.2757349      total: 175ms     remaining: 625ms
23:     learn: 0.2714602      total: 178ms     remaining: 601ms
24:     learn: 0.2688427      total: 182ms     remaining: 583ms
25:     learn: 0.2657347      total: 191ms     remaining: 581ms
26:     learn: 0.2645189      total: 194ms     remaining: 560ms
27:     learn: 0.2624305      total: 204ms     remaining: 561ms
28:     learn: 0.2592059      total: 208ms     remaining: 545ms
29:     learn: 0.2555585      total: 214ms     remaining: 534ms
30:     learn: 0.2530282      total: 227ms     remaining: 542ms
31:     learn: 0.2491963      total: 236ms     remaining: 538ms
32:     learn: 0.2457597      total: 241ms     remaining: 525ms
33:     learn: 0.2414771      total: 248ms     remaining: 519ms
34:     learn: 0.2369467      total: 258ms     remaining: 515ms
35:     learn: 0.2343520      total: 260ms     remaining: 499ms
36:     learn: 0.2324742      total: 267ms     remaining: 491ms
37:     learn: 0.2281510      total: 275ms     remaining: 485ms
38:     learn: 0.2262455      total: 280ms     remaining: 473ms
39:     learn: 0.2241206      total: 290ms     remaining: 470ms
40:     learn: 0.2210699      total: 294ms     remaining: 459ms
41:     learn: 0.2187766      total: 306ms     remaining: 458ms
42:     learn: 0.2163538      total: 308ms     remaining: 445ms
43:     learn: 0.2150051      total: 313ms     remaining: 434ms
44:     learn: 0.2120564      total: 324ms     remaining: 432ms
45:     learn: 0.2086340      total: 327ms     remaining: 419ms
46:     learn: 0.2064908      total: 337ms     remaining: 416ms
47:     learn: 0.2052014      total: 346ms     remaining: 411ms
48:     learn: 0.2034620      total: 350ms     remaining: 400ms
49:     learn: 0.2024103      total: 355ms     remaining: 391ms
50:     learn: 0.2010520      total: 359ms     remaining: 380ms
51:     learn: 0.1989078      total: 361ms     remaining: 368ms
52:     learn: 0.1965908      total: 366ms     remaining: 359ms
53:     learn: 0.1941115      total: 373ms     remaining: 352ms
54:     learn: 0.1921054      total: 384ms     remaining: 349ms
55:     learn: 0.1899669      total: 387ms     remaining: 338ms
56:     learn: 0.1878523      total: 393ms     remaining: 331ms
57:     learn: 0.1842475      total: 403ms     remaining: 326ms
58:     learn: 0.1834495      total: 406ms     remaining: 316ms
59:     learn: 0.1821321      total: 415ms     remaining: 312ms
60:     learn: 0.1798229      total: 418ms     remaining: 302ms
61:     learn: 0.1793962      total: 423ms     remaining: 293ms
62:     learn: 0.1758670      total: 436ms     remaining: 290ms
63:     learn: 0.1742132      total: 439ms     remaining: 281ms
64:     learn: 0.1726778      total: 451ms     remaining: 277ms
```

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65:      learn: 0.1718353        total: 453ms    remaining: 268ms
66:      learn: 0.1702102        total: 458ms    remaining: 260ms
67:      learn: 0.1692375        total: 464ms    remaining: 252ms
68:      learn: 0.1671537        total: 467ms    remaining: 244ms
69:      learn: 0.1654997        total: 469ms    remaining: 234ms
70:      learn: 0.1648782        total: 471ms    remaining: 226ms
71:      learn: 0.1635453        total: 474ms    remaining: 217ms
72:      learn: 0.1622664        total: 477ms    remaining: 209ms
73:      learn: 0.1604245        total: 479ms    remaining: 201ms
74:      learn: 0.1590887        total: 482ms    remaining: 193ms
75:      learn: 0.1581584        total: 486ms    remaining: 185ms
76:      learn: 0.1572154        total: 494ms    remaining: 180ms
77:      learn: 0.1555982        total: 496ms    remaining: 172ms
78:      learn: 0.1540894        total: 498ms    remaining: 164ms
79:      learn: 0.1533156        total: 512ms    remaining: 160ms
80:      learn: 0.1524727        total: 514ms    remaining: 152ms
81:      learn: 0.1512443        total: 517ms    remaining: 145ms
82:      learn: 0.1504335        total: 528ms    remaining: 140ms
83:      learn: 0.1489011        total: 538ms    remaining: 134ms
84:      learn: 0.1483859        total: 541ms    remaining: 127ms
85:      learn: 0.1466854        total: 550ms    remaining: 122ms
86:      learn: 0.1457865        total: 553ms    remaining: 114ms
87:      learn: 0.1449273        total: 557ms    remaining: 108ms
88:      learn: 0.1445951        total: 569ms    remaining: 102ms
89:      learn: 0.1436147        total: 577ms    remaining: 96.1ms
90:      learn: 0.1422321        total: 587ms    remaining: 90.3ms
91:      learn: 0.1421015        total: 592ms    remaining: 83.6ms
92:      learn: 0.1416674        total: 606ms    remaining: 78.2ms
93:      learn: 0.1403036        total: 615ms    remaining: 71.9ms
94:      learn: 0.1394683        total: 625ms    remaining: 65.8ms
95:      learn: 0.1385354        total: 628ms    remaining: 58.9ms
96:      learn: 0.1376381        total: 640ms    remaining: 52.8ms
97:      learn: 0.1364194        total: 642ms    remaining: 45.9ms
98:      learn: 0.1356235        total: 647ms    remaining: 39.2ms
99:      learn: 0.1346599        total: 658ms    remaining: 32.9ms
100:     learn: 0.1341532        total: 660ms    remaining: 26.2ms
101:     learn: 0.1334161        total: 670ms    remaining: 19.7ms
102:     learn: 0.1321458        total: 673ms    remaining: 13.1ms
103:     learn: 0.1316272        total: 683ms    remaining: 6.57ms
104:     learn: 0.1308188        total: 686ms    remaining: 0us
Learning rate set to 0.070694
0:       learn: 0.6326930        total: 4.37ms   remaining: 459ms
1:       learn: 0.5988488        total: 13.9ms   remaining: 722ms
2:       learn: 0.5504758        total: 20ms     remaining: 687ms
3:       learn: 0.5144693        total: 25ms     remaining: 637ms
4:       learn: 0.4779228        total: 27.7ms   remaining: 559ms
5:       learn: 0.4531804        total: 32.4ms   remaining: 539ms
6:       learn: 0.4292316        total: 37.7ms   remaining: 533ms
7:       learn: 0.4082197        total: 40.5ms   remaining: 496ms
8:       learn: 0.3944478        total: 45.2ms   remaining: 487ms
9:       learn: 0.3742669        total: 49.4ms   remaining: 475ms
10:      learn: 0.3616473        total: 53.6ms   remaining: 463ms
11:      learn: 0.3509775        total: 77.5ms   remaining: 607ms
12:      learn: 0.3393554        total: 97.7ms   remaining: 699ms
```

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13:     learn: 0.3296461     total: 101ms     remaining: 666ms
14:     learn: 0.3225481     total: 106ms     remaining: 644ms
15:     learn: 0.3141502     total: 111ms     remaining: 622ms
16:     learn: 0.3102659     total: 115ms     remaining: 601ms
17:     learn: 0.3061660     total: 119ms     remaining: 583ms
18:     learn: 0.3022923     total: 124ms     remaining: 567ms
19:     learn: 0.2966117     total: 128ms     remaining: 551ms
20:     learn: 0.2875744     total: 132ms     remaining: 535ms
21:     learn: 0.2832266     total: 136ms     remaining: 521ms
22:     learn: 0.2784532     total: 141ms     remaining: 508ms
23:     learn: 0.2739031     total: 145ms     remaining: 495ms
24:     learn: 0.2711081     total: 149ms     remaining: 484ms
25:     learn: 0.2680077     total: 162ms     remaining: 499ms
26:     learn: 0.2667034     total: 167ms     remaining: 487ms
27:     learn: 0.2628592     total: 171ms     remaining: 477ms
28:     learn: 0.2597806     total: 176ms     remaining: 467ms
29:     learn: 0.2559118     total: 181ms     remaining: 459ms
30:     learn: 0.2532402     total: 184ms     remaining: 445ms
31:     learn: 0.2493436     total: 189ms     remaining: 437ms
32:     learn: 0.2465499     total: 194ms     remaining: 429ms
33:     learn: 0.2423006     total: 198ms     remaining: 420ms
34:     learn: 0.2378204     total: 203ms     remaining: 411ms
35:     learn: 0.2351509     total: 207ms     remaining: 402ms
36:     learn: 0.2332227     total: 213ms     remaining: 398ms
37:     learn: 0.2303305     total: 216ms     remaining: 387ms
38:     learn: 0.2283133     total: 220ms     remaining: 378ms
39:     learn: 0.2265186     total: 227ms     remaining: 374ms
40:     learn: 0.2236951     total: 234ms     remaining: 371ms
41:     learn: 0.2215077     total: 241ms     remaining: 367ms
42:     learn: 0.2189636     total: 243ms     remaining: 357ms
43:     learn: 0.2176487     total: 249ms     remaining: 351ms
44:     learn: 0.2145302     total: 254ms     remaining: 344ms
45:     learn: 0.2111845     total: 258ms     remaining: 337ms
46:     learn: 0.2080963     total: 264ms     remaining: 332ms
47:     learn: 0.2068293     total: 267ms     remaining: 323ms
48:     learn: 0.2049545     total: 271ms     remaining: 316ms
49:     learn: 0.2039912     total: 275ms     remaining: 308ms
50:     learn: 0.2023483     total: 280ms     remaining: 301ms
51:     learn: 0.2010553     total: 284ms     remaining: 294ms
52:     learn: 0.1987192     total: 288ms     remaining: 288ms
53:     learn: 0.1962269     total: 293ms     remaining: 282ms
54:     learn: 0.1941961     total: 297ms     remaining: 275ms
55:     learn: 0.1923526     total: 300ms     remaining: 268ms
56:     learn: 0.1902471     total: 305ms     remaining: 262ms
57:     learn: 0.1879204     total: 309ms     remaining: 256ms
58:     learn: 0.1868491     total: 313ms     remaining: 249ms
59:     learn: 0.1857638     total: 317ms     remaining: 243ms
60:     learn: 0.1840865     total: 321ms     remaining: 237ms
61:     learn: 0.1836310     total: 325ms     remaining: 231ms
62:     learn: 0.1799732     total: 330ms     remaining: 225ms
63:     learn: 0.1783353     total: 334ms     remaining: 219ms
64:     learn: 0.1763485     total: 339ms     remaining: 214ms
65:     learn: 0.1755431     total: 343ms     remaining: 208ms
66:     learn: 0.1738428     total: 347ms     remaining: 202ms
```

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67:       learn: 0.1728276        total: 350ms    remaining: 196ms
68:       learn: 0.1704651        total: 364ms    remaining: 195ms
69:       learn: 0.1686409        total: 366ms    remaining: 188ms
70:       learn: 0.1680088        total: 370ms    remaining: 183ms
71:       learn: 0.1666272        total: 373ms    remaining: 176ms
72:       learn: 0.1645182        total: 376ms    remaining: 170ms
73:       learn: 0.1626728        total: 384ms    remaining: 166ms
74:       learn: 0.1610132        total: 386ms    remaining: 159ms
75:       learn: 0.1591604        total: 388ms    remaining: 153ms
76:       learn: 0.1579893        total: 398ms    remaining: 150ms
77:       learn: 0.1565170        total: 409ms    remaining: 147ms
78:       learn: 0.1558243        total: 418ms    remaining: 143ms
79:       learn: 0.1550765        total: 423ms    remaining: 137ms
80:       learn: 0.1538443        total: 436ms    remaining: 134ms
81:       learn: 0.1520464        total: 439ms    remaining: 129ms
82:       learn: 0.1511683        total: 441ms    remaining: 122ms
83:       learn: 0.1502331        total: 451ms    remaining: 118ms
84:       learn: 0.1490065        total: 459ms    remaining: 113ms
85:       learn: 0.1478831        total: 465ms    remaining: 108ms
86:       learn: 0.1470134        total: 468ms    remaining: 102ms
87:       learn: 0.1460295        total: 474ms    remaining: 97ms
88:       learn: 0.1448782        total: 476ms    remaining: 91ms
89:       learn: 0.1438618        total: 483ms    remaining: 85.8ms
90:       learn: 0.1429114        total: 485ms    remaining: 79.9ms
91:       learn: 0.1422235        total: 487ms    remaining: 74.1ms
92:       learn: 0.1403695        total: 494ms    remaining: 69.1ms
93:       learn: 0.1393115        total: 496ms    remaining: 63.3ms
94:       learn: 0.1387733        total: 499ms    remaining: 57.7ms
95:       learn: 0.1376425        total: 502ms    remaining: 52.3ms
96:       learn: 0.1369850        total: 508ms    remaining: 47.2ms
97:       learn: 0.1367709        total: 510ms    remaining: 41.7ms
98:       learn: 0.1354889        total: 512ms    remaining: 36.2ms
99:       learn: 0.1348466        total: 520ms    remaining: 31.2ms
100:      learn: 0.1331356        total: 539ms    remaining: 26.7ms
101:      learn: 0.1324060        total: 543ms    remaining: 21.3ms
102:      learn: 0.1314034        total: 548ms    remaining: 16ms
103:      learn: 0.1309221        total: 553ms    remaining: 10.6ms
104:      learn: 0.1302352        total: 560ms    remaining: 5.33ms
105:      learn: 0.1299535        total: 565ms    remaining: 0us
Learning rate set to 0.070088
0:        learn: 0.6331763        total: 2.42ms   remaining: 257ms
1:        learn: 0.5995431        total: 6.34ms   remaining: 333ms
2:        learn: 0.5514355        total: 12.8ms   remaining: 443ms
3:        learn: 0.5155648        total: 25.2ms   remaining: 648ms
4:        learn: 0.4791158        total: 31.8ms   remaining: 648ms
5:        learn: 0.4544186        total: 46.3ms   remaining: 779ms
6:        learn: 0.4304883        total: 48.7ms   remaining: 696ms
7:        learn: 0.4094613        total: 53ms     remaining: 656ms
8:        learn: 0.3956577        total: 57.4ms   remaining: 625ms
9:        learn: 0.3754515        total: 72.4ms   remaining: 703ms
10:       learn: 0.3628197        total: 76.8ms   remaining: 670ms
11:       learn: 0.3521139        total: 79.7ms   remaining: 631ms
12:       learn: 0.3404626        total: 84.2ms   remaining: 609ms
13:       learn: 0.3329384        total: 88.7ms   remaining: 589ms
```

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14:     learn: 0.3258527     total: 93.7ms     remaining: 574ms
15:     learn: 0.3172249     total: 96.9ms     remaining: 551ms
16:     learn: 0.3133727     total: 101ms      remaining: 537ms
17:     learn: 0.3090709     total: 106ms      remaining: 522ms
18:     learn: 0.3049903     total: 110ms      remaining: 508ms
19:     learn: 0.2994874     total: 123ms      remaining: 536ms
20:     learn: 0.2901661     total: 126ms      remaining: 516ms
21:     learn: 0.2846539     total: 131ms      remaining: 506ms
22:     learn: 0.2830099     total: 134ms      remaining: 490ms
23:     learn: 0.2777912     total: 138ms      remaining: 476ms
24:     learn: 0.2741095     total: 142ms      remaining: 467ms
25:     learn: 0.2687931     total: 147ms      remaining: 459ms
26:     learn: 0.2652492     total: 152ms      remaining: 451ms
27:     learn: 0.2609616     total: 155ms      remaining: 436ms
28:     learn: 0.2577226     total: 159ms      remaining: 428ms
29:     learn: 0.2559300     total: 181ms      remaining: 465ms
30:     learn: 0.2513244     total: 193ms      remaining: 472ms
31:     learn: 0.2473110     total: 199ms      remaining: 466ms
32:     learn: 0.2455458     total: 208ms      remaining: 467ms
33:     learn: 0.2418409     total: 217ms      remaining: 467ms
34:     learn: 0.2402896     total: 220ms      remaining: 453ms
35:     learn: 0.2400162     total: 228ms      remaining: 451ms
36:     learn: 0.2368425     total: 233ms      remaining: 440ms
37:     learn: 0.2342402     total: 241ms      remaining: 438ms
38:     learn: 0.2303558     total: 247ms      remaining: 431ms
39:     learn: 0.2296646     total: 256ms      remaining: 429ms
40:     learn: 0.2270548     total: 275ms      remaining: 443ms
41:     learn: 0.2243682     total: 291ms      remaining: 450ms
42:     learn: 0.2214109     total: 303ms      remaining: 450ms
43:     learn: 0.2194343     total: 307ms      remaining: 439ms
44:     learn: 0.2182301     total: 312ms      remaining: 430ms
45:     learn: 0.2157138     total: 319ms      remaining: 423ms
46:     learn: 0.2135517     total: 321ms      remaining: 410ms
47:     learn: 0.2109160     total: 323ms      remaining: 398ms
48:     learn: 0.2091971     total: 331ms      remaining: 391ms
49:     learn: 0.2079887     total: 333ms      remaining: 379ms
50:     learn: 0.2059917     total: 335ms      remaining: 368ms
51:     learn: 0.2023840     total: 341ms      remaining: 360ms
52:     learn: 0.2003819     total: 343ms      remaining: 349ms
53:     learn: 0.1981988     total: 349ms      remaining: 343ms
54:     learn: 0.1957656     total: 352ms      remaining: 333ms
55:     learn: 0.1936887     total: 359ms      remaining: 327ms
56:     learn: 0.1919379     total: 365ms      remaining: 320ms
57:     learn: 0.1915428     total: 372ms      remaining: 314ms
58:     learn: 0.1905287     total: 376ms      remaining: 306ms
59:     learn: 0.1899477     total: 390ms      remaining: 305ms
60:     learn: 0.1886789     total: 394ms      remaining: 297ms
61:     learn: 0.1886138     total: 398ms      remaining: 289ms
62:     learn: 0.1874694     total: 404ms      remaining: 282ms
63:     learn: 0.1854101     total: 413ms      remaining: 278ms
64:     learn: 0.1836116     total: 418ms      remaining: 270ms
65:     learn: 0.1820169     total: 431ms      remaining: 268ms
66:     learn: 0.1794041     total: 436ms      remaining: 260ms
67:     learn: 0.1779246     total: 445ms      remaining: 255ms
```

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68:       learn: 0.1768551        total: 447ms       remaining: 246ms
69:       learn: 0.1761594        total: 454ms       remaining: 240ms
70:       learn: 0.1752324        total: 457ms       remaining: 232ms
71:       learn: 0.1740816        total: 461ms       remaining: 224ms
72:       learn: 0.1708862        total: 466ms       remaining: 217ms
73:       learn: 0.1698609        total: 472ms       remaining: 211ms
74:       learn: 0.1687458        total: 499ms       remaining: 213ms
75:       learn: 0.1669827        total: 517ms       remaining: 211ms
76:       learn: 0.1654079        total: 528ms       remaining: 206ms
77:       learn: 0.1647298        total: 536ms       remaining: 199ms
78:       learn: 0.1646126        total: 543ms       remaining: 192ms
79:       learn: 0.1632075        total: 561ms       remaining: 189ms
80:       learn: 0.1626183        total: 573ms       remaining: 184ms
81:       learn: 0.1617776        total: 577ms       remaining: 176ms
82:       learn: 0.1601663        total: 581ms       remaining: 168ms
83:       learn: 0.1587888        total: 590ms       remaining: 162ms
84:       learn: 0.1562353        total: 595ms       remaining: 154ms
85:       learn: 0.1545101        total: 599ms       remaining: 146ms
86:       learn: 0.1537374        total: 604ms       remaining: 139ms
87:       learn: 0.1524334        total: 608ms       remaining: 131ms
88:       learn: 0.1511505        total: 621ms       remaining: 126ms
89:       learn: 0.1505683        total: 625ms       remaining: 118ms
90:       learn: 0.1494836        total: 630ms       remaining: 111ms
91:       learn: 0.1473878        total: 634ms       remaining: 103ms
92:       learn: 0.1462874        total: 639ms       remaining: 96.1ms
93:       learn: 0.1450990        total: 643ms       remaining: 89ms
94:       learn: 0.1435325        total: 648ms       remaining: 81.8ms
95:       learn: 0.1422553        total: 659ms       remaining: 75.5ms
96:       learn: 0.1409153        total: 662ms       remaining: 68.3ms
97:       learn: 0.1397240        total: 681ms       remaining: 62.6ms
98:       learn: 0.1381611        total: 685ms       remaining: 55.3ms
99:       learn: 0.1370690        total: 689ms       remaining: 48.3ms
100:      learn: 0.1359579        total: 694ms       remaining: 41.2ms
101:      learn: 0.1350599        total: 705ms       remaining: 34.6ms
102:      learn: 0.1337037        total: 711ms       remaining: 27.6ms
103:      learn: 0.1328293        total: 716ms       remaining: 20.6ms
104:      learn: 0.1317436        total: 721ms       remaining: 13.7ms
105:      learn: 0.1301070        total: 728ms       remaining: 6.87ms
106:      learn: 0.1290567        total: 734ms       remaining: 0us
Learning rate set to 0.069492
0:        learn: 0.6336498        total: 9.2ms       remaining: 984ms
1:        learn: 0.6002270        total: 25.8ms      remaining: 1.37s
2:        learn: 0.5523834        total: 28.6ms      remaining: 1s
3:        learn: 0.5166484        total: 38ms        remaining: 988ms
4:        learn: 0.4802986        total: 47.5ms      remaining: 978ms
5:        learn: 0.4556458        total: 50.1ms      remaining: 851ms
6:        learn: 0.4317359        total: 55.6ms      remaining: 803ms
7:        learn: 0.4106943        total: 58.9ms      remaining: 736ms
8:        learn: 0.3968608        total: 63.1ms      remaining: 695ms
9:        learn: 0.3779080        total: 77.6ms      remaining: 761ms
10:       learn: 0.3668250        total: 93.6ms      remaining: 825ms
11:       learn: 0.3551897        total: 97.1ms      remaining: 777ms
12:       learn: 0.3429922        total: 108ms       remaining: 790ms
13:       learn: 0.3359622        total: 116ms       remaining: 779ms
```

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14:     learn: 0.3249987         total: 119ms    remaining: 738ms
15:     learn: 0.3165462         total: 126ms    remaining: 723ms
16:     learn: 0.3058846         total: 130ms    remaining: 693ms
17:     learn: 0.3004127         total: 134ms    remaining: 670ms
18:     learn: 0.2968774         total: 137ms    remaining: 640ms
19:     learn: 0.2903476         total: 141ms    remaining: 622ms
20:     learn: 0.2850405         total: 146ms    remaining: 606ms
21:     learn: 0.2811008         total: 150ms    remaining: 585ms
22:     learn: 0.2776367         total: 156ms    remaining: 576ms
23:     learn: 0.2733239         total: 160ms    remaining: 559ms
24:     learn: 0.2706940         total: 165ms    remaining: 547ms
25:     learn: 0.2676929         total: 172ms    remaining: 543ms
26:     learn: 0.2663432         total: 178ms    remaining: 535ms
27:     learn: 0.2626860         total: 181ms    remaining: 516ms
28:     learn: 0.2596019         total: 187ms    remaining: 510ms
29:     learn: 0.2564020         total: 189ms    remaining: 492ms
30:     learn: 0.2536049         total: 191ms    remaining: 475ms
31:     learn: 0.2498500         total: 195ms    remaining: 462ms
32:     learn: 0.2464116         total: 201ms    remaining: 457ms
33:     learn: 0.2422035         total: 207ms    remaining: 450ms
34:     learn: 0.2378290         total: 210ms    remaining: 438ms
35:     learn: 0.2349924         total: 214ms    remaining: 427ms
36:     learn: 0.2332992         total: 217ms    remaining: 417ms
37:     learn: 0.2292101         total: 222ms    remaining: 408ms
38:     learn: 0.2278532         total: 224ms    remaining: 396ms
39:     learn: 0.2248316         total: 227ms    remaining: 386ms
40:     learn: 0.2217494         total: 232ms    remaining: 379ms
41:     learn: 0.2194280         total: 234ms    remaining: 367ms
42:     learn: 0.2168994         total: 238ms    remaining: 360ms
43:     learn: 0.2156156         total: 245ms    remaining: 356ms
44:     learn: 0.2126192         total: 247ms    remaining: 345ms
45:     learn: 0.2091901         total: 250ms    remaining: 337ms
46:     learn: 0.2067240         total: 254ms    remaining: 330ms
47:     learn: 0.2044305         total: 257ms    remaining: 321ms
48:     learn: 0.2026404         total: 261ms    remaining: 314ms
49:     learn: 0.2017515         total: 265ms    remaining: 307ms
50:     learn: 0.2004196         total: 291ms    remaining: 326ms
51:     learn: 0.1990684         total: 295ms    remaining: 318ms
52:     learn: 0.1968602         total: 300ms    remaining: 312ms
53:     learn: 0.1943569         total: 304ms    remaining: 304ms
54:     learn: 0.1928467         total: 308ms    remaining: 297ms
55:     learn: 0.1908276         total: 313ms    remaining: 290ms
56:     learn: 0.1887149         total: 317ms    remaining: 284ms
57:     learn: 0.1851927         total: 322ms    remaining: 277ms
58:     learn: 0.1842635         total: 327ms    remaining: 272ms
59:     learn: 0.1828740         total: 330ms    remaining: 264ms
60:     learn: 0.1805605         total: 335ms    remaining: 258ms
61:     learn: 0.1800945         total: 339ms    remaining: 252ms
62:     learn: 0.1781969         total: 343ms    remaining: 245ms
63:     learn: 0.1765668         total: 366ms    remaining: 252ms
64:     learn: 0.1746293         total: 375ms    remaining: 248ms
65:     learn: 0.1737602         total: 380ms    remaining: 242ms
66:     learn: 0.1721015         total: 384ms    remaining: 235ms
67:     learn: 0.1709868         total: 389ms    remaining: 229ms
```

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                  ...        ....       ....       ........       ...
68:     learn: 0.1695367        total: 392ms       remaining: 221ms
69:     learn: 0.1678192        total: 396ms       remaining: 215ms
70:     learn: 0.1674133        total: 401ms       remaining: 209ms
71:     learn: 0.1656272        total: 407ms       remaining: 203ms
72:     learn: 0.1643208        total: 409ms       remaining: 196ms
73:     learn: 0.1626696        total: 416ms       remaining: 191ms
74:     learn: 0.1613553        total: 421ms       remaining: 185ms
75:     learn: 0.1596300        total: 426ms       remaining: 179ms
76:     learn: 0.1585401        total: 431ms       remaining: 174ms
77:     learn: 0.1568260        total: 442ms       remaining: 170ms
78:     learn: 0.1560995        total: 446ms       remaining: 164ms
79:     learn: 0.1550300        total: 451ms       remaining: 158ms
80:     learn: 0.1541464        total: 466ms       remaining: 155ms
81:     learn: 0.1520795        total: 472ms       remaining: 150ms
82:     learn: 0.1512802        total: 477ms       remaining: 144ms
83:     learn: 0.1498001        total: 481ms       remaining: 138ms
84:     learn: 0.1494537        total: 485ms       remaining: 131ms
85:     learn: 0.1483425        total: 492ms       remaining: 126ms
86:     learn: 0.1468607        total: 494ms       remaining: 119ms
87:     learn: 0.1460773        total: 498ms       remaining: 113ms
88:     learn: 0.1455168        total: 501ms       remaining: 107ms
89:     learn: 0.1445818        total: 514ms       remaining: 103ms
90:     learn: 0.1434466        total: 517ms       remaining: 96.5ms
91:     learn: 0.1433166        total: 521ms       remaining: 90.6ms
92:     learn: 0.1427524        total: 524ms       remaining: 84.5ms
93:     learn: 0.1415243        total: 528ms       remaining: 78.7ms
94:     learn: 0.1397908        total: 533ms       remaining: 72.9ms
95:     learn: 0.1387676        total: 537ms       remaining: 67.1ms
96:     learn: 0.1378648        total: 542ms       remaining: 61.4ms
97:     learn: 0.1368077        total: 547ms       remaining: 55.8ms
98:     learn: 0.1361852        total: 554ms       remaining: 50.4ms
99:     learn: 0.1357618        total: 558ms       remaining: 44.7ms
100:    learn: 0.1356368        total: 561ms       remaining: 38.9ms
101:    learn: 0.1348766        total: 564ms       remaining: 33.2ms
102:    learn: 0.1345856        total: 575ms       remaining: 27.9ms
103:    learn: 0.1332959        total: 578ms       remaining: 22.2ms
104:    learn: 0.1320325        total: 580ms       remaining: 16.6ms
105:    learn: 0.1308920        total: 588ms       remaining: 11.1ms
106:    learn: 0.1302831        total: 590ms       remaining: 5.51ms
107:    learn: 0.1290837        total: 591ms       remaining: 0us
Learning rate set to 0.068907
0:      learn: 0.6341172        total: 2.16ms      remaining: 234ms
1:      learn: 0.6009011        total: 8.63ms      remaining: 462ms
2:      learn: 0.5626622        total: 10.1ms      remaining: 358ms
3:      learn: 0.5260275        total: 11.7ms      remaining: 306ms
4:      learn: 0.4881464        total: 17ms        remaining: 354ms
5:      learn: 0.4675296        total: 18.6ms      remaining: 319ms
6:      learn: 0.4421505        total: 20.2ms      remaining: 294ms
7:      learn: 0.4242639        total: 24.7ms      remaining: 312ms
8:      learn: 0.4147577        total: 25.6ms      remaining: 285ms
9:      learn: 0.4010248        total: 26.6ms      remaining: 264ms
10:     learn: 0.3840323        total: 30ms        remaining: 267ms
11:     learn: 0.3709045        total: 32.6ms      remaining: 263ms
12:     learn: 0.3562235        total: 36.7ms      remaining: 271ms
```

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13:     learn: 0.3476210      total: 39.4ms    remaining: 267ms
14:     learn: 0.3351242      total: 46.9ms    remaining: 294ms
15:     learn: 0.3283167      total: 49.3ms    remaining: 287ms
16:     learn: 0.3212806      total: 51.7ms    remaining: 280ms
17:     learn: 0.3128504      total: 59ms      remaining: 298ms
18:     learn: 0.3073690      total: 60.6ms    remaining: 287ms
19:     learn: 0.3047936      total: 61.4ms    remaining: 273ms
20:     learn: 0.2991064      total: 64.3ms    remaining: 269ms
21:     learn: 0.2934547      total: 65.8ms    remaining: 260ms
22:     learn: 0.2883690      total: 68.2ms    remaining: 255ms
23:     learn: 0.2807294      total: 73.5ms    remaining: 260ms
24:     learn: 0.2768152      total: 78.8ms    remaining: 265ms
25:     learn: 0.2735407      total: 81.6ms    remaining: 260ms
26:     learn: 0.2681445      total: 83.4ms    remaining: 253ms
27:     learn: 0.2643728      total: 85.5ms    remaining: 247ms
28:     learn: 0.2608617      total: 97.6ms    remaining: 269ms
29:     learn: 0.2586290      total: 99.2ms    remaining: 261ms
30:     learn: 0.2545729      total: 106ms     remaining: 266ms
31:     learn: 0.2528431      total: 108ms     remaining: 259ms
32:     learn: 0.2501040      total: 111ms     remaining: 256ms
33:     learn: 0.2471730      total: 114ms     remaining: 251ms
34:     learn: 0.2439038      total: 115ms     remaining: 244ms
35:     learn: 0.2397029      total: 120ms     remaining: 244ms
36:     learn: 0.2366257      total: 125ms     remaining: 242ms
37:     learn: 0.2343394      total: 128ms     remaining: 240ms
38:     learn: 0.2330888      total: 133ms     remaining: 238ms
39:     learn: 0.2288637      total: 139ms     remaining: 240ms
40:     learn: 0.2269681      total: 141ms     remaining: 234ms
41:     learn: 0.2242415      total: 148ms     remaining: 236ms
42:     learn: 0.2234436      total: 150ms     remaining: 230ms
43:     learn: 0.2214881      total: 157ms     remaining: 231ms
44:     learn: 0.2198291      total: 158ms     remaining: 225ms
45:     learn: 0.2179579      total: 160ms     remaining: 219ms
46:     learn: 0.2147430      total: 163ms     remaining: 215ms
47:     learn: 0.2121228      total: 166ms     remaining: 211ms
48:     learn: 0.2101793      total: 169ms     remaining: 206ms
49:     learn: 0.2083037      total: 172ms     remaining: 203ms
50:     learn: 0.2065448      total: 175ms     remaining: 199ms
51:     learn: 0.2036271      total: 181ms     remaining: 198ms
52:     learn: 0.2013871      total: 186ms     remaining: 196ms
53:     learn: 0.1997041      total: 188ms     remaining: 191ms
54:     learn: 0.1972528      total: 194ms     remaining: 190ms
55:     learn: 0.1957780      total: 200ms     remaining: 190ms
56:     learn: 0.1936940      total: 202ms     remaining: 184ms
57:     learn: 0.1915773      total: 204ms     remaining: 179ms
58:     learn: 0.1907030      total: 206ms     remaining: 174ms
59:     learn: 0.1884935      total: 207ms     remaining: 169ms
60:     learn: 0.1868659      total: 214ms     remaining: 168ms
61:     learn: 0.1846273      total: 215ms     remaining: 163ms
62:     learn: 0.1832041      total: 217ms     remaining: 158ms
63:     learn: 0.1823742      total: 226ms     remaining: 159ms
64:     learn: 0.1811829      total: 228ms     remaining: 154ms
65:     learn: 0.1805140      total: 234ms     remaining: 152ms
66:     learn: 0.1795147      total: 236ms     remaining: 148ms
```

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00:        learn: 0.1793117        total: 230ms        remaining: 148ms
67:        learn: 0.1774280        total: 237ms        remaining: 143ms
68:        learn: 0.1759118        total: 240ms        remaining: 139ms
69:        learn: 0.1743618        total: 242ms        remaining: 135ms
70:        learn: 0.1728711        total: 244ms        remaining: 131ms
71:        learn: 0.1726283        total: 245ms        remaining: 126ms
72:        learn: 0.1718420        total: 248ms        remaining: 122ms
73:        learn: 0.1707226        total: 250ms        remaining: 118ms
74:        learn: 0.1693378        total: 251ms        remaining: 114ms
75:        learn: 0.1686556        total: 253ms        remaining: 110ms
76:        learn: 0.1672134        total: 255ms        remaining: 106ms
77:        learn: 0.1644978        total: 258ms        remaining: 102ms
78:        learn: 0.1636256        total: 259ms        remaining: 98.5ms
79:        learn: 0.1615873        total: 262ms        remaining: 94.8ms
80:        learn: 0.1602295        total: 263ms        remaining: 90.9ms
81:        learn: 0.1594260        total: 272ms        remaining: 89.5ms
82:        learn: 0.1581308        total: 277ms        remaining: 86.7ms
83:        learn: 0.1566374        total: 279ms        remaining: 83.1ms
84:        learn: 0.1550146        total: 287ms        remaining: 80.9ms
85:        learn: 0.1533351        total: 288ms        remaining: 77.1ms
86:        learn: 0.1525795        total: 291ms        remaining: 73.7ms
87:        learn: 0.1511456        total: 313ms        remaining: 74.7ms
88:        learn: 0.1505146        total: 321ms        remaining: 72.2ms
89:        learn: 0.1496782        total: 328ms        remaining: 69.3ms
90:        learn: 0.1477806        total: 330ms        remaining: 65.3ms
91:        learn: 0.1464447        total: 334ms        remaining: 61.8ms
92:        learn: 0.1450060        total: 345ms        remaining: 59.3ms
93:        learn: 0.1436534        total: 346ms        remaining: 55.3ms
94:        learn: 0.1427207        total: 348ms        remaining: 51.3ms
95:        learn: 0.1414919        total: 355ms        remaining: 48ms
96:        learn: 0.1401951        total: 357ms        remaining: 44.1ms
97:        learn: 0.1382884        total: 361ms        remaining: 40.5ms
98:        learn: 0.1375837        total: 363ms        remaining: 36.7ms
99:        learn: 0.1366086        total: 367ms        remaining: 33.1ms
100:       learn: 0.1355349        total: 369ms        remaining: 29.3ms
101:       learn: 0.1347924        total: 376ms        remaining: 25.8ms
102:       learn: 0.1341071        total: 379ms        remaining: 22.1ms
103:       learn: 0.1325803        total: 380ms        remaining: 18.3ms
104:       learn: 0.1317108        total: 382ms        remaining: 14.6ms
105:       learn: 0.1306708        total: 385ms        remaining: 10.9ms
106:       learn: 0.1293231        total: 389ms        remaining: 7.28ms
107:       learn: 0.1277072        total: 392ms        remaining: 3.63ms
108:       learn: 0.1276472        total: 396ms        remaining: 0us
Learning rate set to 0.068333
0:         learn: 0.6345769        total: 6.17ms       remaining: 673ms
1:         learn: 0.6015633        total: 13.4ms       remaining: 722ms
2:         learn: 0.5635332        total: 18.2ms       remaining: 648ms
3:         learn: 0.5270518        total: 30.8ms       remaining: 816ms
4:         learn: 0.4892879        total: 46.2ms       remaining: 971ms
5:         learn: 0.4687028        total: 53.7ms       remaining: 931ms
6:         learn: 0.4433604        total: 60ms         remaining: 883ms
7:         learn: 0.4254950        total: 74.3ms       remaining: 947ms
8:         learn: 0.4159565        total: 78.8ms       remaining: 885ms
9:         learn: 0.4021829        total: 84.6ms       remaining: 846ms
10:        learn: 0.3851590        total: 99.1ms       remaining: 892ms
```

```
10:     learn: 0.3851590     total: 99.1ms    remaining: 892ms
11:     learn: 0.3719865     total: 105ms     remaining: 853ms
12:     learn: 0.3572766     total: 119ms     remaining: 891ms
13:     learn: 0.3486322     total: 123ms     remaining: 842ms
14:     learn: 0.3361018     total: 135ms     remaining: 858ms
15:     learn: 0.3292814     total: 142ms     remaining: 836ms
16:     learn: 0.3222278     total: 156ms     remaining: 854ms
17:     learn: 0.3137720     total: 158ms     remaining: 808ms
18:     learn: 0.3082713     total: 165ms     remaining: 789ms
19:     learn: 0.3056693     total: 166ms     remaining: 746ms
20:     learn: 0.2999812     total: 168ms     remaining: 713ms
21:     learn: 0.2960905     total: 172ms     remaining: 689ms
22:     learn: 0.2907159     total: 174ms     remaining: 659ms
23:     learn: 0.2830272     total: 177ms     remaining: 635ms
24:     learn: 0.2783495     total: 183ms     remaining: 623ms
25:     learn: 0.2728637     total: 187ms     remaining: 605ms
26:     learn: 0.2675732     total: 192ms     remaining: 591ms
27:     learn: 0.2637495     total: 195ms     remaining: 570ms
28:     learn: 0.2603419     total: 200ms     remaining: 560ms
29:     learn: 0.2580704     total: 206ms     remaining: 548ms
30:     learn: 0.2557980     total: 207ms     remaining: 528ms
31:     learn: 0.2541390     total: 209ms     remaining: 510ms
32:     learn: 0.2506733     total: 217ms     remaining: 506ms
33:     learn: 0.2483065     total: 220ms     remaining: 491ms
34:     learn: 0.2451502     total: 223ms     remaining: 477ms
35:     learn: 0.2409207     total: 230ms     remaining: 472ms
36:     learn: 0.2377299     total: 232ms     remaining: 457ms
37:     learn: 0.2354925     total: 235ms     remaining: 446ms
38:     learn: 0.2342083     total: 242ms     remaining: 440ms
39:     learn: 0.2312360     total: 244ms     remaining: 427ms
40:     learn: 0.2292383     total: 246ms     remaining: 414ms
41:     learn: 0.2279630     total: 252ms     remaining: 408ms
42:     learn: 0.2271992     total: 254ms     remaining: 396ms
43:     learn: 0.2251370     total: 256ms     remaining: 384ms
44:     learn: 0.2234803     total: 260ms     remaining: 376ms
45:     learn: 0.2215682     total: 266ms     remaining: 370ms
46:     learn: 0.2182862     total: 268ms     remaining: 360ms
47:     learn: 0.2156395     total: 274ms     remaining: 354ms
48:     learn: 0.2147291     total: 276ms     remaining: 344ms
49:     learn: 0.2135991     total: 278ms     remaining: 334ms
50:     learn: 0.2117440     total: 283ms     remaining: 327ms
51:     learn: 0.2087789     total: 289ms     remaining: 323ms
52:     learn: 0.2075976     total: 294ms     remaining: 316ms
53:     learn: 0.2054302     total: 297ms     remaining: 308ms
54:     learn: 0.2028498     total: 301ms     remaining: 301ms
55:     learn: 0.2004081     total: 307ms     remaining: 296ms
56:     learn: 0.1988436     total: 311ms     remaining: 289ms
57:     learn: 0.1967433     total: 314ms     remaining: 281ms
58:     learn: 0.1953328     total: 318ms     remaining: 275ms
59:     learn: 0.1936997     total: 324ms     remaining: 270ms
60:     learn: 0.1921255     total: 326ms     remaining: 262ms
61:     learn: 0.1897583     total: 331ms     remaining: 256ms
62:     learn: 0.1890279     total: 334ms     remaining: 249ms
63:     learn: 0.1884065     total: 341ms     remaining: 245ms
64:     learn: 0.1874664     total: 343ms     remaining: 238ms
```

```
64:        learn: 0.1874664       total: 343ms     remaining: 238ms
65:        learn: 0.1867242       total: 346ms     remaining: 231ms
66:        learn: 0.1853632       total: 349ms     remaining: 224ms
67:        learn: 0.1832552       total: 363ms     remaining: 224ms
68:        learn: 0.1816626       total: 372ms     remaining: 221ms
69:        learn: 0.1800040       total: 379ms     remaining: 217ms
70:        learn: 0.1783357       total: 382ms     remaining: 210ms
71:        learn: 0.1778433       total: 390ms     remaining: 206ms
72:        learn: 0.1759306       total: 395ms     remaining: 200ms
73:        learn: 0.1747031       total: 408ms     remaining: 199ms
74:        learn: 0.1734073       total: 423ms     remaining: 197ms
75:        learn: 0.1726919       total: 430ms     remaining: 192ms
76:        learn: 0.1717551       total: 441ms     remaining: 189ms
77:        learn: 0.1691982       total: 443ms     remaining: 182ms
78:        learn: 0.1683579       total: 448ms     remaining: 176ms
79:        learn: 0.1670796       total: 461ms     remaining: 173ms
80:        learn: 0.1658654       total: 465ms     remaining: 166ms
81:        learn: 0.1640200       total: 475ms     remaining: 162ms
82:        learn: 0.1625663       total: 478ms     remaining: 156ms
83:        learn: 0.1612759       total: 483ms     remaining: 150ms
84:        learn: 0.1594453       total: 495ms     remaining: 145ms
85:        learn: 0.1576684       total: 497ms     remaining: 139ms
86:        learn: 0.1571682       total: 507ms     remaining: 134ms
87:        learn: 0.1556212       total: 510ms     remaining: 127ms
88:        learn: 0.1553058       total: 513ms     remaining: 121ms
89:        learn: 0.1544035       total: 522ms     remaining: 116ms
90:        learn: 0.1531734       total: 534ms     remaining: 112ms
91:        learn: 0.1521282       total: 538ms     remaining: 105ms
92:        learn: 0.1508438       total: 545ms     remaining: 99.5ms
93:        learn: 0.1493211       total: 560ms     remaining: 95.3ms
94:        learn: 0.1479554       total: 563ms     remaining: 88.9ms
95:        learn: 0.1465897       total: 567ms     remaining: 82.7ms
96:        learn: 0.1452609       total: 573ms     remaining: 76.8ms
97:        learn: 0.1444417       total: 582ms     remaining: 71.2ms
98:        learn: 0.1434775       total: 590ms     remaining: 65.5ms
99:        learn: 0.1425230       total: 594ms     remaining: 59.4ms
100:       learn: 0.1413065       total: 605ms     remaining: 53.9ms
101:       learn: 0.1398410       total: 608ms     remaining: 47.7ms
102:       learn: 0.1389667       total: 622ms     remaining: 42.3ms
103:       learn: 0.1371917       total: 634ms     remaining: 36.6ms
104:       learn: 0.1359770       total: 645ms     remaining: 30.7ms
105:       learn: 0.1352259       total: 652ms     remaining: 24.6ms
106:       learn: 0.1338988       total: 657ms     remaining: 18.4ms
107:       learn: 0.1333647       total: 662ms     remaining: 12.3ms
108:       learn: 0.1321657       total: 664ms     remaining: 6.09ms
109:       learn: 0.1313550       total: 665ms     remaining: 0us
Learning rate set to 0.067768
0:         learn: 0.6350308       total: 1.61ms    remaining: 177ms
1:         learn: 0.6022181       total: 3.67ms    remaining: 200ms
2:         learn: 0.5643932       total: 7.08ms    remaining: 255ms
3:         learn: 0.5280658       total: 32.7ms    remaining: 875ms
4:         learn: 0.4904195       total: 47.6ms    remaining: 1.01s
5:         learn: 0.4698656       total: 57.9ms    remaining: 1.01s
6:         learn: 0.4445606       total: 68.2ms    remaining: 1.01s
7:         learn: 0.4267173       total: 82.5ms    remaining: 1.06s
```

```
7:      learn: 0.4267173      total: 82.5ms     remaining: 1.06s
8:      learn: 0.4171475      total: 85.1ms     remaining: 964ms
9:      learn: 0.4033346      total: 86.5ms     remaining: 873ms
10:     learn: 0.3862808      total: 92.9ms     remaining: 845ms
11:     learn: 0.3730646      total: 95.1ms     remaining: 785ms
12:     learn: 0.3583259      total: 97.4ms     remaining: 734ms
13:     learn: 0.3496404      total: 101ms      remaining: 696ms
14:     learn: 0.3370770      total: 104ms      remaining: 663ms
15:     learn: 0.3302439      total: 107ms      remaining: 634ms
16:     learn: 0.3231728      total: 109ms      remaining: 602ms
17:     learn: 0.3146913      total: 111ms      remaining: 573ms
18:     learn: 0.3091715      total: 113ms      remaining: 546ms
19:     learn: 0.3065438      total: 113ms      remaining: 516ms
20:     learn: 0.3008530      total: 115ms      remaining: 495ms
21:     learn: 0.2969512      total: 117ms      remaining: 475ms
22:     learn: 0.2915776      total: 119ms      remaining: 456ms
23:     learn: 0.2838611      total: 121ms      remaining: 439ms
24:     learn: 0.2791730      total: 123ms      remaining: 424ms
25:     learn: 0.2736644      total: 129ms      remaining: 422ms
26:     learn: 0.2683615      total: 131ms      remaining: 408ms
27:     learn: 0.2645180      total: 133ms      remaining: 394ms
28:     learn: 0.2611069      total: 135ms      remaining: 382ms
29:     learn: 0.2588222      total: 139ms      remaining: 376ms
30:     learn: 0.2565478      total: 142ms      remaining: 366ms
31:     learn: 0.2548857      total: 144ms      remaining: 356ms
32:     learn: 0.2514182      total: 150ms      remaining: 355ms
33:     learn: 0.2490581      total: 158ms      remaining: 359ms
34:     learn: 0.2459057      total: 165ms      remaining: 358ms
35:     learn: 0.2416842      total: 166ms      remaining: 347ms
36:     learn: 0.2384885      total: 170ms      remaining: 339ms
37:     learn: 0.2362487      total: 171ms      remaining: 329ms
38:     learn: 0.2349619      total: 176ms      remaining: 324ms
39:     learn: 0.2319864      total: 182ms      remaining: 322ms
40:     learn: 0.2299894      total: 185ms      remaining: 317ms
41:     learn: 0.2287144      total: 193ms      remaining: 318ms
42:     learn: 0.2279438      total: 199ms      remaining: 314ms
43:     learn: 0.2258896      total: 213ms      remaining: 324ms
44:     learn: 0.2242343      total: 215ms      remaining: 315ms
45:     learn: 0.2223257      total: 224ms      remaining: 316ms
46:     learn: 0.2190438      total: 226ms      remaining: 308ms
47:     learn: 0.2163977      total: 237ms      remaining: 312ms
48:     learn: 0.2154893      total: 239ms      remaining: 302ms
49:     learn: 0.2143586      total: 243ms      remaining: 297ms
50:     learn: 0.2125023      total: 250ms      remaining: 294ms
51:     learn: 0.2095440      total: 252ms      remaining: 286ms
52:     learn: 0.2083627      total: 258ms      remaining: 283ms
53:     learn: 0.2062016      total: 265ms      remaining: 280ms
54:     learn: 0.2036244      total: 267ms      remaining: 272ms
55:     learn: 0.2011898      total: 276ms      remaining: 271ms
56:     learn: 0.1996278      total: 278ms      remaining: 263ms
57:     learn: 0.1975324      total: 280ms      remaining: 256ms
58:     learn: 0.1961249      total: 282ms      remaining: 249ms
59:     learn: 0.1944927      total: 298ms      remaining: 254ms
60:     learn: 0.1929207      total: 307ms      remaining: 251ms
61:     learn: 0.1905570      total: 310ms      remaining: 245ms
```

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61:       learn: 0.1905570        total: 310ms        remaining: 245ms
62:       learn: 0.1898275        total: 319ms        remaining: 243ms
63:       learn: 0.1892066        total: 323ms        remaining: 238ms
64:       learn: 0.1882681        total: 334ms        remaining: 237ms
65:       learn: 0.1875254        total: 337ms        remaining: 230ms
66:       learn: 0.1861664        total: 343ms        remaining: 225ms
67:       learn: 0.1840584        total: 347ms        remaining: 219ms
68:       learn: 0.1824704        total: 351ms        remaining: 214ms
69:       learn: 0.1808174        total: 358ms        remaining: 210ms
70:       learn: 0.1791567        total: 361ms        remaining: 203ms
71:       learn: 0.1786647        total: 370ms        remaining: 201ms
72:       learn: 0.1767574        total: 375ms        remaining: 195ms
73:       learn: 0.1753280        total: 387ms        remaining: 193ms
74:       learn: 0.1740373        total: 392ms        remaining: 188ms
75:       learn: 0.1733274        total: 395ms        remaining: 182ms
76:       learn: 0.1723963        total: 406ms        remaining: 179ms
77:       learn: 0.1695169        total: 409ms        remaining: 173ms
78:       learn: 0.1686934        total: 421ms        remaining: 170ms
79:       learn: 0.1674315        total: 432ms        remaining: 167ms
80:       learn: 0.1662758        total: 436ms        remaining: 161ms
81:       learn: 0.1646267        total: 442ms        remaining: 156ms
82:       learn: 0.1631437        total: 450ms        remaining: 152ms
83:       learn: 0.1618785        total: 461ms        remaining: 148ms
84:       learn: 0.1601977        total: 464ms        remaining: 142ms
85:       learn: 0.1583978        total: 482ms        remaining: 140ms
86:       learn: 0.1576800        total: 485ms        remaining: 134ms
87:       learn: 0.1562040        total: 492ms        remaining: 129ms
88:       learn: 0.1558872        total: 508ms        remaining: 126ms
89:       learn: 0.1547029        total: 517ms        remaining: 121ms
90:       learn: 0.1531878        total: 525ms        remaining: 115ms
91:       learn: 0.1522376        total: 530ms        remaining: 109ms
92:       learn: 0.1513419        total: 547ms        remaining: 106ms
93:       learn: 0.1498777        total: 550ms        remaining: 99.5ms
94:       learn: 0.1489010        total: 558ms        remaining: 94ms
95:       learn: 0.1474754        total: 561ms        remaining: 87.6ms
96:       learn: 0.1463587        total: 566ms        remaining: 81.6ms
97:       learn: 0.1443836        total: 570ms        remaining: 75.7ms
98:       learn: 0.1437492        total: 577ms        remaining: 70ms
99:       learn: 0.1424741        total: 582ms        remaining: 64ms
100:      learn: 0.1414726        total: 588ms        remaining: 58.2ms
101:      learn: 0.1402965        total: 592ms        remaining: 52.3ms
102:      learn: 0.1393317        total: 600ms        remaining: 46.6ms
103:      learn: 0.1375090        total: 605ms        remaining: 40.7ms
104:      learn: 0.1373308        total: 611ms        remaining: 34.9ms
105:      learn: 0.1365702        total: 619ms        remaining: 29.2ms
106:      learn: 0.1352424        total: 629ms        remaining: 23.5ms
107:      learn: 0.1346701        total: 639ms        remaining: 17.8ms
108:      learn: 0.1339151        total: 642ms        remaining: 11.8ms
109:      learn: 0.1330772        total: 646ms        remaining: 5.88ms
110:      learn: 0.1320332        total: 652ms        remaining: 0us
Learning rate set to 0.067213
0:        learn: 0.6354752        total: 6.06ms       remaining: 673ms
1:        learn: 0.6028617        total: 9.94ms       remaining: 546ms
2:        learn: 0.5652403        total: 12.8ms       remaining: 466ms
```

```
3:      learn: 0.5290656      total: 15.5ms      remaining: 418ms
4:      learn: 0.4915371      total: 18.8ms      remaining: 402ms
5:      learn: 0.4710160      total: 22.4ms      remaining: 395ms
6:      learn: 0.4475636      total: 24ms        remaining: 360ms
7:      learn: 0.4261751      total: 26.5ms      remaining: 344ms
8:      learn: 0.4107987      total: 33.1ms      remaining: 379ms
9:      learn: 0.3918781      total: 34.6ms      remaining: 353ms
10:     learn: 0.3781771      total: 36.1ms      remaining: 331ms
11:     learn: 0.3667635      total: 47.8ms      remaining: 398ms
12:     learn: 0.3498791      total: 53.3ms      remaining: 406ms
13:     learn: 0.3421268      total: 68.5ms      remaining: 479ms
14:     learn: 0.3306627      total: 74.4ms      remaining: 481ms
15:     learn: 0.3205268      total: 88.8ms      remaining: 533ms
16:     learn: 0.3099346      total: 96.3ms      remaining: 538ms
17:     learn: 0.3051669      total: 103ms       remaining: 535ms
18:     learn: 0.2994330      total: 107ms       remaining: 522ms
19:     learn: 0.2928507      total: 120ms       remaining: 554ms
20:     learn: 0.2873680      total: 124ms       remaining: 537ms
21:     learn: 0.2834224      total: 127ms       remaining: 521ms
22:     learn: 0.2792354      total: 134ms       remaining: 517ms
23:     learn: 0.2775013      total: 139ms       remaining: 510ms
24:     learn: 0.2746626      total: 143ms       remaining: 498ms
25:     learn: 0.2715366      total: 152ms       remaining: 504ms
26:     learn: 0.2679526      total: 157ms       remaining: 495ms
27:     learn: 0.2643156      total: 166ms       remaining: 498ms
28:     learn: 0.2611613      total: 175ms       remaining: 500ms
29:     learn: 0.2586573      total: 186ms       remaining: 509ms
30:     learn: 0.2553147      total: 197ms       remaining: 515ms
31:     learn: 0.2510862      total: 206ms       remaining: 515ms
32:     learn: 0.2489698      total: 209ms       remaining: 499ms
33:     learn: 0.2460737      total: 216ms       remaining: 495ms
34:     learn: 0.2441759      total: 223ms       remaining: 490ms
35:     learn: 0.2438793      total: 233ms       remaining: 491ms
36:     learn: 0.2400534      total: 237ms       remaining: 480ms
37:     learn: 0.2364178      total: 241ms       remaining: 470ms
38:     learn: 0.2326441      total: 248ms       remaining: 464ms
39:     learn: 0.2305150      total: 252ms       remaining: 454ms
40:     learn: 0.2284762      total: 255ms       remaining: 442ms
41:     learn: 0.2258634      total: 259ms       remaining: 432ms
42:     learn: 0.2233440      total: 270ms       remaining: 434ms
43:     learn: 0.2214990      total: 273ms       remaining: 422ms
44:     learn: 0.2197912      total: 283ms       remaining: 422ms
45:     learn: 0.2182370      total: 286ms       remaining: 410ms
46:     learn: 0.2161423      total: 291ms       remaining: 402ms
47:     learn: 0.2141522      total: 302ms       remaining: 403ms
48:     learn: 0.2123568      total: 305ms       remaining: 393ms
49:     learn: 0.2109801      total: 314ms       remaining: 389ms
50:     learn: 0.2090291      total: 319ms       remaining: 382ms
51:     learn: 0.2053444      total: 332ms       remaining: 383ms
52:     learn: 0.2034139      total: 336ms       remaining: 374ms
53:     learn: 0.2013061      total: 343ms       remaining: 369ms
54:     learn: 0.1993647      total: 353ms       remaining: 366ms
55:     learn: 0.1972667      total: 357ms       remaining: 357ms
56:     learn: 0.1952264      total: 365ms       remaining: 352ms
```

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57:     learn: 0.1944161    total: 374ms    remaining: 348ms
58:     learn: 0.1928229    total: 379ms    remaining: 340ms
59:     learn: 0.1921278    total: 392ms    remaining: 340ms
60:     learn: 0.1908684    total: 400ms    remaining: 334ms
61:     learn: 0.1886450    total: 424ms    remaining: 342ms
62:     learn: 0.1866260    total: 439ms    remaining: 342ms
63:     learn: 0.1851878    total: 448ms    remaining: 336ms
64:     learn: 0.1831329    total: 454ms    remaining: 328ms
65:     learn: 0.1816595    total: 467ms    remaining: 325ms
66:     learn: 0.1801466    total: 469ms    remaining: 315ms
67:     learn: 0.1788800    total: 471ms    remaining: 305ms
68:     learn: 0.1774623    total: 473ms    remaining: 295ms
69:     learn: 0.1764078    total: 475ms    remaining: 285ms
70:     learn: 0.1749595    total: 477ms    remaining: 275ms
71:     learn: 0.1739583    total: 479ms    remaining: 266ms
72:     learn: 0.1732845    total: 481ms    remaining: 257ms
73:     learn: 0.1715182    total: 483ms    remaining: 248ms
74:     learn: 0.1702045    total: 485ms    remaining: 239ms
75:     learn: 0.1687935    total: 487ms    remaining: 231ms
76:     learn: 0.1675399    total: 489ms    remaining: 222ms
77:     learn: 0.1655335    total: 492ms    remaining: 214ms
78:     learn: 0.1639677    total: 494ms    remaining: 206ms
79:     learn: 0.1627015    total: 506ms    remaining: 202ms
80:     learn: 0.1618279    total: 510ms    remaining: 195ms
81:     learn: 0.1605138    total: 515ms    remaining: 188ms
82:     learn: 0.1596449    total: 521ms    remaining: 182ms
83:     learn: 0.1578434    total: 524ms    remaining: 175ms
84:     learn: 0.1576998    total: 527ms    remaining: 168ms
85:     learn: 0.1563576    total: 531ms    remaining: 160ms
86:     learn: 0.1547415    total: 535ms    remaining: 154ms
87:     learn: 0.1536536    total: 540ms    remaining: 147ms
88:     learn: 0.1523594    total: 545ms    remaining: 141ms
89:     learn: 0.1509348    total: 550ms    remaining: 135ms
90:     learn: 0.1503084    total: 555ms    remaining: 128ms
91:     learn: 0.1496202    total: 560ms    remaining: 122ms
92:     learn: 0.1471833    total: 564ms    remaining: 115ms
93:     learn: 0.1458125    total: 570ms    remaining: 109ms
94:     learn: 0.1443354    total: 575ms    remaining: 103ms
95:     learn: 0.1439323    total: 580ms    remaining: 96.7ms
96:     learn: 0.1434323    total: 584ms    remaining: 90.4ms
97:     learn: 0.1419011    total: 589ms    remaining: 84.1ms
98:     learn: 0.1408585    total: 596ms    remaining: 78.3ms
99:     learn: 0.1392188    total: 600ms    remaining: 72ms
100:    learn: 0.1378481    total: 605ms    remaining: 65.9ms
101:    learn: 0.1372844    total: 608ms    remaining: 59.6ms
102:    learn: 0.1362808    total: 613ms    remaining: 53.5ms
103:    learn: 0.1357530    total: 617ms    remaining: 47.5ms
104:    learn: 0.1350879    total: 624ms    remaining: 41.6ms
105:    learn: 0.1349299    total: 629ms    remaining: 35.6ms
106:    learn: 0.1345114    total: 633ms    remaining: 29.6ms
107:    learn: 0.1331066    total: 638ms    remaining: 23.6ms
108:    learn: 0.1321399    total: 642ms    remaining: 17.7ms
109:    learn: 0.1305764    total: 648ms    remaining: 11.8ms
110:    learn: 0.1297777    total: 652ms    remaining: 5.88ms
```

```
111:      learn: 0.1286832        total: 662ms     remaining: 0us
Learning rate set to 0.066667
0:        learn: 0.6359128        total: 15.8ms    remaining: 1.76s
1:        learn: 0.6034976        total: 19.6ms    remaining: 1.09s
2:        learn: 0.5660763        total: 23.8ms    remaining: 873ms
3:        learn: 0.5300536        total: 33ms      remaining: 899ms
4:        learn: 0.4926435        total: 37.6ms    remaining: 813ms
5:        learn: 0.4721561        total: 44ms      remaining: 785ms
6:        learn: 0.4487342        total: 48.8ms    remaining: 738ms
7:        learn: 0.4273429        total: 60.5ms    remaining: 794ms
8:        learn: 0.4119532        total: 63.6ms    remaining: 735ms
9:        learn: 0.3930207        total: 68.2ms    remaining: 702ms
10:       learn: 0.3793100        total: 73.2ms    remaining: 679ms
11:       learn: 0.3678592        total: 77.4ms    remaining: 652ms
12:       learn: 0.3509497        total: 84.2ms    remaining: 648ms
13:       learn: 0.3428746        total: 89ms      remaining: 629ms
14:       learn: 0.3314690        total: 93.7ms    remaining: 612ms
15:       learn: 0.3228141        total: 98.7ms    remaining: 598ms
16:       learn: 0.3139040        total: 110ms     remaining: 618ms
17:       learn: 0.3086829        total: 112ms     remaining: 593ms
18:       learn: 0.3031407        total: 118ms     remaining: 583ms
19:       learn: 0.2964288        total: 122ms     remaining: 568ms
20:       learn: 0.2891863        total: 126ms     remaining: 554ms
21:       learn: 0.2852523        total: 131ms     remaining: 543ms
22:       learn: 0.2811339        total: 141ms     remaining: 553ms
23:       learn: 0.2766154        total: 172ms     remaining: 638ms
24:       learn: 0.2738929        total: 175ms     remaining: 618ms
25:       learn: 0.2706861        total: 181ms     remaining: 605ms
26:       learn: 0.2694257        total: 190ms     remaining: 605ms
27:       learn: 0.2653722        total: 197ms     remaining: 599ms
28:       learn: 0.2627000        total: 216ms     remaining: 625ms
29:       learn: 0.2602449        total: 223ms     remaining: 616ms
30:       learn: 0.2576065        total: 228ms     remaining: 602ms
31:       learn: 0.2537559        total: 235ms     remaining: 594ms
32:       learn: 0.2513974        total: 240ms     remaining: 581ms
33:       learn: 0.2473509        total: 246ms     remaining: 571ms
34:       learn: 0.2428882        total: 256ms     remaining: 570ms
35:       learn: 0.2403604        total: 260ms     remaining: 557ms
36:       learn: 0.2385434        total: 267ms     remaining: 548ms
37:       learn: 0.2351542        total: 269ms     remaining: 532ms
38:       learn: 0.2326801        total: 274ms     remaining: 519ms
39:       learn: 0.2304258        total: 282ms     remaining: 514ms
40:       learn: 0.2279249        total: 285ms     remaining: 500ms
41:       learn: 0.2260309        total: 288ms     remaining: 487ms
42:       learn: 0.2233833        total: 300ms     remaining: 488ms
43:       learn: 0.2213546        total: 303ms     remaining: 476ms
44:       learn: 0.2184243        total: 313ms     remaining: 473ms
45:       learn: 0.2151629        total: 316ms     remaining: 460ms
46:       learn: 0.2136639        total: 325ms     remaining: 457ms
47:       learn: 0.2123083        total: 342ms     remaining: 463ms
48:       learn: 0.2105023        total: 346ms     remaining: 452ms
49:       learn: 0.2094510        total: 349ms     remaining: 439ms
50:       learn: 0.2078793        total: 360ms     remaining: 438ms
51:       learn: 0.2060840        total: 363ms     remaining: 426ms
```

```
52:     learn: 0.2040808     total: 381ms    remaining: 431ms
53:     learn: 0.2016477     total: 386ms    remaining: 422ms
54:     learn: 0.1996725     total: 396ms    remaining: 417ms
55:     learn: 0.1979214     total: 403ms    remaining: 410ms
56:     learn: 0.1957890     total: 416ms    remaining: 408ms
57:     learn: 0.1947352     total: 420ms    remaining: 398ms
58:     learn: 0.1936950     total: 430ms    remaining: 394ms
59:     learn: 0.1921205     total: 435ms    remaining: 384ms
60:     learn: 0.1896566     total: 439ms    remaining: 374ms
61:     learn: 0.1891929     total: 443ms    remaining: 364ms
62:     learn: 0.1876687     total: 455ms    remaining: 361ms
63:     learn: 0.1860822     total: 459ms    remaining: 352ms
64:     learn: 0.1835041     total: 471ms    remaining: 348ms
65:     learn: 0.1825528     total: 483ms    remaining: 344ms
66:     learn: 0.1806848     total: 490ms    remaining: 337ms
67:     learn: 0.1800955     total: 505ms    remaining: 334ms
68:     learn: 0.1782067     total: 521ms    remaining: 332ms
69:     learn: 0.1764453     total: 524ms    remaining: 322ms
70:     learn: 0.1752363     total: 551ms    remaining: 326ms
71:     learn: 0.1738819     total: 562ms    remaining: 320ms
72:     learn: 0.1725350     total: 568ms    remaining: 311ms
73:     learn: 0.1704198     total: 583ms    remaining: 307ms
74:     learn: 0.1685224     total: 597ms    remaining: 302ms
75:     learn: 0.1666727     total: 602ms    remaining: 293ms
76:     learn: 0.1651461     total: 605ms    remaining: 283ms
77:     learn: 0.1638730     total: 616ms    remaining: 276ms
78:     learn: 0.1633886     total: 627ms    remaining: 270ms
79:     learn: 0.1621342     total: 635ms    remaining: 262ms
80:     learn: 0.1613379     total: 643ms    remaining: 254ms
81:     learn: 0.1598093     total: 648ms    remaining: 245ms
82:     learn: 0.1588894     total: 671ms    remaining: 243ms
83:     learn: 0.1573110     total: 679ms    remaining: 235ms
84:     learn: 0.1547916     total: 684ms    remaining: 225ms
85:     learn: 0.1535809     total: 702ms    remaining: 221ms
86:     learn: 0.1526016     total: 718ms    remaining: 215ms
87:     learn: 0.1516769     total: 737ms    remaining: 209ms
88:     learn: 0.1512510     total: 746ms    remaining: 201ms
89:     learn: 0.1506817     total: 755ms    remaining: 193ms
90:     learn: 0.1493176     total: 771ms    remaining: 186ms
91:     learn: 0.1491991     total: 779ms    remaining: 178ms
92:     learn: 0.1481337     total: 790ms    remaining: 170ms
93:     learn: 0.1468905     total: 801ms    remaining: 162ms
94:     learn: 0.1451676     total: 807ms    remaining: 153ms
95:     learn: 0.1443909     total: 814ms    remaining: 144ms
96:     learn: 0.1437443     total: 825ms    remaining: 136ms
97:     learn: 0.1433181     total: 839ms    remaining: 128ms
98:     learn: 0.1426949     total: 843ms    remaining: 119ms
99:     learn: 0.1422932     total: 851ms    remaining: 111ms
100:    learn: 0.1414147     total: 856ms    remaining: 102ms
101:    learn: 0.1391529     total: 868ms    remaining: 93.6ms
102:    learn: 0.1378364     total: 874ms    remaining: 84.9ms
103:    learn: 0.1374607     total: 889ms    remaining: 77ms
104:    learn: 0.1370419     total: 903ms    remaining: 68.8ms
105:    learn: 0.1356540     total: 910ms    remaining: 60.1ms
```

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106:      learn: 0.1349713      total: 920ms      remaining: 51.6ms
107:      learn: 0.1338160      total: 942ms      remaining: 43.6ms
108:      learn: 0.1335630      total: 967ms      remaining: 35.5ms
109:      learn: 0.1327608      total: 973ms      remaining: 26.5ms
110:      learn: 0.1319990      total: 982ms      remaining: 17.7ms
111:      learn: 0.1306582      total: 986ms      remaining: 8.8ms
112:      learn: 0.1298171      total: 1s         remaining: 0us
Learning rate set to 0.066131
0:        learn: 0.6363427      total: 14.4ms     remaining: 1.63s
1:        learn: 0.6041219      total: 20.9ms     remaining: 1.17s
2:        learn: 0.5669012      total: 25.3ms     remaining: 936ms
3:        learn: 0.5310286      total: 36ms       remaining: 991ms
4:        learn: 0.4937363      total: 49.7ms     remaining: 1.08s
5:        learn: 0.4732825      total: 60.7ms     remaining: 1.09s
6:        learn: 0.4498928      total: 75ms       remaining: 1.15s
7:        learn: 0.4284993      total: 80.9ms     remaining: 1.07s
8:        learn: 0.4130977      total: 99.2ms     remaining: 1.16s
9:        learn: 0.3941542      total: 106ms      remaining: 1.1s
10:       learn: 0.3804344      total: 115ms      remaining: 1.07s
11:       learn: 0.3689469      total: 127ms      remaining: 1.08s
12:       learn: 0.3520134      total: 143ms      remaining: 1.11s
13:       learn: 0.3439184      total: 153ms      remaining: 1.09s
14:       learn: 0.3324693      total: 169ms      remaining: 1.11s
15:       learn: 0.3237725      total: 176ms      remaining: 1.08s
16:       learn: 0.3131329      total: 196ms      remaining: 1.12s
17:       learn: 0.3083747      total: 200ms      remaining: 1.06s
18:       learn: 0.3028251      total: 204ms      remaining: 1.02s
19:       learn: 0.2961707      total: 209ms      remaining: 983ms
20:       learn: 0.2907100      total: 213ms      remaining: 942ms
21:       learn: 0.2865774      total: 217ms      remaining: 909ms
22:       learn: 0.2818712      total: 235ms      remaining: 928ms
23:       learn: 0.2800759      total: 237ms      remaining: 890ms
24:       learn: 0.2762916      total: 241ms      remaining: 857ms
25:       learn: 0.2731385      total: 244ms      remaining: 827ms
26:       learn: 0.2695597      total: 249ms      remaining: 804ms
27:       learn: 0.2658633      total: 254ms      remaining: 780ms
28:       learn: 0.2629402      total: 259ms      remaining: 758ms
29:       learn: 0.2604362      total: 263ms      remaining: 736ms
30:       learn: 0.2556152      total: 267ms      remaining: 715ms
31:       learn: 0.2515998      total: 272ms      remaining: 696ms
32:       learn: 0.2495535      total: 278ms      remaining: 681ms
33:       learn: 0.2466328      total: 282ms      remaining: 663ms
34:       learn: 0.2449081      total: 287ms      remaining: 647ms
35:       learn: 0.2445949      total: 290ms      remaining: 628ms
36:       learn: 0.2415133      total: 299ms      remaining: 622ms
37:       learn: 0.2378251      total: 308ms      remaining: 615ms
38:       learn: 0.2341132      total: 321ms      remaining: 617ms
39:       learn: 0.2332010      total: 325ms      remaining: 601ms
40:       learn: 0.2310754      total: 332ms      remaining: 592ms
41:       learn: 0.2284982      total: 344ms      remaining: 589ms
42:       learn: 0.2271707      total: 355ms      remaining: 585ms
43:       learn: 0.2245934      total: 364ms      remaining: 579ms
44:       learn: 0.2227568      total: 366ms      remaining: 561ms
45:       learn: 0.2212542      total: 370ms      remaining: 548ms
```

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46:     learn: 0.2191966     total: 375ms     remaining: 534ms
47:     learn: 0.2161689     total: 389ms     remaining: 535ms
48:     learn: 0.2123782     total: 400ms     remaining: 530ms
49:     learn: 0.2110247     total: 409ms     remaining: 524ms
50:     learn: 0.2089468     total: 412ms     remaining: 509ms
51:     learn: 0.2057343     total: 426ms     remaining: 507ms
52:     learn: 0.2038227     total: 428ms     remaining: 493ms
53:     learn: 0.2021871     total: 433ms     remaining: 481ms
54:     learn: 0.2004732     total: 437ms     remaining: 469ms
55:     learn: 0.1984404     total: 442ms     remaining: 457ms
56:     learn: 0.1968168     total: 452ms     remaining: 452ms
57:     learn: 0.1964046     total: 456ms     remaining: 440ms
58:     learn: 0.1953533     total: 466ms     remaining: 434ms
59:     learn: 0.1945597     total: 480ms     remaining: 432ms
60:     learn: 0.1937902     total: 490ms     remaining: 425ms
61:     learn: 0.1937220     total: 491ms     remaining: 412ms
62:     learn: 0.1922197     total: 503ms     remaining: 407ms
63:     learn: 0.1915098     total: 506ms     remaining: 395ms
64:     learn: 0.1902992     total: 511ms     remaining: 385ms
65:     learn: 0.1888568     total: 515ms     remaining: 375ms
66:     learn: 0.1863878     total: 524ms     remaining: 368ms
67:     learn: 0.1852602     total: 534ms     remaining: 361ms
68:     learn: 0.1839316     total: 538ms     remaining: 351ms
69:     learn: 0.1822120     total: 551ms     remaining: 346ms
70:     learn: 0.1798375     total: 558ms     remaining: 338ms
71:     learn: 0.1784338     total: 571ms     remaining: 333ms
72:     learn: 0.1766020     total: 574ms     remaining: 322ms
73:     learn: 0.1756410     total: 583ms     remaining: 315ms
74:     learn: 0.1747010     total: 585ms     remaining: 304ms
75:     learn: 0.1731182     total: 590ms     remaining: 295ms
76:     learn: 0.1710024     total: 597ms     remaining: 287ms
77:     learn: 0.1690402     total: 602ms     remaining: 278ms
78:     learn: 0.1678314     total: 606ms     remaining: 268ms
79:     learn: 0.1654479     total: 612ms     remaining: 260ms
80:     learn: 0.1640243     total: 631ms     remaining: 257ms
81:     learn: 0.1630515     total: 641ms     remaining: 250ms
82:     learn: 0.1623362     total: 654ms     remaining: 244ms
83:     learn: 0.1607059     total: 661ms     remaining: 236ms
84:     learn: 0.1597420     total: 672ms     remaining: 229ms
85:     learn: 0.1585714     total: 685ms     remaining: 223ms
86:     learn: 0.1568696     total: 696ms     remaining: 216ms
87:     learn: 0.1550627     total: 705ms     remaining: 208ms
88:     learn: 0.1541588     total: 721ms     remaining: 202ms
89:     learn: 0.1531975     total: 732ms     remaining: 195ms
90:     learn: 0.1526537     total: 740ms     remaining: 187ms
91:     learn: 0.1521035     total: 750ms     remaining: 179ms
92:     learn: 0.1506954     total: 760ms     remaining: 172ms
93:     learn: 0.1498834     total: 762ms     remaining: 162ms
94:     learn: 0.1482534     total: 773ms     remaining: 155ms
95:     learn: 0.1470966     total: 776ms     remaining: 145ms
96:     learn: 0.1459269     total: 785ms     remaining: 137ms
97:     learn: 0.1449129     total: 797ms     remaining: 130ms
98:     learn: 0.1438162     total: 799ms     remaining: 121ms
99:     learn: 0.1432522     total: 811ms     remaining: 114ms
```

```
100:      learn: 0.1420187      total: 818ms      remaining: 105ms
101:      learn: 0.1413503      total: 829ms      remaining: 97.5ms
102:      learn: 0.1399811      total: 836ms      remaining: 89.2ms
103:      learn: 0.1389847      total: 848ms      remaining: 81.6ms
104:      learn: 0.1380169      total: 853ms      remaining: 73.1ms
105:      learn: 0.1372259      total: 860ms      remaining: 64.9ms
106:      learn: 0.1360645      total: 868ms      remaining: 56.8ms
107:      learn: 0.1350945      total: 870ms      remaining: 48.3ms
108:      learn: 0.1337720      total: 882ms      remaining: 40.5ms
109:      learn: 0.1331119      total: 883ms      remaining: 32.1ms
110:      learn: 0.1323151      total: 897ms      remaining: 24.2ms
111:      learn: 0.1314563      total: 898ms      remaining: 16ms
112:      learn: 0.1307075      total: 911ms      remaining: 8.07ms
113:      learn: 0.1299748      total: 913ms      remaining: 0us
```
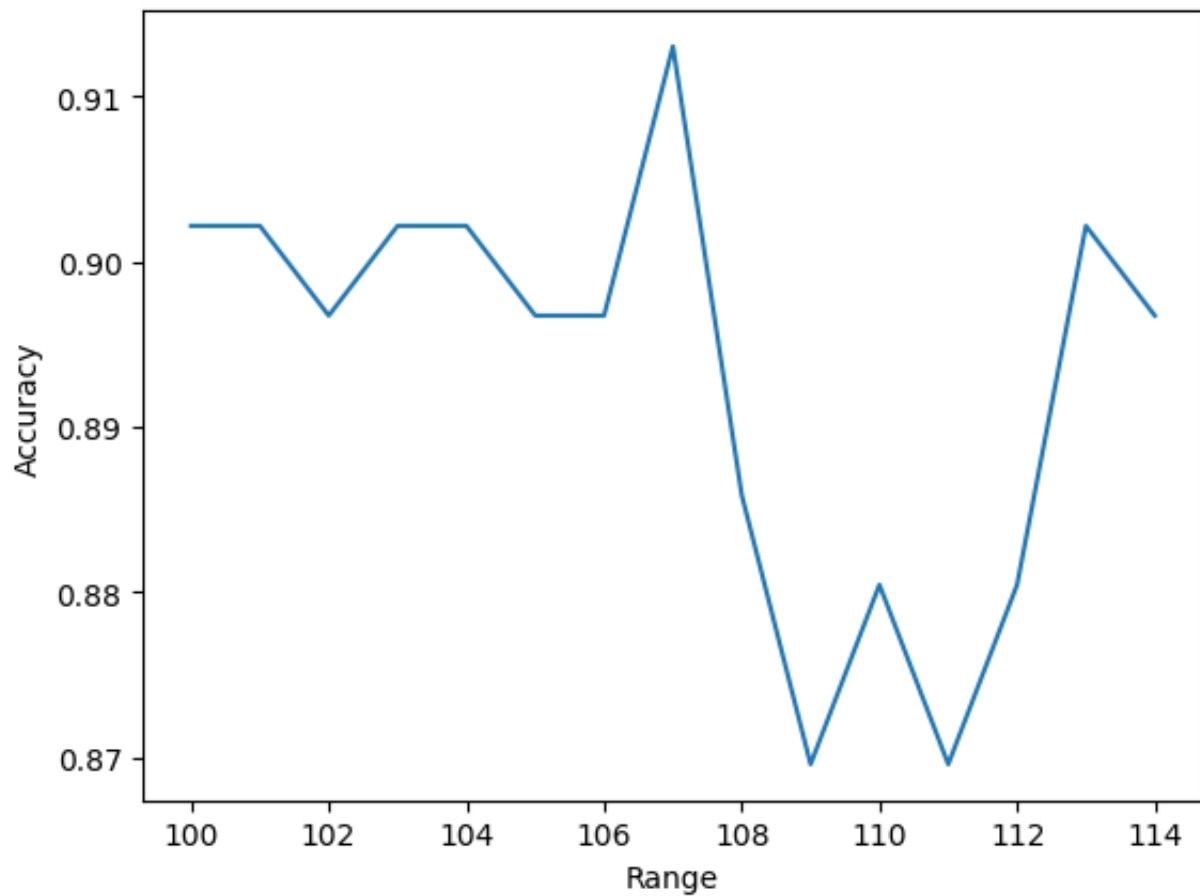
```
# plot confusion matrix
from sklearn.metrics import confusion_matrix
cm = confusion_matrix(y_test, y_pred)
plt.figure(figsize=(5,3))
sns.heatmap(cm, annot=True)
```

<Axes: >
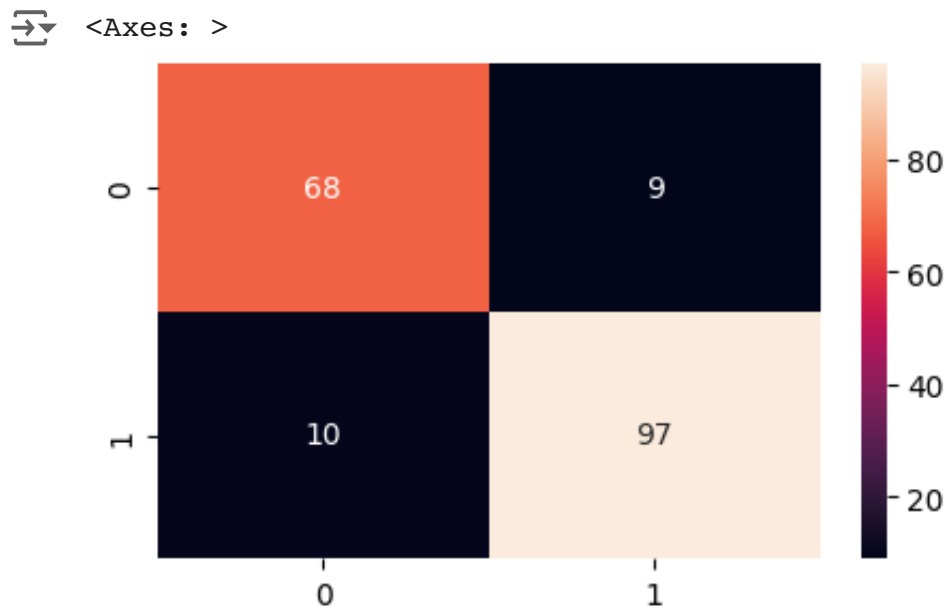
```
# Feature importance for xgboost
feat_importances = pd.Series(model.feature_importances_, index=X.columns)
feat_importances.nlargest(20).plot(kind='barh')
plt.xlabel('Relative Importance')
plt.ylabel('Features')
plt.title('Feature Importances')
plt.show()
```