```python
# Plotting Libraries
import pandas as pd
import numpy as np
import matplotlib.pyplot as plt
import seaborn as sns
%matplotlib inline

# Metrics for Classification technique
from sklearn.metrics import classification_report,confusion_matrix,accuracy_score

# Scaler
from sklearn.preprocessing import StandardScaler
from sklearn.model_selection import  RandomizedSearchCV, train_test_split

from xgboost import XGBClassifier
# !pip install catboost
from catboost import CatBoostClassifier
from sklearn.ensemble import RandomForestClassifier
from sklearn.neighbors import KNeighborsClassifier
from sklearn.svm import SVC
```

```python
file = open("col_description.txt")
lines = file.readlines()
print("col Description: \n")
for line in lines:
    print(line)
```

```
col Description:

age

sex

chest pain type (4 values)

resting blood pressure

serum cholestoral in mg/dl

fasting blood sugar > 120 mg/dl

resting electrocardiographic results (values 0,1,2)

maximum heart rate achieved

exercise induced angina

oldpeak = ST depression induced by exercise relative to rest

the slope of the peak exercise ST segment

number of major vessels (0-3) colored by flourosopy

thal: 0 = normal; 1 = fixed defect; 2 = reversable defect
```

```python
# Loading Data:
data = pd.read_csv('heart.csv')
data.head()
```

age	sex	cp	trestbps	chol	fbs	restecg	thalach	exang	oldpeak	slope	ca	thal	target

	age	sex	cp	trestbps	chol	fbs	restecg	thalach	exang	oldpeak	slope	ca	thal	target
0	52	1	0	125	212	0	1	168	0	1.0	2	2	3	0
1	53	1	0	140	203	1	0	155	1	3.1	0	0	3	0
2	70	1	0	145	174	0	1	125	1	2.6	0	0	3	0
3	61	1	0	148	203	0	1	161	0	0.0	2	1	3	0
4	62	0	0	138	294	1	1	106	0	1.9	1	3	2	0

In [ ]:
```
data.shape
```

Out[ ]: (1025, 14)

In [ ]:
```
data.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 1025 entries, 0 to 1024
Data columns (total 14 columns):
 #   Column    Non-Null Count  Dtype
---  ------    --------------  -----
 0   age       1025 non-null   int64
 1   sex       1025 non-null   int64
 2   cp        1025 non-null   int64
 3   trestbps  1025 non-null   int64
 4   chol      1025 non-null   int64
 5   fbs       1025 non-null   int64
 6   restecg   1025 non-null   int64
 7   thalach   1025 non-null   int64
 8   exang     1025 non-null   int64
 9   oldpeak   1025 non-null   float64
 10  slope     1025 non-null   int64
 11  ca        1025 non-null   int64
 12  thal      1025 non-null   int64
 13  target    1025 non-null   int64
dtypes: float64(1), int64(13)
memory usage: 112.2 KB
```

In [ ]:
```
# Checking for null values
data.isnull().sum()
```

Out[ ]:
```
age         0
sex         0
cp          0
trestbps    0
chol        0
fbs         0
restecg     0
thalach     0
exang       0
oldpeak     0
slope       0
ca          0
thal        0
target      0
dtype: int64
```

In [ ]:
```
data.describe()
```

Out[ ]:

	age	sex	cp	trestbps	chol	fbs	restecg

|	age	sex	cp	trestbps	chol	fbs	restecg	
count	1025.000000	1025.000000	1025.000000	1025.000000	1025.00000	1025.000000	1025.000000	1
mean	54.434146	0.695610	0.942439	131.611707	246.00000	0.149268	0.529756	
std	9.072290	0.460373	1.029641	17.516718	51.59251	0.356527	0.527878	
min	29.000000	0.000000	0.000000	94.000000	126.00000	0.000000	0.000000	
25%	48.000000	0.000000	0.000000	120.000000	211.00000	0.000000	0.000000	
50%	56.000000	1.000000	1.000000	130.000000	240.00000	0.000000	1.000000	
75%	61.000000	1.000000	2.000000	140.000000	275.00000	0.000000	1.000000	
max	77.000000	1.000000	3.000000	200.000000	564.00000	1.000000	2.000000	

```python
# plotting correlation heatmap the given data
corr = data.corr()
plt.figure(figsize=(20,15))
sns.heatmap(corr,annot=True,linewidth=2)
plt.tight_layout()
```
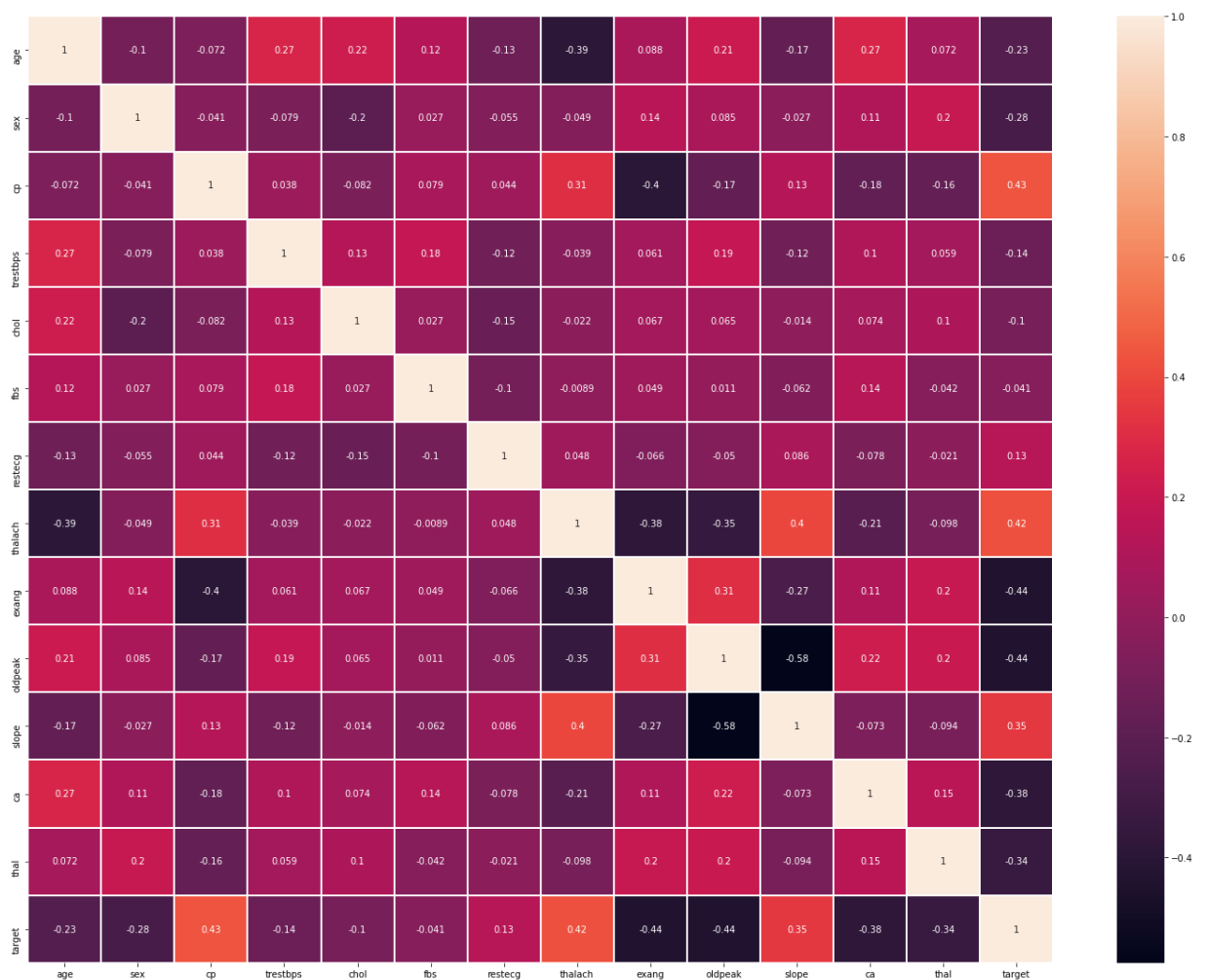


```python
# checking correlation of different variables with target variables
sns.set_context('notebook',font_scale = 2.3)
data.drop('target', axis=1).corrwith(data.target).plot(kind='bar', grid=True, figsiz
plt.tight_layout()
```

Correlation with the target
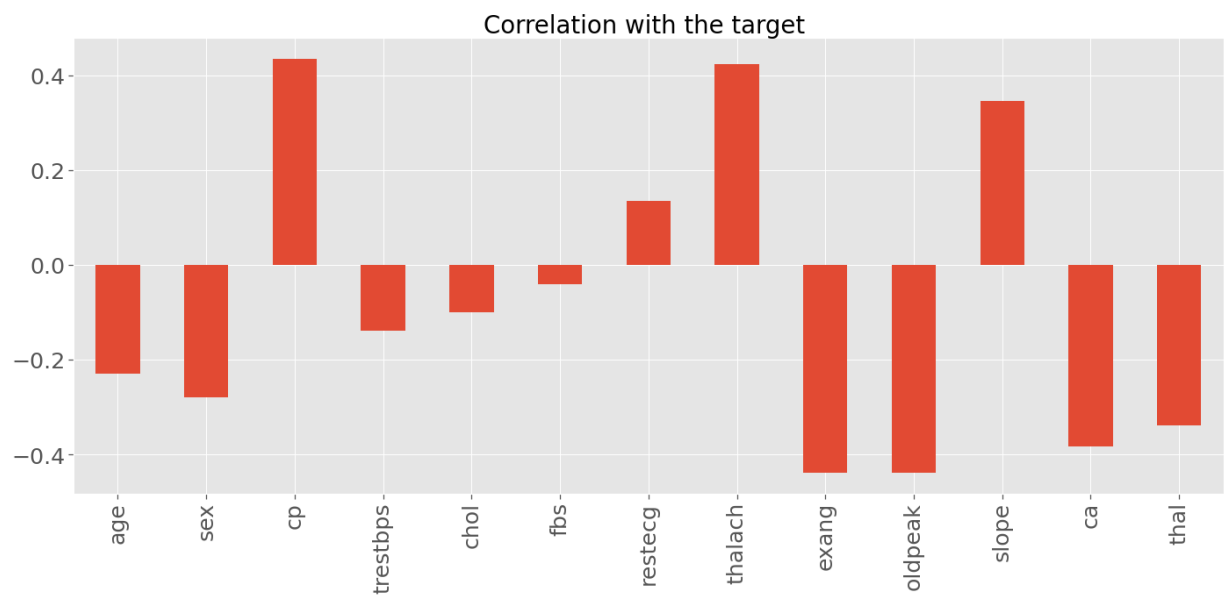
Age Analysis

In [ ]:
```python
[data['age'].value_counts()]
```

Out[ ]:
```
[58    68
 57    57
 54    53
 59    46
 52    43
 56    39
 51    39
 62    37
 60    37
 44    36
 64    34
 41    32
 63    32
 61    31
 67    31
 55    30
 65    27
 53    26
 43    26
 42    26
 66    25
 45    25
 48    23
 46    23
 50    21
 47    18
 49    17
 35    15
 39    14
 70    14
 38    12
 68    12
 40    11
 71    11
 69     9
 37     6
 34     6
 29     4
 74     3
 76     3
 77     3
 Name: age, dtype: int64]
```

```
In [ ]:  plt.figure(figsize=(25,12))
         sns.barplot(x=data.age.value_counts().index,y=data.age.value_counts().values)
         plt.xlabel('Age')
         plt.ylabel('Count')
         plt.title('Age Analysis')
```

Out[ ]: Text(0.5, 1.0, 'Age Analysis')
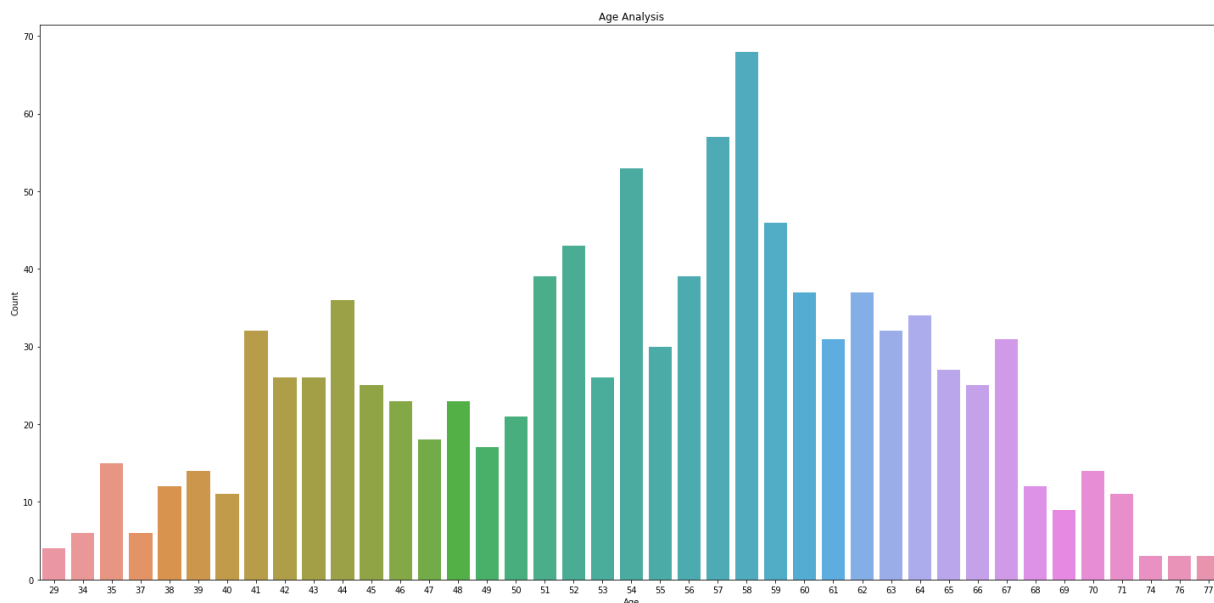

```
In [ ]:  # range of ages:

         print(f'min Age: {data.age.min()}')
         print(f'max Age: {data.age.max()}')
         print(f'Average Age: {data.age.mean()}')
         print(f'Median Age: {data.age.median()}')
```

```
min Age: 29
max Age: 77
Average Age: 54.43414634146342
Median Age: 56.0
```

Gender Feature Analysis

```
In [ ]:  plt.figure(figsize=(18,9))
         sns.countplot(data['sex'])
```

```
C:\Users\rachi\AppData\Local\Programs\Python\Python39\lib\site-packages\seaborn\_dec
orators.py:36: FutureWarning: Pass the following variable as a keyword arg: x. From
version 0.12, the only valid positional argument will be `data`, and passing other a
rguments without an explicit keyword will result in an error or misinterpretation.
  warnings.warn(
```

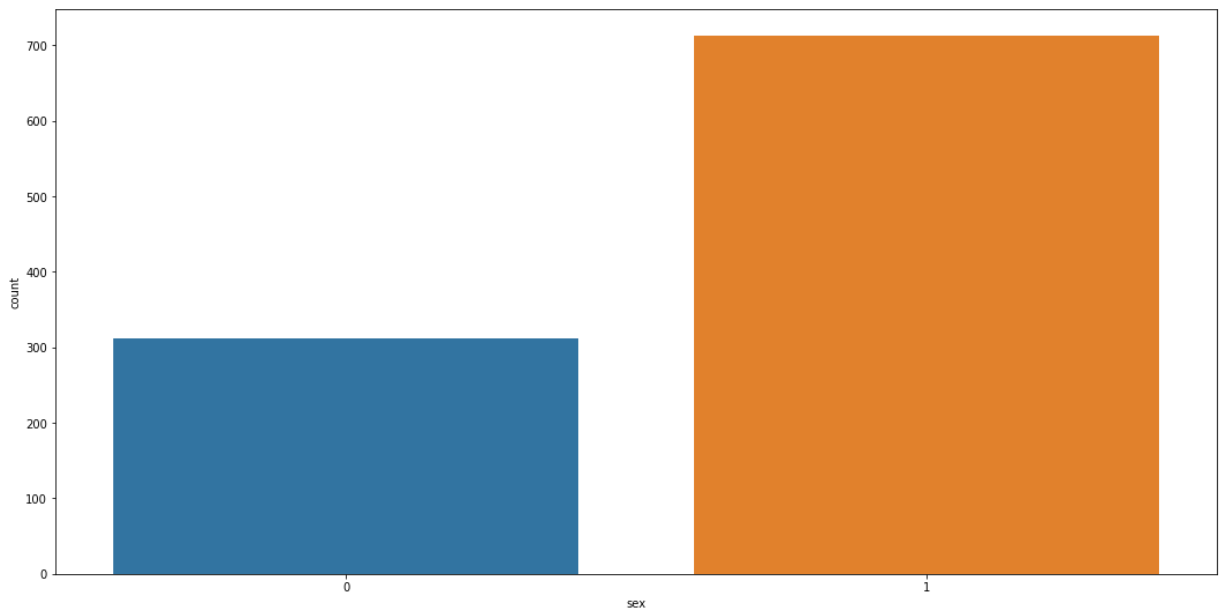Out[ ]: <AxesSubplot:xlabel='sex', ylabel='count'>

Chest pain Type Feature Analysis

In [ ]:
```python
plt.figure(figsize=(18,9))
sns.countplot(data['cp'])
```

C:\Users\rachi\AppData\Local\Programs\Python\Python39\lib\site-packages\seaborn_dec
orators.py:36: FutureWarning: Pass the following variable as a keyword arg: x. From
version 0.12, the only valid positional argument will be `data`, and passing other a
rguments without an explicit keyword will result in an error or misinterpretation.
  warnings.warn(

Out[ ]: <AxesSubplot:xlabel='cp', ylabel='count'>

In [ ]:
```python
plt.figure(figsize=(18,9))
sns.countplot(data.cp,hue=data.sex)
```

C:\Users\rachi\AppData\Local\Programs\Python\Python39\lib\site-packages\seaborn_dec
orators.py:36: FutureWarning: Pass the following variable as a keyword arg: x. From
version 0.12, the only valid positional argument will be `data`, and passing other a
rguments without an explicit keyword will result in an error or misinterpretation.
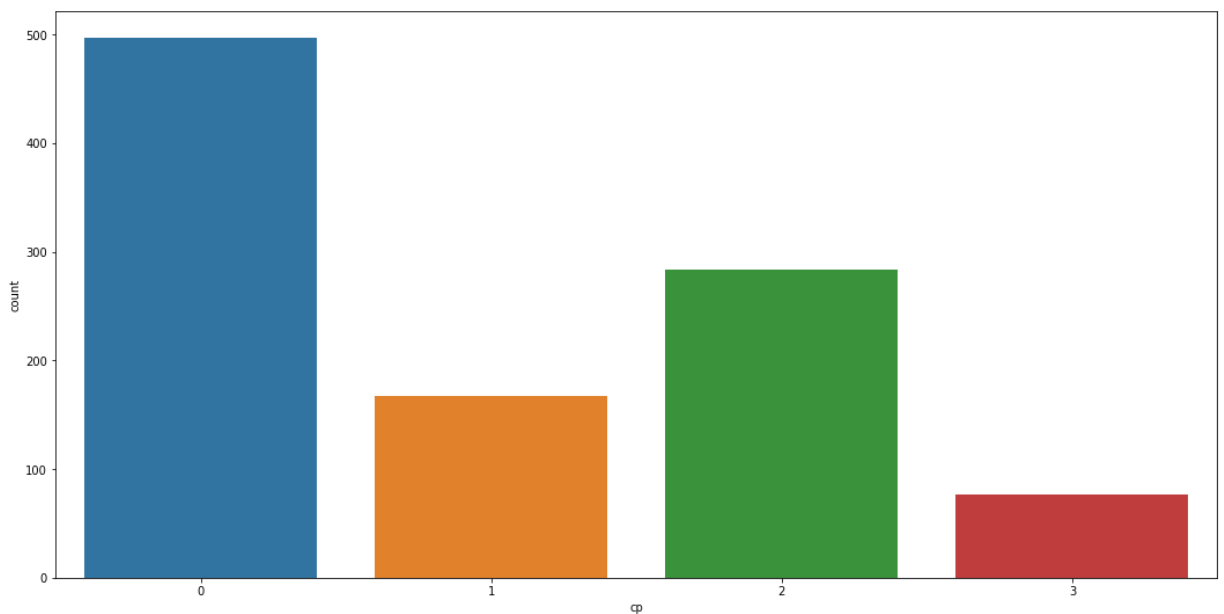 warnings.warn(

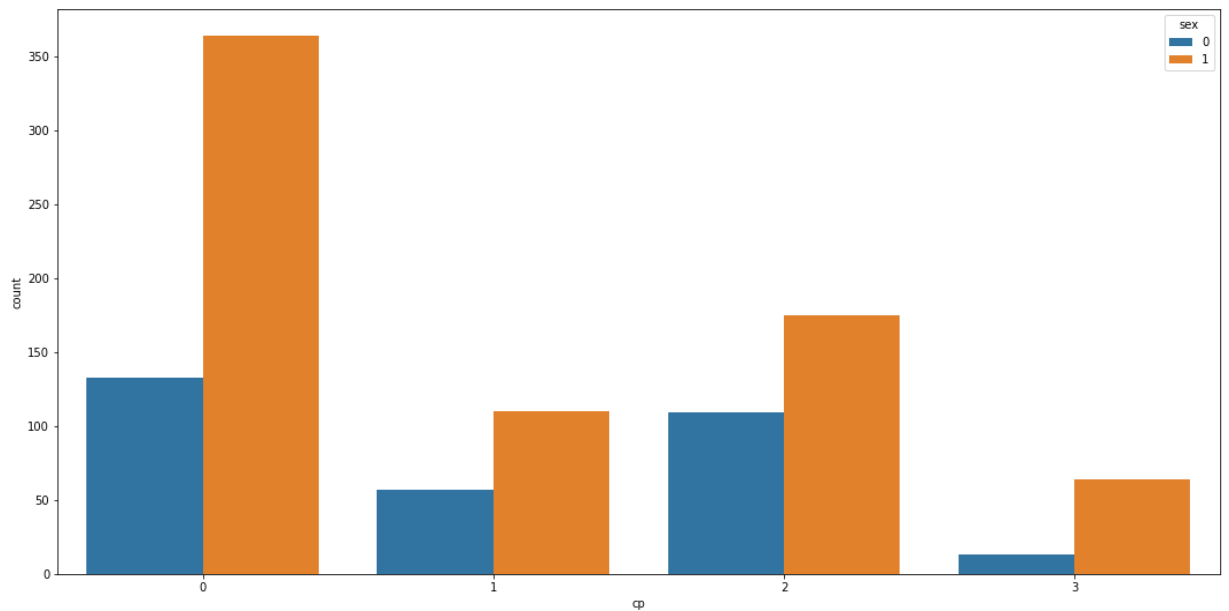Out[ ]: <AxesSubplot:xlabel='cp', ylabel='count'>

Feature Engineering

```python
In [ ]:
# Getting unique values from each feature
cat_val = []
cont_val=[]
for c in data.columns:
    print("---------------")
    print(f'{c} : {data[c].unique()}')
    if len(data[c].unique()) <= 10:
      cat_val.append(c)
    else:
        cont_val.append(c)
```

```
---------------
age : [52 53 70 61 62 58 55 46 54 71 43 34 51 50 60 67 45 63 42 44 56 57 59 64
 65 41 66 38 49 48 29 37 47 68 76 40 39 77 69 35 74]
---------------
sex : [1 0]
---------------
cp : [0 1 2 3]
---------------
trestbps : [125 140 145 148 138 100 114 160 120 122 112 132 118 128 124 106 104 135
 130 136 180 129 150 178 146 117 152 154 170 134 174 144 108 123 110 142
 126 192 115  94 200 165 102 105 155 172 164 156 101]
---------------
chol : [212 203 174 294 248 318 289 249 286 149 341 210 298 204 308 266 244 211
 185 223 208 252 209 307 233 319 256 327 169 131 269 196 231 213 271 263
 229 360 258 330 342 226 228 278 230 283 241 175 188 217 193 245 232 299
 288 197 315 215 164 326 207 177 257 255 187 201 220 268 267 236 303 282
 126 309 186 275 281 206 335 218 254 295 417 260 240 302 192 225 325 235
 274 234 182 167 172 321 300 199 564 157 304 222 184 354 160 247 239 246
 409 293 180 250 221 200 227 243 311 261 242 205 306 219 353 198 394 183
 237 224 265 313 340 259 270 216 264 276 322 214 273 253 176 284 305 168
 407 290 277 262 195 166 178 141]
---------------
fbs : [0 1]
---------------
restecg : [1 0 2]
---------------
thalach : [168 155 125 161 106 122 140 145 144 116 136 192 156 142 109 162 165 148
 172 173 146 179 152 117 115 112 163 147 182 105 150 151 169 166 178 132
 160 123 139 111 180 164 202 157 159 170 138 175 158 126 143 141 167  95
 190 118 103 181 108 177 134 120 171 149 154 153  88 174 114 195 133  96
 124 131 185 194 128 127 186 184 188 130  71 137  99 121 187  97  90 129
```

```
  113]
---------------
exang : [0 1]
---------------
oldpeak : [1.  3.1 2.6 0.  1.9 4.4 0.8 3.2 1.6 3.  0.7 4.2 1.5 2.2 1.1 0.3 0.4 0.6
 3.4 2.8 1.2 2.9 3.6 1.4 0.2 2.  5.6 0.9 1.8 6.2 4.  2.5 0.5 0.1 2.1 2.4
 3.8 2.3 1.3 3.5]
---------------
slope : [2 0 1]
---------------
ca : [2 0 1 3 4]
---------------
thal : [3 2 1 0]
---------------
target : [0 1]
```

In [ ]:
```python
cat_val.remove('target')
dfs = pd.get_dummies(data,columns = cat_val)
```

In [ ]:
```python
dfs.head()
```

Out[ ]:

	age	trestbps	chol	thalach	oldpeak	target	sex_0	sex_1	cp_0	cp_1	...	slope_2	ca_0	ca_1
0	52	125	212	168	1.0	0	0	1	1	0	...	1	0	0
1	53	140	203	155	3.1	0	0	1	1	0	...	0	1	0
2	70	145	174	125	2.6	0	0	1	1	0	...	0	1	0
3	61	148	203	161	0.0	0	0	1	1	0	...	1	0	1
4	62	138	294	106	1.9	0	1	0	1	0	...	0	0	0

5 rows × 31 columns

In [ ]:
```python
scaler = StandardScaler()
col_to_scale = ['age', 'trestbps', 'chol', 'thalach', 'oldpeak']
dfs[col_to_scale] = scaler.fit_transform(dfs[col_to_scale])
```

In [ ]:
```python
#scaled data
dfs.head()
```

Out[ ]:

	age	trestbps	chol	thalach	oldpeak	target	sex_0	sex_1	cp_0	cp_1	...	slope
0	-0.268437	-0.377636	-0.659332	0.821321	-0.060888	0	0	1	1	0	...	
1	-0.158157	0.479107	-0.833861	0.255968	1.727137	0	0	1	1	0	...	
2	1.716595	0.764688	-1.396233	-1.048692	1.301417	0	0	1	1	0	...	
3	0.724079	0.936037	-0.833861	0.516900	-0.912329	0	0	1	1	0	...	
4	0.834359	0.364875	0.930822	-1.874977	0.705408	0	1	0	1	0	...	

5 rows × 31 columns

In [ ]:
```python
# model Creation
```

```python
X = dfs.drop('target',axis=1)
y = dfs.target
```

```python
# Splitting the dataset
x_train,x_test,y_train,y_test = train_test_split(X,y,test_size=0.3,random_state=42)
```

```python
x_train.head()
```

	age	trestbps	chol	thalach	oldpeak	sex_0	sex_1	cp_0	cp_1	cp_2	...	slop
1020	0.503520	0.479107	-0.484803	0.647366	-0.912329	0	1	0	1	0	...	
479	0.393241	-0.206287	-0.581764	-0.787760	0.960840	0	1	1	0	0	...	
227	-1.150673	-0.777449	-0.077568	-0.004964	-0.656897	1	0	0	0	1	...	
910	-0.488996	0.479107	-0.252098	0.603877	-0.401465	0	1	0	0	1	...	
362	-1.260953	-0.548984	-0.639940	0.690855	-0.742041	1	0	0	0	1	...	

5 rows × 30 columns

```python
y_train
```

```
1020    1
479     0
227     1
910     0
362     1
       ..
700     1
71      0
106     0
270     1
860     0
Name: target, Length: 717, dtype: int64
```

Model Selection

```python
knn = KNeighborsClassifier(n_neighbors=10)
```

```python
knn.fit(x_train,y_train)
```

```
KNeighborsClassifier(n_neighbors=10)
```

```python
y_pred_knn = knn.predict(x_test)
```

```python
print(f'Prediction Score knn : {accuracy_score(y_test,y_pred_knn)}')
```

```
Prediction Score knn : 0.827922077922078
```

Random Forest Classifier

`In [ ]:`
```python
rfc = RandomForestClassifier()
rfc.fit(x_train,y_train)
y_pred_rfc = rfc.predict(x_test)
```

`In [ ]:`
```python
print(f'Prediction Score rfc : {accuracy_score(y_test,y_pred_rfc)}')
```

Prediction Score rfc : 0.9805194805194806

`In [ ]:`
```python
## XGBoost
xgb = XGBClassifier(random_state = 42)
xgb.fit(x_train,y_train)
y_pred_xgb = xgb.predict(x_test)
```

C:\Users\rachi\AppData\Local\Programs\Python\Python39\lib\site-packages\xgboost\skle
arn.py:1224: UserWarning: The use of label encoder in XGBClassifier is deprecated an
d will be removed in a future release. To remove this warning, do the following: 1)
Pass option use_label_encoder=False when constructing XGBClassifier object; and 2) E
ncode your labels (y) as integers starting with 0, i.e. 0, 1, 2, ..., [num_class -
1].
  warnings.warn(label_encoder_deprecation_msg, UserWarning)
[10:53:49] WARNING: C:/Users/Administrator/workspace/xgboost-win64_release_1.5.1/sr
c/learner.cc:1115: Starting in XGBoost 1.3.0, the default evaluation metric used wit
h the objective 'binary:logistic' was changed from 'error' to 'logloss'. Explicitly
set eval_metric if you'd like to restore the old behavior.

`In [ ]:`
```python
print(f'Prediction Score xgb : {accuracy_score(y_test,y_pred_xgb)}')
```

Prediction Score xgb : 0.9805194805194806

CatBoost

`In [ ]:`
```python
cat = CatBoostClassifier(random_state=42)
```

`In [ ]:`
```python
cat.fit(x_train,y_train)
cat.predict(x_test)
```

```
Learning rate set to 0.008938
0:      learn: 0.6830783        total: 148ms    remaining: 2m 27s
1:      learn: 0.6747900        total: 151ms    remaining: 1m 15s
2:      learn: 0.6669779        total: 153ms    remaining: 50.8s
3:      learn: 0.6574535        total: 155ms    remaining: 38.5s
4:      learn: 0.6487004        total: 158ms    remaining: 31.5s
5:      learn: 0.6408954        total: 178ms    remaining: 29.5s
6:      learn: 0.6323640        total: 185ms    remaining: 26.3s
7:      learn: 0.6251490        total: 189ms    remaining: 23.4s
8:      learn: 0.6188970        total: 192ms    remaining: 21.1s
9:      learn: 0.6114276        total: 194ms    remaining: 19.2s
10:     learn: 0.6046167        total: 196ms    remaining: 17.6s
11:     learn: 0.5967804        total: 198ms    remaining: 16.3s
12:     learn: 0.5898082        total: 200ms    remaining: 15.2s
13:     learn: 0.5830019        total: 203ms    remaining: 14.3s
14:     learn: 0.5763722        total: 206ms    remaining: 13.5s
15:     learn: 0.5693971        total: 209ms    remaining: 12.9s
16:     learn: 0.5625686        total: 219ms    remaining: 12.6s
17:     learn: 0.5549160        total: 221ms    remaining: 12.1s
18:     learn: 0.5486331        total: 226ms    remaining: 11.7s
19:     learn: 0.5421060        total: 234ms    remaining: 11.5s
20:     learn: 0.5354416        total: 236ms    remaining: 11s
```

```
21:     learn: 0.5294443        total: 239ms    remaining: 10.6s
22:     learn: 0.5236348        total: 241ms    remaining: 10.2s
23:     learn: 0.5184965        total: 243ms    remaining: 9.89s
24:     learn: 0.5135338        total: 248ms    remaining: 9.66s
25:     learn: 0.5084815        total: 250ms    remaining: 9.36s
26:     learn: 0.5042788        total: 252ms    remaining: 9.08s
27:     learn: 0.4994206        total: 254ms    remaining: 8.81s
28:     learn: 0.4949002        total: 256ms    remaining: 8.55s
29:     learn: 0.4899618        total: 260ms    remaining: 8.41s
30:     learn: 0.4852257        total: 265ms    remaining: 8.28s
31:     learn: 0.4802027        total: 267ms    remaining: 8.08s
32:     learn: 0.4756990        total: 269ms    remaining: 7.88s
33:     learn: 0.4707057        total: 275ms    remaining: 7.81s
34:     learn: 0.4669475        total: 278ms    remaining: 7.66s
35:     learn: 0.4619232        total: 292ms    remaining: 7.83s
36:     learn: 0.4580700        total: 296ms    remaining: 7.71s
37:     learn: 0.4540695        total: 307ms    remaining: 7.78s
38:     learn: 0.4506093        total: 319ms    remaining: 7.86s
39:     learn: 0.4465635        total: 326ms    remaining: 7.82s
40:     learn: 0.4416728        total: 328ms    remaining: 7.67s
41:     learn: 0.4380765        total: 331ms    remaining: 7.54s
42:     learn: 0.4336001        total: 335ms    remaining: 7.45s
43:     learn: 0.4293479        total: 337ms    remaining: 7.33s
44:     learn: 0.4249623        total: 341ms    remaining: 7.23s
45:     learn: 0.4214348        total: 345ms    remaining: 7.16s
46:     learn: 0.4175722        total: 349ms    remaining: 7.09s
47:     learn: 0.4144807        total: 362ms    remaining: 7.18s
48:     learn: 0.4113003        total: 364ms    remaining: 7.07s
49:     learn: 0.4072209        total: 379ms    remaining: 7.19s
50:     learn: 0.4046445        total: 381ms    remaining: 7.09s
51:     learn: 0.4020363        total: 383ms    remaining: 6.98s
52:     learn: 0.3984941        total: 386ms    remaining: 6.9s
53:     learn: 0.3955071        total: 389ms    remaining: 6.82s
54:     learn: 0.3918783        total: 393ms    remaining: 6.76s
55:     learn: 0.3886411        total: 397ms    remaining: 6.7s
56:     learn: 0.3854220        total: 400ms    remaining: 6.61s
57:     learn: 0.3822960        total: 402ms    remaining: 6.53s
58:     learn: 0.3789729        total: 406ms    remaining: 6.47s
59:     learn: 0.3756726        total: 424ms    remaining: 6.64s
60:     learn: 0.3724881        total: 439ms    remaining: 6.76s
61:     learn: 0.3697339        total: 462ms    remaining: 7s
62:     learn: 0.3666526        total: 464ms    remaining: 6.9s
63:     learn: 0.3633833        total: 465ms    remaining: 6.81s
64:     learn: 0.3602313        total: 467ms    remaining: 6.72s
65:     learn: 0.3573174        total: 478ms    remaining: 6.76s
66:     learn: 0.3544681        total: 508ms    remaining: 7.08s
67:     learn: 0.3522834        total: 512ms    remaining: 7.01s
68:     learn: 0.3506016        total: 513ms    remaining: 6.93s
69:     learn: 0.3479069        total: 516ms    remaining: 6.86s
70:     learn: 0.3449212        total: 518ms    remaining: 6.78s
71:     learn: 0.3426600        total: 520ms    remaining: 6.71s
72:     learn: 0.3394234        total: 571ms    remaining: 7.25s
73:     learn: 0.3367120        total: 585ms    remaining: 7.33s
74:     learn: 0.3340029        total: 588ms    remaining: 7.26s
75:     learn: 0.3320280        total: 616ms    remaining: 7.49s
76:     learn: 0.3298815        total: 620ms    remaining: 7.43s
77:     learn: 0.3274475        total: 647ms    remaining: 7.64s
78:     learn: 0.3245694        total: 649ms    remaining: 7.56s
79:     learn: 0.3225380        total: 651ms    remaining: 7.49s
80:     learn: 0.3199305        total: 653ms    remaining: 7.41s
81:     learn: 0.3177874        total: 655ms    remaining: 7.33s
82:     learn: 0.3153117        total: 662ms    remaining: 7.32s
83:     learn: 0.3136570        total: 664ms    remaining: 7.24s
84:     learn: 0.3119687        total: 666ms    remaining: 7.17s
85:     learn: 0.3100649        total: 668ms    remaining: 7.09s
86:     learn: 0.3083096        total: 669ms    remaining: 7.02s
87:     learn: 0.3062572        total: 671ms    remaining: 6.95s
88:     learn: 0.3043132        total: 674ms    remaining: 6.89s
89:     learn: 0.3024588        total: 682ms    remaining: 6.89s
```

```
90:     learn: 0.3011867        total: 698ms    remaining: 6.97s
91:     learn: 0.3000453        total: 700ms    remaining: 6.91s
92:     learn: 0.2984122        total: 702ms    remaining: 6.84s
93:     learn: 0.2964238        total: 703ms    remaining: 6.78s
94:     learn: 0.2947373        total: 705ms    remaining: 6.71s
95:     learn: 0.2927215        total: 707ms    remaining: 6.65s
96:     learn: 0.2902743        total: 708ms    remaining: 6.59s
97:     learn: 0.2891810        total: 710ms    remaining: 6.53s
98:     learn: 0.2868542        total: 712ms    remaining: 6.48s
99:     learn: 0.2853060        total: 715ms    remaining: 6.43s
100:    learn: 0.2832342        total: 717ms    remaining: 6.38s
101:    learn: 0.2818922        total: 720ms    remaining: 6.34s
102:    learn: 0.2802486        total: 722ms    remaining: 6.29s
103:    learn: 0.2782565        total: 741ms    remaining: 6.38s
104:    learn: 0.2766107        total: 757ms    remaining: 6.45s
105:    learn: 0.2753437        total: 765ms    remaining: 6.45s
106:    learn: 0.2737083        total: 767ms    remaining: 6.4s
107:    learn: 0.2723876        total: 769ms    remaining: 6.35s
108:    learn: 0.2710198        total: 779ms    remaining: 6.37s
109:    learn: 0.2699074        total: 781ms    remaining: 6.32s
110:    learn: 0.2695816        total: 783ms    remaining: 6.27s
111:    learn: 0.2678394        total: 803ms    remaining: 6.37s
112:    learn: 0.2665010        total: 818ms    remaining: 6.42s
113:    learn: 0.2654375        total: 820ms    remaining: 6.37s
114:    learn: 0.2637751        total: 835ms    remaining: 6.42s
115:    learn: 0.2622760        total: 839ms    remaining: 6.39s
116:    learn: 0.2605527        total: 842ms    remaining: 6.36s
117:    learn: 0.2597983        total: 845ms    remaining: 6.32s
118:    learn: 0.2585165        total: 849ms    remaining: 6.29s
119:    learn: 0.2570913        total: 852ms    remaining: 6.25s
120:    learn: 0.2561403        total: 864ms    remaining: 6.28s
121:    learn: 0.2544658        total: 866ms    remaining: 6.24s
122:    learn: 0.2530222        total: 869ms    remaining: 6.2s
123:    learn: 0.2521516        total: 872ms    remaining: 6.16s
124:    learn: 0.2507724        total: 879ms    remaining: 6.15s
125:    learn: 0.2493192        total: 881ms    remaining: 6.11s
126:    learn: 0.2477948        total: 884ms    remaining: 6.07s
127:    learn: 0.2463716        total: 885ms    remaining: 6.03s
128:    learn: 0.2448574        total: 887ms    remaining: 5.99s
129:    learn: 0.2435240        total: 889ms    remaining: 5.95s
130:    learn: 0.2425224        total: 892ms    remaining: 5.91s
131:    learn: 0.2412279        total: 894ms    remaining: 5.88s
132:    learn: 0.2399246        total: 896ms    remaining: 5.84s
133:    learn: 0.2388174        total: 899ms    remaining: 5.81s
134:    learn: 0.2379431        total: 902ms    remaining: 5.78s
135:    learn: 0.2368410        total: 914ms    remaining: 5.81s
136:    learn: 0.2356027        total: 916ms    remaining: 5.77s
137:    learn: 0.2348908        total: 918ms    remaining: 5.73s
138:    learn: 0.2338338        total: 919ms    remaining: 5.7s
139:    learn: 0.2327308        total: 921ms    remaining: 5.66s
140:    learn: 0.2320340        total: 923ms    remaining: 5.62s
141:    learn: 0.2310003        total: 925ms    remaining: 5.59s
142:    learn: 0.2299545        total: 927ms    remaining: 5.56s
143:    learn: 0.2290017        total: 930ms    remaining: 5.53s
144:    learn: 0.2281205        total: 932ms    remaining: 5.5s
145:    learn: 0.2270082        total: 934ms    remaining: 5.46s
146:    learn: 0.2256904        total: 959ms    remaining: 5.56s
147:    learn: 0.2246543        total: 974ms    remaining: 5.61s
148:    learn: 0.2238853        total: 976ms    remaining: 5.58s
149:    learn: 0.2228348        total: 979ms    remaining: 5.55s
150:    learn: 0.2220422        total: 988ms    remaining: 5.56s
151:    learn: 0.2213011        total: 991ms    remaining: 5.53s
152:    learn: 0.2203012        total: 1s       remaining: 5.56s
153:    learn: 0.2192811        total: 1.01s    remaining: 5.53s
154:    learn: 0.2184125        total: 1.01s    remaining: 5.5s
155:    learn: 0.2177944        total: 1.01s    remaining: 5.46s
156:    learn: 0.2166681        total: 1.01s    remaining: 5.43s
157:    learn: 0.2160995        total: 1.01s    remaining: 5.39s
158:    learn: 0.2152645        total: 1.01s    remaining: 5.36s
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159:    learn: 0.2144941        total: 1.01s    remaining: 5.33s
160:    learn: 0.2135215        total: 1.02s    remaining: 5.3s
161:    learn: 0.2126132        total: 1.03s    remaining: 5.35s
162:    learn: 0.2114418        total: 1.05s    remaining: 5.39s
163:    learn: 0.2107324        total: 1.07s    remaining: 5.44s
164:    learn: 0.2098950        total: 1.07s    remaining: 5.41s
165:    learn: 0.2091941        total: 1.07s    remaining: 5.38s
166:    learn: 0.2087636        total: 1.07s    remaining: 5.36s
167:    learn: 0.2079327        total: 1.08s    remaining: 5.33s
168:    learn: 0.2070313        total: 1.08s    remaining: 5.3s
169:    learn: 0.2063806        total: 1.09s    remaining: 5.35s
170:    learn: 0.2051600        total: 1.1s     remaining: 5.32s
171:    learn: 0.2042284        total: 1.1s     remaining: 5.3s
172:    learn: 0.2035608        total: 1.13s    remaining: 5.39s
173:    learn: 0.2025931        total: 1.13s    remaining: 5.36s
174:    learn: 0.2016401        total: 1.13s    remaining: 5.34s
175:    learn: 0.2005673        total: 1.14s    remaining: 5.34s
176:    learn: 0.1995341        total: 1.14s    remaining: 5.31s
177:    learn: 0.1989057        total: 1.16s    remaining: 5.34s
178:    learn: 0.1982019        total: 1.17s    remaining: 5.38s
179:    learn: 0.1973530        total: 1.17s    remaining: 5.35s
180:    learn: 0.1971169        total: 1.18s    remaining: 5.32s
181:    learn: 0.1965265        total: 1.2s     remaining: 5.41s
182:    learn: 0.1958211        total: 1.21s    remaining: 5.38s
183:    learn: 0.1953800        total: 1.21s    remaining: 5.35s
184:    learn: 0.1946557        total: 1.21s    remaining: 5.33s
185:    learn: 0.1935515        total: 1.21s    remaining: 5.3s
186:    learn: 0.1927342        total: 1.21s    remaining: 5.27s
187:    learn: 0.1919946        total: 1.22s    remaining: 5.25s
188:    learn: 0.1914563        total: 1.22s    remaining: 5.23s
189:    learn: 0.1907114        total: 1.22s    remaining: 5.2s
190:    learn: 0.1899638        total: 1.22s    remaining: 5.18s
191:    learn: 0.1895518        total: 1.23s    remaining: 5.16s
192:    learn: 0.1884266        total: 1.23s    remaining: 5.13s
193:    learn: 0.1877772        total: 1.23s    remaining: 5.11s
194:    learn: 0.1871172        total: 1.23s    remaining: 5.08s
195:    learn: 0.1861812        total: 1.23s    remaining: 5.06s
196:    learn: 0.1853377        total: 1.24s    remaining: 5.03s
197:    learn: 0.1844336        total: 1.24s    remaining: 5.01s
198:    learn: 0.1838570        total: 1.24s    remaining: 4.98s
199:    learn: 0.1832671        total: 1.25s    remaining: 4.99s
200:    learn: 0.1828772        total: 1.25s    remaining: 4.97s
201:    learn: 0.1821755        total: 1.26s    remaining: 4.99s
202:    learn: 0.1815081        total: 1.26s    remaining: 4.97s
203:    learn: 0.1813003        total: 1.27s    remaining: 4.95s
204:    learn: 0.1807229        total: 1.27s    remaining: 4.92s
205:    learn: 0.1800824        total: 1.27s    remaining: 4.9s
206:    learn: 0.1794480        total: 1.29s    remaining: 4.95s
207:    learn: 0.1790069        total: 1.29s    remaining: 4.92s
208:    learn: 0.1784046        total: 1.29s    remaining: 4.9s
209:    learn: 0.1779741        total: 1.3s     remaining: 4.88s
210:    learn: 0.1776506        total: 1.3s     remaining: 4.85s
211:    learn: 0.1770379        total: 1.3s     remaining: 4.83s
212:    learn: 0.1763646        total: 1.3s     remaining: 4.81s
213:    learn: 0.1759213        total: 1.3s     remaining: 4.79s
214:    learn: 0.1751089        total: 1.35s    remaining: 4.95s
215:    learn: 0.1741862        total: 1.36s    remaining: 4.94s
216:    learn: 0.1736348        total: 1.41s    remaining: 5.09s
217:    learn: 0.1729107        total: 1.41s    remaining: 5.07s
218:    learn: 0.1724294        total: 1.42s    remaining: 5.08s
219:    learn: 0.1720329        total: 1.44s    remaining: 5.11s
220:    learn: 0.1714368        total: 1.46s    remaining: 5.14s
221:    learn: 0.1708209        total: 1.47s    remaining: 5.16s
222:    learn: 0.1704713        total: 1.47s    remaining: 5.13s
223:    learn: 0.1699782        total: 1.48s    remaining: 5.12s
224:    learn: 0.1694287        total: 1.49s    remaining: 5.12s
225:    learn: 0.1687127        total: 1.49s    remaining: 5.11s
226:    learn: 0.1680245        total: 1.51s    remaining: 5.13s
227:    learn: 0.1674640        total: 1.51s    remaining: 5.12s
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228:    learn: 0.1667464        total: 1.52s    remaining: 5.11s
229:    learn: 0.1662098        total: 1.52s    remaining: 5.1s
230:    learn: 0.1655075        total: 1.55s    remaining: 5.17s
231:    learn: 0.1649916        total: 1.57s    remaining: 5.19s
232:    learn: 0.1646175        total: 1.57s    remaining: 5.17s
233:    learn: 0.1640019        total: 1.6s     remaining: 5.23s
234:    learn: 0.1635480        total: 1.64s    remaining: 5.35s
235:    learn: 0.1631823        total: 1.66s    remaining: 5.38s
236:    learn: 0.1628351        total: 1.68s    remaining: 5.39s
237:    learn: 0.1624126        total: 1.71s    remaining: 5.46s
238:    learn: 0.1618020        total: 1.71s    remaining: 5.45s
239:    learn: 0.1613605        total: 1.71s    remaining: 5.42s
240:    learn: 0.1608744        total: 1.74s    remaining: 5.47s
241:    learn: 0.1603674        total: 1.74s    remaining: 5.45s
242:    learn: 0.1598883        total: 1.74s    remaining: 5.42s
243:    learn: 0.1595329        total: 1.74s    remaining: 5.4s
244:    learn: 0.1592088        total: 1.74s    remaining: 5.37s
245:    learn: 0.1586843        total: 1.75s    remaining: 5.35s
246:    learn: 0.1581621        total: 1.75s    remaining: 5.33s
247:    learn: 0.1575260        total: 1.75s    remaining: 5.31s
248:    learn: 0.1571037        total: 1.77s    remaining: 5.33s
249:    learn: 0.1565415        total: 1.78s    remaining: 5.35s
250:    learn: 0.1559697        total: 1.8s     remaining: 5.37s
251:    learn: 0.1554845        total: 1.8s     remaining: 5.34s
252:    learn: 0.1547849        total: 1.8s     remaining: 5.32s
253:    learn: 0.1540095        total: 1.82s    remaining: 5.35s
254:    learn: 0.1537325        total: 1.83s    remaining: 5.34s
255:    learn: 0.1531411        total: 1.83s    remaining: 5.32s
256:    learn: 0.1525811        total: 1.83s    remaining: 5.31s
257:    learn: 0.1522445        total: 1.84s    remaining: 5.29s
258:    learn: 0.1520367        total: 1.84s    remaining: 5.27s
259:    learn: 0.1516112        total: 1.84s    remaining: 5.25s
260:    learn: 0.1512394        total: 1.85s    remaining: 5.23s
261:    learn: 0.1507090        total: 1.85s    remaining: 5.21s
262:    learn: 0.1502604        total: 1.85s    remaining: 5.19s
263:    learn: 0.1498477        total: 1.85s    remaining: 5.17s
264:    learn: 0.1494566        total: 1.88s    remaining: 5.22s
265:    learn: 0.1491146        total: 1.89s    remaining: 5.21s
266:    learn: 0.1486813        total: 1.89s    remaining: 5.2s
267:    learn: 0.1483442        total: 1.9s     remaining: 5.18s
268:    learn: 0.1478499        total: 1.9s     remaining: 5.16s
269:    learn: 0.1472660        total: 1.9s     remaining: 5.14s
270:    learn: 0.1469262        total: 1.91s    remaining: 5.12s
271:    learn: 0.1463798        total: 1.91s    remaining: 5.1s
272:    learn: 0.1460226        total: 1.91s    remaining: 5.08s
273:    learn: 0.1455771        total: 1.91s    remaining: 5.06s
274:    learn: 0.1452068        total: 1.91s    remaining: 5.04s
275:    learn: 0.1446513        total: 1.91s    remaining: 5.02s
276:    learn: 0.1443768        total: 1.92s    remaining: 5s
277:    learn: 0.1441533        total: 1.92s    remaining: 4.98s
278:    learn: 0.1439997        total: 1.92s    remaining: 4.96s
279:    learn: 0.1435667        total: 1.92s    remaining: 4.94s
280:    learn: 0.1432949        total: 1.94s    remaining: 4.96s
281:    learn: 0.1431041        total: 1.94s    remaining: 4.94s
282:    learn: 0.1428010        total: 1.95s    remaining: 4.95s
283:    learn: 0.1425788        total: 1.95s    remaining: 4.93s
284:    learn: 0.1419791        total: 1.96s    remaining: 4.91s
285:    learn: 0.1416577        total: 1.96s    remaining: 4.89s
286:    learn: 0.1410315        total: 1.96s    remaining: 4.87s
287:    learn: 0.1406605        total: 1.96s    remaining: 4.85s
288:    learn: 0.1402736        total: 1.96s    remaining: 4.83s
289:    learn: 0.1401295        total: 1.97s    remaining: 4.81s
290:    learn: 0.1396317        total: 1.97s    remaining: 4.81s
291:    learn: 0.1393809        total: 1.98s    remaining: 4.79s
292:    learn: 0.1389667        total: 1.98s    remaining: 4.78s
293:    learn: 0.1383326        total: 1.98s    remaining: 4.76s
294:    learn: 0.1379749        total: 1.98s    remaining: 4.74s
295:    learn: 0.1378138        total: 1.99s    remaining: 4.72s
296:    learn: 0.1374804        total: 1.99s    remaining: 4.71s
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297:    learn: 0.1370491        total: 1.99s    remaining: 4.69s
298:    learn: 0.1366938        total: 1.99s    remaining: 4.67s
299:    learn: 0.1364699        total: 1.99s    remaining: 4.65s
300:    learn: 0.1362813        total: 2s       remaining: 4.63s
301:    learn: 0.1357662        total: 2s       remaining: 4.62s
302:    learn: 0.1354097        total: 2s       remaining: 4.6s
303:    learn: 0.1349704        total: 2s       remaining: 4.58s
304:    learn: 0.1346901        total: 2s       remaining: 4.57s
305:    learn: 0.1343911        total: 2.01s    remaining: 4.56s
306:    learn: 0.1339647        total: 2.01s    remaining: 4.54s
307:    learn: 0.1335767        total: 2.01s    remaining: 4.52s
308:    learn: 0.1332345        total: 2.02s    remaining: 4.51s
309:    learn: 0.1326116        total: 2.02s    remaining: 4.49s
310:    learn: 0.1322596        total: 2.02s    remaining: 4.47s
311:    learn: 0.1320968        total: 2.02s    remaining: 4.46s
312:    learn: 0.1318462        total: 2.02s    remaining: 4.44s
313:    learn: 0.1314148        total: 2.02s    remaining: 4.43s
314:    learn: 0.1311042        total: 2.03s    remaining: 4.41s
315:    learn: 0.1307517        total: 2.03s    remaining: 4.39s
316:    learn: 0.1302846        total: 2.03s    remaining: 4.38s
317:    learn: 0.1301403        total: 2.04s    remaining: 4.37s
318:    learn: 0.1298183        total: 2.04s    remaining: 4.35s
319:    learn: 0.1294204        total: 2.04s    remaining: 4.34s
320:    learn: 0.1291267        total: 2.05s    remaining: 4.33s
321:    learn: 0.1286227        total: 2.05s    remaining: 4.31s
322:    learn: 0.1282464        total: 2.09s    remaining: 4.38s
323:    learn: 0.1277658        total: 2.1s     remaining: 4.38s
324:    learn: 0.1275058        total: 2.1s     remaining: 4.36s
325:    learn: 0.1272502        total: 2.1s     remaining: 4.35s
326:    learn: 0.1269687        total: 2.11s    remaining: 4.33s
327:    learn: 0.1266431        total: 2.12s    remaining: 4.34s
328:    learn: 0.1264253        total: 2.12s    remaining: 4.33s
329:    learn: 0.1261779        total: 2.13s    remaining: 4.32s
330:    learn: 0.1256760        total: 2.13s    remaining: 4.3s
331:    learn: 0.1252715        total: 2.13s    remaining: 4.29s
332:    learn: 0.1247600        total: 2.16s    remaining: 4.33s
333:    learn: 0.1244724        total: 2.17s    remaining: 4.34s
334:    learn: 0.1240976        total: 2.19s    remaining: 4.35s
335:    learn: 0.1237607        total: 2.21s    remaining: 4.36s
336:    learn: 0.1234594        total: 2.21s    remaining: 4.34s
337:    learn: 0.1229962        total: 2.21s    remaining: 4.33s
338:    learn: 0.1227457        total: 2.21s    remaining: 4.32s
339:    learn: 0.1224705        total: 2.21s    remaining: 4.3s
340:    learn: 0.1219655        total: 2.22s    remaining: 4.29s
341:    learn: 0.1216202        total: 2.22s    remaining: 4.28s
342:    learn: 0.1212062        total: 2.23s    remaining: 4.26s
343:    learn: 0.1208674        total: 2.23s    remaining: 4.25s
344:    learn: 0.1206754        total: 2.24s    remaining: 4.26s
345:    learn: 0.1204471        total: 2.26s    remaining: 4.27s
346:    learn: 0.1201945        total: 2.26s    remaining: 4.25s
347:    learn: 0.1199340        total: 2.26s    remaining: 4.24s
348:    learn: 0.1197254        total: 2.27s    remaining: 4.23s
349:    learn: 0.1194072        total: 2.27s    remaining: 4.21s
350:    learn: 0.1189668        total: 2.29s    remaining: 4.23s
351:    learn: 0.1188243        total: 2.3s     remaining: 4.24s
352:    learn: 0.1187622        total: 2.3s     remaining: 4.22s
353:    learn: 0.1184165        total: 2.31s    remaining: 4.21s
354:    learn: 0.1180224        total: 2.31s    remaining: 4.2s
355:    learn: 0.1176035        total: 2.31s    remaining: 4.18s
356:    learn: 0.1171769        total: 2.31s    remaining: 4.17s
357:    learn: 0.1169605        total: 2.32s    remaining: 4.16s
358:    learn: 0.1167376        total: 2.32s    remaining: 4.14s
359:    learn: 0.1163651        total: 2.33s    remaining: 4.13s
360:    learn: 0.1158899        total: 2.33s    remaining: 4.12s
361:    learn: 0.1155646        total: 2.33s    remaining: 4.11s
362:    learn: 0.1151694        total: 2.33s    remaining: 4.1s
363:    learn: 0.1148350        total: 2.34s    remaining: 4.08s
364:    learn: 0.1146079        total: 2.34s    remaining: 4.07s
365:    learn: 0.1141703        total: 2.34s    remaining: 4.06s
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366:    learn: 0.1140885        total: 2.35s    remaining: 4.04s
367:    learn: 0.1137875        total: 2.35s    remaining: 4.03s
368:    learn: 0.1134605        total: 2.35s    remaining: 4.02s
369:    learn: 0.1130660        total: 2.35s    remaining: 4.01s
370:    learn: 0.1127580        total: 2.36s    remaining: 4s
371:    learn: 0.1125318        total: 2.36s    remaining: 3.98s
372:    learn: 0.1123195        total: 2.36s    remaining: 3.97s
373:    learn: 0.1121370        total: 2.36s    remaining: 3.96s
374:    learn: 0.1118285        total: 2.37s    remaining: 3.94s
375:    learn: 0.1114461        total: 2.37s    remaining: 3.94s
376:    learn: 0.1112550        total: 2.38s    remaining: 3.93s
377:    learn: 0.1110513        total: 2.38s    remaining: 3.92s
378:    learn: 0.1108394        total: 2.38s    remaining: 3.9s
379:    learn: 0.1106497        total: 2.39s    remaining: 3.9s
380:    learn: 0.1104951        total: 2.39s    remaining: 3.88s
381:    learn: 0.1100920        total: 2.39s    remaining: 3.87s
382:    learn: 0.1098762        total: 2.4s     remaining: 3.86s
383:    learn: 0.1097315        total: 2.4s     remaining: 3.85s
384:    learn: 0.1093727        total: 2.41s    remaining: 3.84s
385:    learn: 0.1092067        total: 2.41s    remaining: 3.83s
386:    learn: 0.1088769        total: 2.41s    remaining: 3.82s
387:    learn: 0.1086620        total: 2.42s    remaining: 3.81s
388:    learn: 0.1083760        total: 2.42s    remaining: 3.81s
389:    learn: 0.1081505        total: 2.43s    remaining: 3.8s
390:    learn: 0.1079503        total: 2.43s    remaining: 3.79s
391:    learn: 0.1076358        total: 2.43s    remaining: 3.77s
392:    learn: 0.1072877        total: 2.44s    remaining: 3.76s
393:    learn: 0.1070228        total: 2.44s    remaining: 3.75s
394:    learn: 0.1067521        total: 2.44s    remaining: 3.74s
395:    learn: 0.1066100        total: 2.45s    remaining: 3.73s
396:    learn: 0.1065363        total: 2.47s    remaining: 3.75s
397:    learn: 0.1063309        total: 2.47s    remaining: 3.73s
398:    learn: 0.1060671        total: 2.47s    remaining: 3.72s
399:    learn: 0.1056385        total: 2.48s    remaining: 3.72s
400:    learn: 0.1054092        total: 2.48s    remaining: 3.71s
401:    learn: 0.1052734        total: 2.48s    remaining: 3.7s
402:    learn: 0.1051004        total: 2.49s    remaining: 3.69s
403:    learn: 0.1049960        total: 2.49s    remaining: 3.67s
404:    learn: 0.1047513        total: 2.49s    remaining: 3.66s
405:    learn: 0.1045263        total: 2.5s     remaining: 3.65s
406:    learn: 0.1042737        total: 2.5s     remaining: 3.64s
407:    learn: 0.1041131        total: 2.5s     remaining: 3.63s
408:    learn: 0.1039445        total: 2.52s    remaining: 3.63s
409:    learn: 0.1037036        total: 2.52s    remaining: 3.62s
410:    learn: 0.1035325        total: 2.52s    remaining: 3.61s
411:    learn: 0.1032898        total: 2.52s    remaining: 3.6s
412:    learn: 0.1032546        total: 2.53s    remaining: 3.59s
413:    learn: 0.1029738        total: 2.53s    remaining: 3.58s
414:    learn: 0.1026554        total: 2.53s    remaining: 3.57s
415:    learn: 0.1025229        total: 2.54s    remaining: 3.57s
416:    learn: 0.1024330        total: 2.56s    remaining: 3.58s
417:    learn: 0.1022299        total: 2.56s    remaining: 3.57s
418:    learn: 0.1020188        total: 2.56s    remaining: 3.56s
419:    learn: 0.1017322        total: 2.57s    remaining: 3.54s
420:    learn: 0.1015913        total: 2.57s    remaining: 3.53s
421:    learn: 0.1013836        total: 2.57s    remaining: 3.52s
422:    learn: 0.1011770        total: 2.58s    remaining: 3.51s
423:    learn: 0.1010628        total: 2.59s    remaining: 3.52s
424:    learn: 0.1008621        total: 2.59s    remaining: 3.51s
425:    learn: 0.1006830        total: 2.59s    remaining: 3.5s
426:    learn: 0.1003522        total: 2.6s     remaining: 3.48s
427:    learn: 0.1002296        total: 2.6s     remaining: 3.47s
428:    learn: 0.1000316        total: 2.6s     remaining: 3.46s
429:    learn: 0.0998130        total: 2.6s     remaining: 3.45s
430:    learn: 0.0995936        total: 2.63s    remaining: 3.47s
431:    learn: 0.0993516        total: 2.63s    remaining: 3.46s
432:    learn: 0.0990945        total: 2.63s    remaining: 3.45s
433:    learn: 0.0989122        total: 2.64s    remaining: 3.44s
434:    learn: 0.0987759        total: 2.64s    remaining: 3.44s
```

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435:    learn: 0.0984747        total: 2.65s     remaining: 3.42s
436:    learn: 0.0982368        total: 2.65s     remaining: 3.41s
437:    learn: 0.0979441        total: 2.65s     remaining: 3.4s
438:    learn: 0.0977459        total: 2.65s     remaining: 3.39s
439:    learn: 0.0975847        total: 2.66s     remaining: 3.38s
440:    learn: 0.0973967        total: 2.66s     remaining: 3.37s
441:    learn: 0.0971170        total: 2.66s     remaining: 3.36s
442:    learn: 0.0968919        total: 2.67s     remaining: 3.36s
443:    learn: 0.0966983        total: 2.67s     remaining: 3.35s
444:    learn: 0.0964445        total: 2.68s     remaining: 3.34s
445:    learn: 0.0961563        total: 2.68s     remaining: 3.33s
446:    learn: 0.0958908        total: 2.68s     remaining: 3.32s
447:    learn: 0.0957464        total: 2.68s     remaining: 3.31s
448:    learn: 0.0955400        total: 2.68s     remaining: 3.29s
449:    learn: 0.0954111        total: 2.69s     remaining: 3.28s
450:    learn: 0.0952259        total: 2.69s     remaining: 3.27s
451:    learn: 0.0949652        total: 2.69s     remaining: 3.26s
452:    learn: 0.0948704        total: 2.7s      remaining: 3.26s
453:    learn: 0.0947770        total: 2.71s     remaining: 3.26s
454:    learn: 0.0945418        total: 2.71s     remaining: 3.25s
455:    learn: 0.0943960        total: 2.71s     remaining: 3.24s
456:    learn: 0.0941761        total: 2.72s     remaining: 3.23s
457:    learn: 0.0939354        total: 2.72s     remaining: 3.22s
458:    learn: 0.0936799        total: 2.73s     remaining: 3.21s
459:    learn: 0.0935206        total: 2.73s     remaining: 3.2s
460:    learn: 0.0932906        total: 2.73s     remaining: 3.2s
461:    learn: 0.0931588        total: 2.74s     remaining: 3.19s
462:    learn: 0.0929315        total: 2.74s     remaining: 3.18s
463:    learn: 0.0926838        total: 2.75s     remaining: 3.17s
464:    learn: 0.0924584        total: 2.75s     remaining: 3.16s
465:    learn: 0.0922937        total: 2.75s     remaining: 3.15s
466:    learn: 0.0921588        total: 2.75s     remaining: 3.14s
467:    learn: 0.0919798        total: 2.76s     remaining: 3.13s
468:    learn: 0.0918537        total: 2.76s     remaining: 3.12s
469:    learn: 0.0916636        total: 2.76s     remaining: 3.12s
470:    learn: 0.0914836        total: 2.77s     remaining: 3.11s
471:    learn: 0.0912974        total: 2.77s     remaining: 3.1s
472:    learn: 0.0910598        total: 2.77s     remaining: 3.09s
473:    learn: 0.0908856        total: 2.81s     remaining: 3.12s
474:    learn: 0.0906317        total: 2.81s     remaining: 3.1s
475:    learn: 0.0904130        total: 2.81s     remaining: 3.1s
476:    learn: 0.0902600        total: 2.81s     remaining: 3.09s
477:    learn: 0.0900322        total: 2.82s     remaining: 3.08s
478:    learn: 0.0899352        total: 2.85s     remaining: 3.1s
479:    learn: 0.0896362        total: 2.85s     remaining: 3.09s
480:    learn: 0.0894447        total: 2.85s     remaining: 3.08s
481:    learn: 0.0893017        total: 2.85s     remaining: 3.07s
482:    learn: 0.0891502        total: 2.86s     remaining: 3.06s
483:    learn: 0.0889259        total: 2.86s     remaining: 3.05s
484:    learn: 0.0887498        total: 2.86s     remaining: 3.04s
485:    learn: 0.0886628        total: 2.87s     remaining: 3.03s
486:    learn: 0.0885712        total: 2.87s     remaining: 3.02s
487:    learn: 0.0884239        total: 2.87s     remaining: 3.01s
488:    learn: 0.0880918        total: 2.87s     remaining: 3s
489:    learn: 0.0879421        total: 2.88s     remaining: 3s
490:    learn: 0.0877117        total: 2.88s     remaining: 2.98s
491:    learn: 0.0874740        total: 2.88s     remaining: 2.98s
492:    learn: 0.0872831        total: 2.9s      remaining: 2.98s
493:    learn: 0.0872332        total: 2.9s      remaining: 2.98s
494:    learn: 0.0869713        total: 2.91s     remaining: 2.97s
495:    learn: 0.0868480        total: 2.91s     remaining: 2.96s
496:    learn: 0.0866032        total: 2.92s     remaining: 2.95s
497:    learn: 0.0864146        total: 2.92s     remaining: 2.94s
498:    learn: 0.0860192        total: 2.92s     remaining: 2.94s
499:    learn: 0.0859229        total: 2.92s     remaining: 2.92s
500:    learn: 0.0857622        total: 2.93s     remaining: 2.92s
501:    learn: 0.0854862        total: 2.93s     remaining: 2.91s
502:    learn: 0.0852635        total: 2.93s     remaining: 2.9s
503:    learn: 0.0851053        total: 2.94s     remaining: 2.89s
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504:    learn: 0.0849588        total: 2.94s    remaining: 2.89s
505:    learn: 0.0848360        total: 2.95s    remaining: 2.88s
506:    learn: 0.0846325        total: 2.95s    remaining: 2.87s
507:    learn: 0.0844952        total: 2.95s    remaining: 2.86s
508:    learn: 0.0843018        total: 2.96s    remaining: 2.85s
509:    learn: 0.0841750        total: 2.96s    remaining: 2.84s
510:    learn: 0.0840439        total: 2.97s    remaining: 2.84s
511:    learn: 0.0838988        total: 2.98s    remaining: 2.84s
512:    learn: 0.0837416        total: 2.99s    remaining: 2.84s
513:    learn: 0.0835183        total: 2.99s    remaining: 2.83s
514:    learn: 0.0832880        total: 2.99s    remaining: 2.82s
515:    learn: 0.0830996        total: 2.99s    remaining: 2.81s
516:    learn: 0.0829917        total: 3s       remaining: 2.8s
517:    learn: 0.0829185        total: 3s       remaining: 2.79s
518:    learn: 0.0827072        total: 3.02s    remaining: 2.8s
519:    learn: 0.0825839        total: 3.02s    remaining: 2.79s
520:    learn: 0.0822225        total: 3.02s    remaining: 2.78s
521:    learn: 0.0820741        total: 3.03s    remaining: 2.77s
522:    learn: 0.0819004        total: 3.06s    remaining: 2.79s
523:    learn: 0.0817534        total: 3.06s    remaining: 2.78s
524:    learn: 0.0815507        total: 3.08s    remaining: 2.79s
525:    learn: 0.0812974        total: 3.08s    remaining: 2.78s
526:    learn: 0.0811146        total: 3.08s    remaining: 2.77s
527:    learn: 0.0808623        total: 3.09s    remaining: 2.76s
528:    learn: 0.0806732        total: 3.09s    remaining: 2.75s
529:    learn: 0.0805558        total: 3.09s    remaining: 2.74s
530:    learn: 0.0803436        total: 3.11s    remaining: 2.75s
531:    learn: 0.0801987        total: 3.14s    remaining: 2.76s
532:    learn: 0.0800031        total: 3.16s    remaining: 2.77s
533:    learn: 0.0798560        total: 3.16s    remaining: 2.76s
534:    learn: 0.0797475        total: 3.16s    remaining: 2.75s
535:    learn: 0.0795998        total: 3.17s    remaining: 2.74s
536:    learn: 0.0794616        total: 3.17s    remaining: 2.73s
537:    learn: 0.0793465        total: 3.17s    remaining: 2.72s
538:    learn: 0.0792214        total: 3.17s    remaining: 2.71s
539:    learn: 0.0790801        total: 3.2s     remaining: 2.73s
540:    learn: 0.0788736        total: 3.21s    remaining: 2.72s
541:    learn: 0.0787483        total: 3.21s    remaining: 2.71s
542:    learn: 0.0786424        total: 3.21s    remaining: 2.7s
543:    learn: 0.0784603        total: 3.21s    remaining: 2.69s
544:    learn: 0.0782506        total: 3.21s    remaining: 2.68s
545:    learn: 0.0781296        total: 3.23s    remaining: 2.69s
546:    learn: 0.0779219        total: 3.25s    remaining: 2.69s
547:    learn: 0.0778532        total: 3.25s    remaining: 2.68s
548:    learn: 0.0776984        total: 3.25s    remaining: 2.67s
549:    learn: 0.0774054        total: 3.26s    remaining: 2.66s
550:    learn: 0.0772786        total: 3.26s    remaining: 2.66s
551:    learn: 0.0769857        total: 3.26s    remaining: 2.65s
552:    learn: 0.0768031        total: 3.27s    remaining: 2.64s
553:    learn: 0.0766823        total: 3.27s    remaining: 2.63s
554:    learn: 0.0764531        total: 3.27s    remaining: 2.62s
555:    learn: 0.0762302        total: 3.28s    remaining: 2.62s
556:    learn: 0.0761551        total: 3.28s    remaining: 2.61s
557:    learn: 0.0760068        total: 3.28s    remaining: 2.6s
558:    learn: 0.0758278        total: 3.29s    remaining: 2.59s
559:    learn: 0.0756713        total: 3.29s    remaining: 2.58s
560:    learn: 0.0754481        total: 3.29s    remaining: 2.58s
561:    learn: 0.0752433        total: 3.3s     remaining: 2.57s
562:    learn: 0.0751832        total: 3.3s     remaining: 2.56s
563:    learn: 0.0749383        total: 3.3s     remaining: 2.55s
564:    learn: 0.0747645        total: 3.31s    remaining: 2.54s
565:    learn: 0.0746956        total: 3.31s    remaining: 2.54s
566:    learn: 0.0744902        total: 3.32s    remaining: 2.54s
567:    learn: 0.0743833        total: 3.33s    remaining: 2.53s
568:    learn: 0.0741976        total: 3.33s    remaining: 2.53s
569:    learn: 0.0740784        total: 3.38s    remaining: 2.55s
570:    learn: 0.0739039        total: 3.39s    remaining: 2.54s
571:    learn: 0.0737702        total: 3.39s    remaining: 2.54s
572:    learn: 0.0736271        total: 3.39s    remaining: 2.53s
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573:    learn: 0.0735427        total: 3.39s     remaining: 2.52s
574:    learn: 0.0734011        total: 3.4s      remaining: 2.51s
575:    learn: 0.0732532        total: 3.4s      remaining: 2.5s
576:    learn: 0.0731175        total: 3.4s      remaining: 2.49s
577:    learn: 0.0728988        total: 3.4s      remaining: 2.48s
578:    learn: 0.0727554        total: 3.41s     remaining: 2.48s
579:    learn: 0.0726129        total: 3.41s     remaining: 2.47s
580:    learn: 0.0725048        total: 3.41s     remaining: 2.46s
581:    learn: 0.0724137        total: 3.42s     remaining: 2.46s
582:    learn: 0.0722428        total: 3.43s     remaining: 2.45s
583:    learn: 0.0720482        total: 3.43s     remaining: 2.44s
584:    learn: 0.0719420        total: 3.43s     remaining: 2.44s
585:    learn: 0.0716787        total: 3.44s     remaining: 2.43s
586:    learn: 0.0715756        total: 3.44s     remaining: 2.42s
587:    learn: 0.0714042        total: 3.44s     remaining: 2.41s
588:    learn: 0.0712767        total: 3.46s     remaining: 2.41s
589:    learn: 0.0711093        total: 3.46s     remaining: 2.4s
590:    learn: 0.0710292        total: 3.46s     remaining: 2.4s
591:    learn: 0.0707053        total: 3.46s     remaining: 2.39s
592:    learn: 0.0705541        total: 3.47s     remaining: 2.38s
593:    learn: 0.0704532        total: 3.47s     remaining: 2.37s
594:    learn: 0.0702851        total: 3.47s     remaining: 2.36s
595:    learn: 0.0702014        total: 3.48s     remaining: 2.36s
596:    learn: 0.0701197        total: 3.48s     remaining: 2.35s
597:    learn: 0.0699507        total: 3.48s     remaining: 2.34s
598:    learn: 0.0697484        total: 3.49s     remaining: 2.34s
599:    learn: 0.0696464        total: 3.51s     remaining: 2.34s
600:    learn: 0.0694953        total: 3.51s     remaining: 2.33s
601:    learn: 0.0694303        total: 3.51s     remaining: 2.32s
602:    learn: 0.0693080        total: 3.52s     remaining: 2.31s
603:    learn: 0.0691960        total: 3.52s     remaining: 2.31s
604:    learn: 0.0690155        total: 3.52s     remaining: 2.3s
605:    learn: 0.0688881        total: 3.54s     remaining: 2.3s
606:    learn: 0.0688183        total: 3.54s     remaining: 2.29s
607:    learn: 0.0687832        total: 3.55s     remaining: 2.29s
608:    learn: 0.0686578        total: 3.55s     remaining: 2.28s
609:    learn: 0.0685936        total: 3.56s     remaining: 2.27s
610:    learn: 0.0684823        total: 3.56s     remaining: 2.27s
611:    learn: 0.0683829        total: 3.56s     remaining: 2.26s
612:    learn: 0.0683065        total: 3.57s     remaining: 2.25s
613:    learn: 0.0682187        total: 3.57s     remaining: 2.25s
614:    learn: 0.0680445        total: 3.58s     remaining: 2.24s
615:    learn: 0.0679991        total: 3.58s     remaining: 2.23s
616:    learn: 0.0679123        total: 3.58s     remaining: 2.22s
617:    learn: 0.0678007        total: 3.58s     remaining: 2.21s
618:    learn: 0.0676223        total: 3.64s     remaining: 2.24s
619:    learn: 0.0675161        total: 3.64s     remaining: 2.23s
620:    learn: 0.0673348        total: 3.64s     remaining: 2.22s
621:    learn: 0.0671133        total: 3.65s     remaining: 2.21s
622:    learn: 0.0669647        total: 3.65s     remaining: 2.21s
623:    learn: 0.0669163        total: 3.65s     remaining: 2.2s
624:    learn: 0.0667521        total: 3.65s     remaining: 2.19s
625:    learn: 0.0666786        total: 3.66s     remaining: 2.19s
626:    learn: 0.0666245        total: 3.66s     remaining: 2.18s
627:    learn: 0.0665018        total: 3.66s     remaining: 2.17s
628:    learn: 0.0662916        total: 3.67s     remaining: 2.16s
629:    learn: 0.0661950        total: 3.67s     remaining: 2.15s
630:    learn: 0.0660695        total: 3.67s     remaining: 2.15s
631:    learn: 0.0658528        total: 3.68s     remaining: 2.14s
632:    learn: 0.0657590        total: 3.68s     remaining: 2.13s
633:    learn: 0.0657074        total: 3.69s     remaining: 2.13s
634:    learn: 0.0655837        total: 3.7s      remaining: 2.12s
635:    learn: 0.0654731        total: 3.7s      remaining: 2.12s
636:    learn: 0.0653162        total: 3.71s     remaining: 2.11s
637:    learn: 0.0651489        total: 3.71s     remaining: 2.1s
638:    learn: 0.0650853        total: 3.74s     remaining: 2.11s
639:    learn: 0.0649370        total: 3.74s     remaining: 2.1s
640:    learn: 0.0647738        total: 3.74s     remaining: 2.1s
641:    learn: 0.0646772        total: 3.75s     remaining: 2.09s
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642:    learn: 0.0645941        total: 3.78s    remaining: 2.1s
643:    learn: 0.0645239        total: 3.78s    remaining: 2.09s
644:    learn: 0.0644012        total: 3.79s    remaining: 2.08s
645:    learn: 0.0641783        total: 3.79s    remaining: 2.08s
646:    learn: 0.0640940        total: 3.83s    remaining: 2.09s
647:    learn: 0.0639532        total: 3.83s    remaining: 2.08s
648:    learn: 0.0639159        total: 3.83s    remaining: 2.07s
649:    learn: 0.0638061        total: 3.84s    remaining: 2.06s
650:    learn: 0.0636178        total: 3.85s    remaining: 2.06s
651:    learn: 0.0633950        total: 3.85s    remaining: 2.05s
652:    learn: 0.0632538        total: 3.85s    remaining: 2.05s
653:    learn: 0.0631084        total: 3.85s    remaining: 2.04s
654:    learn: 0.0629699        total: 3.86s    remaining: 2.03s
655:    learn: 0.0628282        total: 3.86s    remaining: 2.02s
656:    learn: 0.0625983        total: 3.86s    remaining: 2.02s
657:    learn: 0.0624304        total: 3.87s    remaining: 2.01s
658:    learn: 0.0622797        total: 3.87s    remaining: 2s
659:    learn: 0.0621234        total: 3.87s    remaining: 1.99s
660:    learn: 0.0619131        total: 3.88s    remaining: 1.99s
661:    learn: 0.0617624        total: 3.88s    remaining: 1.98s
662:    learn: 0.0615978        total: 3.91s    remaining: 1.99s
663:    learn: 0.0614566        total: 3.92s    remaining: 1.98s
664:    learn: 0.0613052        total: 3.92s    remaining: 1.97s
665:    learn: 0.0612154        total: 3.92s    remaining: 1.97s
666:    learn: 0.0611182        total: 3.93s    remaining: 1.96s
667:    learn: 0.0610130        total: 3.93s    remaining: 1.95s
668:    learn: 0.0608215        total: 3.93s    remaining: 1.95s
669:    learn: 0.0606768        total: 3.94s    remaining: 1.94s
670:    learn: 0.0605677        total: 3.94s    remaining: 1.93s
671:    learn: 0.0604659        total: 3.94s    remaining: 1.92s
672:    learn: 0.0602679        total: 3.94s    remaining: 1.92s
673:    learn: 0.0601415        total: 3.95s    remaining: 1.91s
674:    learn: 0.0599318        total: 3.96s    remaining: 1.9s
675:    learn: 0.0598271        total: 3.96s    remaining: 1.9s
676:    learn: 0.0596949        total: 3.96s    remaining: 1.89s
677:    learn: 0.0594865        total: 3.96s    remaining: 1.88s
678:    learn: 0.0594089        total: 3.97s    remaining: 1.88s
679:    learn: 0.0593399        total: 3.97s    remaining: 1.87s
680:    learn: 0.0592222        total: 3.97s    remaining: 1.86s
681:    learn: 0.0590896        total: 3.98s    remaining: 1.86s
682:    learn: 0.0590074        total: 3.99s    remaining: 1.85s
683:    learn: 0.0588528        total: 3.99s    remaining: 1.84s
684:    learn: 0.0587340        total: 3.99s    remaining: 1.83s
685:    learn: 0.0586399        total: 3.99s    remaining: 1.83s
686:    learn: 0.0584949        total: 4s       remaining: 1.82s
687:    learn: 0.0584190        total: 4s       remaining: 1.81s
688:    learn: 0.0583186        total: 4s       remaining: 1.81s
689:    learn: 0.0582680        total: 4s       remaining: 1.8s
690:    learn: 0.0582612        total: 4s       remaining: 1.79s
691:    learn: 0.0581961        total: 4.01s    remaining: 1.78s
692:    learn: 0.0581050        total: 4.01s    remaining: 1.78s
693:    learn: 0.0580416        total: 4.01s    remaining: 1.77s
694:    learn: 0.0578690        total: 4.03s    remaining: 1.77s
695:    learn: 0.0577392        total: 4.03s    remaining: 1.76s
696:    learn: 0.0575946        total: 4.05s    remaining: 1.76s
697:    learn: 0.0575665        total: 4.05s    remaining: 1.75s
698:    learn: 0.0574782        total: 4.06s    remaining: 1.75s
699:    learn: 0.0573922        total: 4.07s    remaining: 1.74s
700:    learn: 0.0572602        total: 4.08s    remaining: 1.74s
701:    learn: 0.0571461        total: 4.08s    remaining: 1.73s
702:    learn: 0.0570906        total: 4.08s    remaining: 1.73s
703:    learn: 0.0569877        total: 4.09s    remaining: 1.72s
704:    learn: 0.0568784        total: 4.09s    remaining: 1.71s
705:    learn: 0.0567856        total: 4.09s    remaining: 1.7s
706:    learn: 0.0567112        total: 4.09s    remaining: 1.7s
707:    learn: 0.0565891        total: 4.1s     remaining: 1.69s
708:    learn: 0.0564567        total: 4.1s     remaining: 1.68s
709:    learn: 0.0563733        total: 4.1s     remaining: 1.68s
710:    learn: 0.0562901        total: 4.11s    remaining: 1.67s
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711:    learn: 0.0561542        total: 4.11s    remaining: 1.66s
712:    learn: 0.0560138        total: 4.11s    remaining: 1.66s
713:    learn: 0.0559362        total: 4.12s    remaining: 1.65s
714:    learn: 0.0558268        total: 4.12s    remaining: 1.64s
715:    learn: 0.0557338        total: 4.12s    remaining: 1.64s
716:    learn: 0.0556194        total: 4.14s    remaining: 1.63s
717:    learn: 0.0555319        total: 4.14s    remaining: 1.63s
718:    learn: 0.0554845        total: 4.15s    remaining: 1.62s
719:    learn: 0.0554162        total: 4.17s    remaining: 1.62s
720:    learn: 0.0553552        total: 4.17s    remaining: 1.61s
721:    learn: 0.0552084        total: 4.17s    remaining: 1.61s
722:    learn: 0.0551340        total: 4.18s    remaining: 1.6s
723:    learn: 0.0550099        total: 4.19s    remaining: 1.6s
724:    learn: 0.0548524        total: 4.19s    remaining: 1.59s
725:    learn: 0.0547571        total: 4.19s    remaining: 1.58s
726:    learn: 0.0545901        total: 4.2s     remaining: 1.57s
727:    learn: 0.0545317        total: 4.2s     remaining: 1.57s
728:    learn: 0.0544476        total: 4.2s     remaining: 1.56s
729:    learn: 0.0543742        total: 4.2s     remaining: 1.55s
730:    learn: 0.0543032        total: 4.21s    remaining: 1.55s
731:    learn: 0.0542282        total: 4.21s    remaining: 1.54s
732:    learn: 0.0540562        total: 4.21s    remaining: 1.53s
733:    learn: 0.0539336        total: 4.22s    remaining: 1.53s
734:    learn: 0.0538523        total: 4.22s    remaining: 1.52s
735:    learn: 0.0537896        total: 4.22s    remaining: 1.51s
736:    learn: 0.0537092        total: 4.23s    remaining: 1.51s
737:    learn: 0.0536351        total: 4.23s    remaining: 1.5s
738:    learn: 0.0534859        total: 4.23s    remaining: 1.5s
739:    learn: 0.0534401        total: 4.24s    remaining: 1.49s
740:    learn: 0.0533388        total: 4.24s    remaining: 1.48s
741:    learn: 0.0532664        total: 4.24s    remaining: 1.47s
742:    learn: 0.0532144        total: 4.24s    remaining: 1.47s
743:    learn: 0.0530717        total: 4.25s    remaining: 1.46s
744:    learn: 0.0529108        total: 4.25s    remaining: 1.46s
745:    learn: 0.0528323        total: 4.25s    remaining: 1.45s
746:    learn: 0.0527825        total: 4.27s    remaining: 1.45s
747:    learn: 0.0526809        total: 4.27s    remaining: 1.44s
748:    learn: 0.0525682        total: 4.27s    remaining: 1.43s
749:    learn: 0.0525081        total: 4.28s    remaining: 1.43s
750:    learn: 0.0524516        total: 4.3s     remaining: 1.43s
751:    learn: 0.0523727        total: 4.3s     remaining: 1.42s
752:    learn: 0.0523238        total: 4.32s    remaining: 1.42s
753:    learn: 0.0522078        total: 4.32s    remaining: 1.41s
754:    learn: 0.0520974        total: 4.32s    remaining: 1.4s
755:    learn: 0.0520666        total: 4.32s    remaining: 1.4s
756:    learn: 0.0520251        total: 4.33s    remaining: 1.39s
757:    learn: 0.0519382        total: 4.33s    remaining: 1.38s
758:    learn: 0.0518386        total: 4.33s    remaining: 1.38s
759:    learn: 0.0516836        total: 4.34s    remaining: 1.37s
760:    learn: 0.0516094        total: 4.34s    remaining: 1.36s
761:    learn: 0.0515088        total: 4.34s    remaining: 1.36s
762:    learn: 0.0513890        total: 4.34s    remaining: 1.35s
763:    learn: 0.0513362        total: 4.36s    remaining: 1.35s
764:    learn: 0.0512415        total: 4.36s    remaining: 1.34s
765:    learn: 0.0511525        total: 4.37s    remaining: 1.33s
766:    learn: 0.0510656        total: 4.38s    remaining: 1.33s
767:    learn: 0.0509785        total: 4.38s    remaining: 1.32s
768:    learn: 0.0509178        total: 4.38s    remaining: 1.31s
769:    learn: 0.0507606        total: 4.38s    remaining: 1.31s
770:    learn: 0.0506350        total: 4.38s    remaining: 1.3s
771:    learn: 0.0504997        total: 4.39s    remaining: 1.3s
772:    learn: 0.0504080        total: 4.39s    remaining: 1.29s
773:    learn: 0.0503183        total: 4.39s    remaining: 1.28s
774:    learn: 0.0502116        total: 4.4s     remaining: 1.28s
775:    learn: 0.0501694        total: 4.4s     remaining: 1.27s
776:    learn: 0.0500827        total: 4.4s     remaining: 1.26s
777:    learn: 0.0500048        total: 4.41s    remaining: 1.26s
778:    learn: 0.0499009        total: 4.42s    remaining: 1.25s
779:    learn: 0.0498620        total: 4.42s    remaining: 1.25s
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780:    learn: 0.0497996    total: 4.42s    remaining: 1.24s
781:    learn: 0.0497401    total: 4.43s    remaining: 1.24s
782:    learn: 0.0496766    total: 4.43s    remaining: 1.23s
783:    learn: 0.0495838    total: 4.43s    remaining: 1.22s
784:    learn: 0.0495108    total: 4.44s    remaining: 1.22s
785:    learn: 0.0493861    total: 4.44s    remaining: 1.21s
786:    learn: 0.0493025    total: 4.44s    remaining: 1.2s
787:    learn: 0.0492218    total: 4.45s    remaining: 1.2s
788:    learn: 0.0491583    total: 4.45s    remaining: 1.19s
789:    learn: 0.0490364    total: 4.45s    remaining: 1.18s
790:    learn: 0.0489607    total: 4.45s    remaining: 1.18s
791:    learn: 0.0489114    total: 4.46s    remaining: 1.17s
792:    learn: 0.0488611    total: 4.49s    remaining: 1.17s
793:    learn: 0.0487735    total: 4.49s    remaining: 1.17s
794:    learn: 0.0487140    total: 4.5s     remaining: 1.16s
795:    learn: 0.0486301    total: 4.5s     remaining: 1.15s
796:    learn: 0.0485689    total: 4.52s    remaining: 1.15s
797:    learn: 0.0484843    total: 4.52s    remaining: 1.15s
798:    learn: 0.0483400    total: 4.53s    remaining: 1.14s
799:    learn: 0.0482034    total: 4.53s    remaining: 1.13s
800:    learn: 0.0481339    total: 4.53s    remaining: 1.13s
801:    learn: 0.0480927    total: 4.54s    remaining: 1.12s
802:    learn: 0.0480208    total: 4.54s    remaining: 1.11s
803:    learn: 0.0479423    total: 4.54s    remaining: 1.11s
804:    learn: 0.0478591    total: 4.55s    remaining: 1.1s
805:    learn: 0.0477914    total: 4.55s    remaining: 1.09s
806:    learn: 0.0477313    total: 4.55s    remaining: 1.09s
807:    learn: 0.0475567    total: 4.56s    remaining: 1.08s
808:    learn: 0.0474529    total: 4.56s    remaining: 1.08s
809:    learn: 0.0473641    total: 4.56s    remaining: 1.07s
810:    learn: 0.0472634    total: 4.57s    remaining: 1.06s
811:    learn: 0.0472291    total: 4.57s    remaining: 1.06s
812:    learn: 0.0471882    total: 4.61s    remaining: 1.06s
813:    learn: 0.0471050    total: 4.61s    remaining: 1.05s
814:    learn: 0.0470805    total: 4.61s    remaining: 1.05s
815:    learn: 0.0470434    total: 4.62s    remaining: 1.04s
816:    learn: 0.0469136    total: 4.62s    remaining: 1.03s
817:    learn: 0.0468504    total: 4.62s    remaining: 1.03s
818:    learn: 0.0467343    total: 4.62s    remaining: 1.02s
819:    learn: 0.0466075    total: 4.63s    remaining: 1.01s
820:    learn: 0.0465427    total: 4.63s    remaining: 1.01s
821:    learn: 0.0464618    total: 4.63s    remaining: 1s
822:    learn: 0.0463826    total: 4.63s    remaining: 996ms
823:    learn: 0.0463141    total: 4.63s    remaining: 990ms
824:    learn: 0.0462392    total: 4.64s    remaining: 984ms
825:    learn: 0.0460553    total: 4.64s    remaining: 977ms
826:    learn: 0.0460172    total: 4.67s    remaining: 977ms
827:    learn: 0.0459074    total: 4.68s    remaining: 973ms
828:    learn: 0.0457444    total: 4.69s    remaining: 967ms
829:    learn: 0.0456861    total: 4.69s    remaining: 960ms
830:    learn: 0.0455806    total: 4.69s    remaining: 954ms
831:    learn: 0.0454977    total: 4.69s    remaining: 948ms
832:    learn: 0.0453945    total: 4.7s     remaining: 941ms
833:    learn: 0.0453528    total: 4.7s     remaining: 935ms
834:    learn: 0.0453076    total: 4.7s     remaining: 929ms
835:    learn: 0.0452100    total: 4.7s     remaining: 923ms
836:    learn: 0.0451504    total: 4.71s    remaining: 917ms
837:    learn: 0.0450843    total: 4.71s    remaining: 911ms
838:    learn: 0.0450160    total: 4.71s    remaining: 904ms
839:    learn: 0.0449647    total: 4.71s    remaining: 898ms
840:    learn: 0.0448835    total: 4.72s    remaining: 892ms
841:    learn: 0.0447854    total: 4.72s    remaining: 886ms
842:    learn: 0.0447256    total: 4.72s    remaining: 879ms
843:    learn: 0.0446803    total: 4.72s    remaining: 873ms
844:    learn: 0.0446323    total: 4.73s    remaining: 867ms
845:    learn: 0.0445836    total: 4.73s    remaining: 861ms
846:    learn: 0.0445612    total: 4.73s    remaining: 855ms
847:    learn: 0.0444456    total: 4.74s    remaining: 849ms
848:    learn: 0.0443804    total: 4.74s    remaining: 843ms
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849:    learn: 0.0443380        total: 4.74s    remaining: 837ms
850:    learn: 0.0442945        total: 4.75s    remaining: 831ms
851:    learn: 0.0442173        total: 4.75s    remaining: 825ms
852:    learn: 0.0441527        total: 4.75s    remaining: 819ms
853:    learn: 0.0440990        total: 4.75s    remaining: 813ms
854:    learn: 0.0439891        total: 4.76s    remaining: 807ms
855:    learn: 0.0439313        total: 4.76s    remaining: 801ms
856:    learn: 0.0438142        total: 4.76s    remaining: 795ms
857:    learn: 0.0437425        total: 4.78s    remaining: 792ms
858:    learn: 0.0437149        total: 4.79s    remaining: 786ms
859:    learn: 0.0436568        total: 4.79s    remaining: 779ms
860:    learn: 0.0436077        total: 4.79s    remaining: 774ms
861:    learn: 0.0435688        total: 4.8s     remaining: 768ms
862:    learn: 0.0434635        total: 4.8s     remaining: 762ms
863:    learn: 0.0433985        total: 4.81s    remaining: 758ms
864:    learn: 0.0433428        total: 4.81s    remaining: 751ms
865:    learn: 0.0432732        total: 4.82s    remaining: 745ms
866:    learn: 0.0431545        total: 4.82s    remaining: 739ms
867:    learn: 0.0430898        total: 4.82s    remaining: 733ms
868:    learn: 0.0429684        total: 4.83s    remaining: 727ms
869:    learn: 0.0428657        total: 4.83s    remaining: 721ms
870:    learn: 0.0428341        total: 4.84s    remaining: 717ms
871:    learn: 0.0427412        total: 4.84s    remaining: 711ms
872:    learn: 0.0426572        total: 4.85s    remaining: 705ms
873:    learn: 0.0425632        total: 4.85s    remaining: 699ms
874:    learn: 0.0424771        total: 4.86s    remaining: 694ms
875:    learn: 0.0424279        total: 4.86s    remaining: 688ms
876:    learn: 0.0423721        total: 4.86s    remaining: 682ms
877:    learn: 0.0422927        total: 4.87s    remaining: 676ms
878:    learn: 0.0422081        total: 4.87s    remaining: 670ms
879:    learn: 0.0421631        total: 4.87s    remaining: 664ms
880:    learn: 0.0420856        total: 4.87s    remaining: 658ms
881:    learn: 0.0420159        total: 4.87s    remaining: 652ms
882:    learn: 0.0419534        total: 4.89s    remaining: 648ms
883:    learn: 0.0419299        total: 4.9s     remaining: 643ms
884:    learn: 0.0418581        total: 4.9s     remaining: 637ms
885:    learn: 0.0417914        total: 4.9s     remaining: 631ms
886:    learn: 0.0417233        total: 4.9s     remaining: 625ms
887:    learn: 0.0416635        total: 4.91s    remaining: 619ms
888:    learn: 0.0416092        total: 4.91s    remaining: 613ms
889:    learn: 0.0415744        total: 4.91s    remaining: 607ms
890:    learn: 0.0414642        total: 4.92s    remaining: 601ms
891:    learn: 0.0413534        total: 4.93s    remaining: 597ms
892:    learn: 0.0412831        total: 4.93s    remaining: 591ms
893:    learn: 0.0411821        total: 4.93s    remaining: 585ms
894:    learn: 0.0411344        total: 4.94s    remaining: 579ms
895:    learn: 0.0410780        total: 4.94s    remaining: 574ms
896:    learn: 0.0410591        total: 4.95s    remaining: 569ms
897:    learn: 0.0409595        total: 4.96s    remaining: 563ms
898:    learn: 0.0408969        total: 4.96s    remaining: 557ms
899:    learn: 0.0408283        total: 4.96s    remaining: 551ms
900:    learn: 0.0408043        total: 4.96s    remaining: 545ms
901:    learn: 0.0407650        total: 4.96s    remaining: 539ms
902:    learn: 0.0406979        total: 4.97s    remaining: 533ms
903:    learn: 0.0406158        total: 4.97s    remaining: 528ms
904:    learn: 0.0405496        total: 4.97s    remaining: 522ms
905:    learn: 0.0404981        total: 4.97s    remaining: 516ms
906:    learn: 0.0404101        total: 5s       remaining: 512ms
907:    learn: 0.0403537        total: 5s       remaining: 507ms
908:    learn: 0.0403233        total: 5s       remaining: 501ms
909:    learn: 0.0402765        total: 5s       remaining: 495ms
910:    learn: 0.0401899        total: 5.03s    remaining: 491ms
911:    learn: 0.0401516        total: 5.03s    remaining: 485ms
912:    learn: 0.0401073        total: 5.03s    remaining: 480ms
913:    learn: 0.0400036        total: 5.06s    remaining: 476ms
914:    learn: 0.0399603        total: 5.06s    remaining: 470ms
915:    learn: 0.0399566        total: 5.07s    remaining: 464ms
916:    learn: 0.0398965        total: 5.07s    remaining: 459ms
917:    learn: 0.0398610        total: 5.07s    remaining: 453ms
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918:    learn: 0.0398002     total: 5.07s    remaining: 447ms
919:    learn: 0.0397361     total: 5.08s    remaining: 441ms
920:    learn: 0.0396586     total: 5.08s    remaining: 436ms
921:    learn: 0.0396423     total: 5.08s    remaining: 430ms
922:    learn: 0.0395439     total: 5.09s    remaining: 424ms
923:    learn: 0.0394651     total: 5.09s    remaining: 419ms
924:    learn: 0.0394455     total: 5.09s    remaining: 413ms
925:    learn: 0.0393441     total: 5.1s     remaining: 408ms
926:    learn: 0.0392757     total: 5.11s    remaining: 402ms
927:    learn: 0.0392438     total: 5.11s    remaining: 397ms
928:    learn: 0.0391830     total: 5.11s    remaining: 391ms
929:    learn: 0.0390839     total: 5.12s    remaining: 385ms
930:    learn: 0.0390473     total: 5.12s    remaining: 379ms
931:    learn: 0.0389806     total: 5.12s    remaining: 374ms
932:    learn: 0.0389238     total: 5.13s    remaining: 368ms
933:    learn: 0.0388614     total: 5.13s    remaining: 363ms
934:    learn: 0.0388036     total: 5.14s    remaining: 357ms
935:    learn: 0.0387741     total: 5.14s    remaining: 352ms
936:    learn: 0.0387477     total: 5.14s    remaining: 346ms
937:    learn: 0.0386902     total: 5.15s    remaining: 340ms
938:    learn: 0.0386101     total: 5.16s    remaining: 335ms
939:    learn: 0.0385884     total: 5.16s    remaining: 329ms
940:    learn: 0.0385166     total: 5.16s    remaining: 324ms
941:    learn: 0.0384736     total: 5.18s    remaining: 319ms
942:    learn: 0.0384368     total: 5.18s    remaining: 313ms
943:    learn: 0.0384265     total: 5.18s    remaining: 307ms
944:    learn: 0.0383847     total: 5.18s    remaining: 302ms
945:    learn: 0.0383386     total: 5.19s    remaining: 296ms
946:    learn: 0.0383017     total: 5.19s    remaining: 291ms
947:    learn: 0.0382388     total: 5.19s    remaining: 285ms
948:    learn: 0.0381917     total: 5.2s     remaining: 279ms
949:    learn: 0.0380822     total: 5.2s     remaining: 274ms
950:    learn: 0.0380396     total: 5.2s     remaining: 268ms
951:    learn: 0.0379948     total: 5.24s    remaining: 264ms
952:    learn: 0.0379427     total: 5.25s    remaining: 259ms
953:    learn: 0.0379357     total: 5.25s    remaining: 253ms
954:    learn: 0.0378672     total: 5.25s    remaining: 247ms
955:    learn: 0.0378227     total: 5.25s    remaining: 242ms
956:    learn: 0.0377448     total: 5.26s    remaining: 236ms
957:    learn: 0.0377210     total: 5.26s    remaining: 231ms
958:    learn: 0.0376771     total: 5.26s    remaining: 225ms
959:    learn: 0.0376394     total: 5.26s    remaining: 219ms
960:    learn: 0.0375432     total: 5.27s    remaining: 214ms
961:    learn: 0.0375056     total: 5.27s    remaining: 208ms
962:    learn: 0.0374244     total: 5.27s    remaining: 203ms
963:    learn: 0.0373847     total: 5.28s    remaining: 197ms
964:    learn: 0.0373778     total: 5.28s    remaining: 191ms
965:    learn: 0.0373459     total: 5.28s    remaining: 186ms
966:    learn: 0.0372674     total: 5.29s    remaining: 180ms
967:    learn: 0.0372189     total: 5.29s    remaining: 175ms
968:    learn: 0.0372087     total: 5.29s    remaining: 169ms
969:    learn: 0.0371674     total: 5.3s     remaining: 164ms
970:    learn: 0.0371254     total: 5.3s     remaining: 158ms
971:    learn: 0.0370333     total: 5.31s    remaining: 153ms
972:    learn: 0.0370022     total: 5.32s    remaining: 147ms
973:    learn: 0.0369982     total: 5.32s    remaining: 142ms
974:    learn: 0.0369107     total: 5.33s    remaining: 137ms
975:    learn: 0.0368421     total: 5.33s    remaining: 131ms
976:    learn: 0.0367825     total: 5.33s    remaining: 126ms
977:    learn: 0.0367415     total: 5.34s    remaining: 120ms
978:    learn: 0.0366783     total: 5.34s    remaining: 115ms
979:    learn: 0.0365946     total: 5.34s    remaining: 109ms
980:    learn: 0.0365481     total: 5.34s    remaining: 103ms
981:    learn: 0.0364777     total: 5.35s    remaining: 98ms
982:    learn: 0.0364412     total: 5.36s    remaining: 92.7ms
983:    learn: 0.0363569     total: 5.36s    remaining: 87.2ms
984:    learn: 0.0362825     total: 5.36s    remaining: 81.6ms
985:    learn: 0.0361722     total: 5.36s    remaining: 76.2ms
986:    learn: 0.0361516     total: 5.4s     remaining: 71.1ms
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987:    learn: 0.0361256    total: 5.4s     remaining: 65.6ms
988:    learn: 0.0360437    total: 5.4s     remaining: 60.1ms
989:    learn: 0.0360046    total: 5.41s    remaining: 54.6ms
990:    learn: 0.0359285    total: 5.43s    remaining: 49.3ms
991:    learn: 0.0358896    total: 5.43s    remaining: 43.8ms
992:    learn: 0.0358637    total: 5.43s    remaining: 38.3ms
993:    learn: 0.0357962    total: 5.43s    remaining: 32.8ms
994:    learn: 0.0357655    total: 5.44s    remaining: 27.3ms
995:    learn: 0.0356829    total: 5.44s    remaining: 21.9ms
996:    learn: 0.0356448    total: 5.45s    remaining: 16.4ms
997:    learn: 0.0355964    total: 5.45s    remaining: 10.9ms
998:    learn: 0.0355397    total: 5.45s    remaining: 5.46ms
999:    learn: 0.0354587    total: 5.46s    remaining: 0us
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Out[ ]:
```
array([1, 1, 0, 1, 0, 1, 0, 0, 1, 0, 1, 0, 1, 1, 0, 0, 0, 1, 1, 0, 0, 0,
       0, 0, 0, 1, 1, 1, 0, 0, 0, 1, 0, 1, 1, 1, 0, 1, 1, 1, 0, 0, 1, 0,
       0, 0, 0, 0, 0, 1, 1, 0, 0, 0, 1, 1, 0, 0, 0, 1, 1, 1, 0, 1, 0, 0,
       1, 0, 0, 1, 0, 0, 0, 1, 1, 1, 0, 0, 0, 1, 0, 0, 0, 0, 1, 0, 1, 0,
       0, 0, 0, 0, 1, 1, 1, 1, 0, 0, 0, 0, 1, 0, 0, 1, 0, 1, 0, 1, 0, 1,
       0, 1, 1, 0, 1, 1, 0, 1, 1, 0, 1, 1, 0, 0, 1, 0, 1, 0, 0, 1, 1, 0,
       1, 1, 0, 1, 0, 1, 1, 0, 1, 1, 1, 1, 1, 1, 1, 1, 0, 0, 0, 0, 1, 1,
       0, 0, 0, 1, 0, 0, 1, 1, 0, 0, 1, 1, 0, 0, 1, 1, 0, 1, 1, 0, 1, 1,
       1, 0, 0, 1, 1, 0, 1, 0, 1, 1, 1, 0, 1, 1, 1, 0, 0, 0, 0, 1, 0, 0,
       1, 1, 1, 1, 1, 0, 0, 0, 1, 1, 1, 1, 1, 0, 1, 0, 0, 0, 0, 0, 1, 0,
       1, 0, 0, 1, 1, 1, 1, 1, 0, 1, 0, 0, 0, 0, 0, 0, 0, 0, 1, 0, 1, 0,
       1, 0, 0, 1, 0, 1, 1, 0, 1, 0, 0, 0, 0, 1, 0, 1, 0, 1, 0, 1, 1, 0,
       0, 0, 0, 1, 0, 0, 0, 1, 0, 1, 0, 1, 1, 1, 0, 1, 0, 1, 0, 0, 1, 0,
       1, 1, 0, 1, 1, 0, 1, 1, 0, 1, 1, 0, 0, 1, 0, 0, 1, 1, 0, 0, 0, 0],
      dtype=int64)
```

In [ ]:
```python
y_pred_xgb = xgb.predict(x_test)
print(f'Prediction Score xgb : {accuracy_score(y_test,y_pred_xgb)}')
```

```
Prediction Score xgb : 0.9805194805194806
```