CSI5388 Natural Language Processing

Assignment - 2

INGREDIENTS FOR HAPPINESS

In [1]:
```
# Import Data
import pandas as pd
import numpy as np
train_labeled = pd.read_csv("data/TRAIN/labeled_10k.csv", engine = 'python')
train_unlabeled = pd.read_csv("data/TRAIN/unlabeled_70k.csv", engine = 'python')
test_labeled = pd.read_csv("data/TEST/labeled_17k.csv", engine = 'python',encoding='cp1252') # engine should be set as py
test_unlabeled = pd.read_csv("data/TEST/unlabeled_17k.csv", engine = 'python',encoding='cp1252')
```

In [2]:
```
train_labeled.head()
```

Out[2]:

	hmid	moment	concepts	agency	social	age	country	gender	married	parenthood	reflection	duration
0	27674	I was happy when my son got 90% marks in his e...	education|family	no	yes	29.0	IND	m	married	y	24h	half_a_day
1	27685	went to movies with my friends it was fun	entertainment	yes	yes	29.0	IND	m	single	y	24h	half_a_day
2	27691	A hot kiss with my girl friend last night made...	romance	yes	yes	25.0	IND	m	married	y	24h	at_least_one_hour
3	27701	My son woke me up to a fantastic breakfast of ...	family|food	no	yes	79	USA	f	widowed	y	24h	all_day_im_still_feeling_it
4	27712	My older daughter keeps patting my younger dau...	family	no	yes	30	USA	f	married	y	24h	a_few_moment

In [3]:
```
train_unlabeled.head()
```

Out[3]:

	hmid	moment	age	country	gender	married	parenthood	reflection	duration
0	27673	I went on a successful date with someone I fel...	35.0	USA	m	single	n	24h	at_least_one_hour
1	27675	I went to the gym this morning and did yoga.	30.0	USA	f	married	y	24h	at_least_one_hour
2	27678	I meditated last night.	23.0	IND	m	single	n	24h	at_least_one_hour
3	27679	I made a new recipe for peasant bread, and it ...	30.0	USA	m	single	n	24h	half_a_day
4	27680	I got gift from my elder brother which was rea...	23.0	IND	m	single	n	24h	at_least_one_hour

In [4]:
```
test_labeled.head()
```

Out[4]:

	hmid	moment	reflection	age	country	gender	duration	married	parenthood	concepts	agency	social
0	0	I was able to spend the day with my fiance sho...	24h	28	USA	m	all_day_im_still_feeling_it	single	n	shopping|family|romance	yes	no
1	1	I was able to play with my cat.	24h	28	USA	m	at_least_one_hour	single	n	animals	yes	no
2	2	I was able to clean my room and gold my laundry.	24h	28	USA	m	at_least_one_hour	single	n	0	yes	no
3	3	I spend the day at a party on the beach and I ...	24h	24	USA	m	half_a_day	single	n	vacation|party|weather	yes	yes

	hmid	moment	reflection	age	country	gender	duration	married	parenthood	concepts	agency	social
4	4	My cat greeting me when I got home from work -...	24h	24	USA	m	half_a_day	single	n	animals	no	no

In [5]:
```
test_unlabeled.head()
```

Out[5]:

	hmid	moment	reflection	age	country	gender	duration	married	parenthood
0	0	I was able to spend the day with my fiance sho...	24h	28	USA	m	all_day_im_still_feeling_it	single	n
1	1	I was able to play with my cat.	24h	28	USA	m	at_least_one_hour	single	n
2	2	I was able to clean my room and gold my laundry.	24h	28	USA	m	at_least_one_hour	single	n
3	3	I spend the day at a party on the beach and I ...	24h	24	USA	m	half_a_day	single	n
4	4	My cat greeting me when I got home from work -...	24h	24	USA	m	half_a_day	single	n

Pre-processing

In [ ]:
```
```

In [6]:
```
import nltk
```

In [7]:
```
train_labeled['moment'].head(3)
```

Out[7]:
```
0    I was happy when my son got 90% marks in his e...
1            went to movies with my friends it was fun
2    A hot kiss with my girl friend last night made...
Name: moment, dtype: object
```

In [8]:
```
train_unlabeled['moment'].head(3)
```

Out[8]:
```
0    I went on a successful date with someone I fel...
1         I went to the gym this morning and did yoga.
2                              I meditated last night.
Name: moment, dtype: object
```

In [9]:
```
train_labeled['moment'] = train_labeled['moment'].str.lower()
train_unlabeled['moment'] = train_unlabeled['moment'].str.lower()
```

In [10]:
```
train_unlabeled['moment'].head(3)
```

Out[10]:
```
0    i went on a successful date with someone i fel...
1         i went to the gym this morning and did yoga.
2                              i meditated last night.
Name: moment, dtype: object
```

Removing the punctuations

In [11]:
```
import string
print(string.punctuation)
punct_str = string.punctuation
```

```
!"#$%&'()*+,-./:;<=>?@[\]^_`{|}~
```

In [12]:
```
upd_moment = []
upd_moment_2 = []

for text_t1 in train_labeled['moment']:
    text_upd = "".join([ char for char in text_t1 if char not in string.punctuation])
    upd_moment.append(text_upd)

for text_t2 in train_unlabeled['moment']:
    text_upd_2 = "".join([ char for char in text_t2 if char not in string.punctuation])
    upd_moment_2.append(text_upd_2)
```

In [13]:
```
train_labeled['moment'] = upd_moment
train_unlabeled['moment']= upd_moment_2
```

In [14]:
```
train_labeled['moment'][4]
```

Out[14]:
```
'my older daughter keeps patting my younger daughters head'
```

In [ ]:
```
```

Tokenization

In [15]:
```
import nltk
nltk.download('punkt')
nltk.download('stopwords')
nltk.download('corpus')
```

```
[nltk_data] Downloading package punkt to
[nltk_data]     C:\Users\parit\AppData\Roaming\nltk_data...
[nltk_data]   Package punkt is already up-to-date!
[nltk_data] Downloading package stopwords to
[nltk_data]     C:\Users\parit\AppData\Roaming\nltk_data...
[nltk_data]   Package stopwords is already up-to-date!
[nltk_data] Error loading corpus: Package 'corpus' not found in index
```

Out[15]:
```
False
```

In [16]:
```
from nltk import word_tokenize
list_tokenize = []

for moments_sent in train_labeled['moment']:
    tokenized_wrds = word_tokenize(moments_sent)
    list_tokenize.append(tokenized_wrds)
train_labeled['moment'] = list_tokenize

list_tokenize = []
for moments_sent in train_unlabeled['moment']:
    tokenized_wrds = word_tokenize(moments_sent)
    list_tokenize.append(tokenized_wrds)
train_unlabeled['moment'] = list_tokenize
```

In [17]:
```
train_labeled.head()
```

Out[17]:

	hmid	moment	concepts	agency	social	age	country	gender	married	parenthood	reflection	duration

	hmid	moment	concepts	agency	social	age	country	gender	married	parenthood	reflection	duration
0	27674	[i, was, happy, when, my, son, got, 90, marks,...	education|family	no	yes	29.0	IND	m	married	y	24h	half_a_day
1	27685	[went, to, movies, with, my, friends, it, was,...	entertainment	yes	yes	29.0	IND	m	single	y	24h	half_a_day
2	27691	[a, hot, kiss, with, my, girl, friend, last, n...	romance	yes	yes	25.0	IND	m	married	y	24h	at_least_one_hour
3	27701	[my, son, woke, me, up, to, a, fantastic, brea...	family|food	no	yes	79	USA	f	widowed	y	24h	all_day_im_still_feeling_it
4	27712	[my, older, daughter, keeps, patting, my, youn...	family	no	yes	30	USA	f	married	y	24h	a_few_moment

In [18]:
```
train_unlabeled.head()
```

Out[18]:

	hmid	moment	age	country	gender	married	parenthood	reflection	duration
0	27673	[i, went, on, a, successful, date, with, someo...	35.0	USA	m	single	n	24h	at_least_one_hour
1	27675	[i, went, to, the, gym, this, morning, and, di...	30.0	USA	f	married	y	24h	at_least_one_hour
2	27678	[i, meditated, last, night]	23.0	IND	m	single	n	24h	at_least_one_hour
3	27679	[i, made, a, new, recipe, for, peasant, bread,...	30.0	USA	m	single	n	24h	half_a_day
4	27680	[i, got, gift, from, my, elder, brother, which...	23.0	IND	m	single	n	24h	at_least_one_hour

Remove Stopwords

In [19]:
```
from nltk.corpus import stopwords
stop_words_eng = stopwords.words('english')
print(stop_words_eng)
```

```
['i', 'me', 'my', 'myself', 'we', 'our', 'ours', 'ourselves', 'you', "you're", "you've", "you'll", "you'd", 'your', 'your
s', 'yourself', 'yourselves', 'he', 'him', 'his', 'himself', 'she', "she's", 'her', 'hers', 'herself', 'it', "it's", 'it
s', 'itself', 'they', 'them', 'their', 'theirs', 'themselves', 'what', 'which', 'who', 'whom', 'this', 'that', "that'll",
'these', 'those', 'am', 'is', 'are', 'was', 'were', 'be', 'been', 'being', 'have', 'has', 'had', 'having', 'do', 'does',
'did', 'doing', 'a', 'an', 'the', 'and', 'but', 'if', 'or', 'because', 'as', 'until', 'while', 'of', 'at', 'by', 'for',
'with', 'about', 'against', 'between', 'into', 'through', 'during', 'before', 'after', 'above', 'below', 'to', 'from', 'u
p', 'down', 'in', 'out', 'on', 'off', 'over', 'under', 'again', 'further', 'then', 'once', 'here', 'there', 'when', 'wher
e', 'why', 'how', 'all', 'any', 'both', 'each', 'few', 'more', 'most', 'other', 'some', 'such', 'no', 'nor', 'not', 'onl
y', 'own', 'same', 'so', 'than', 'too', 'very', 's', 't', 'can', 'will', 'just', 'don', "don't", 'should', "should've",
'now', 'd', 'll', 'm', 'o', 're', 've', 'y', 'ain', 'aren', "aren't", 'couldn', "couldn't", 'didn', "didn't", 'doesn', "d
oesn't", 'hadn', "hadn't", 'hasn', "hasn't", 'haven', "haven't", 'isn', "isn't", 'ma', 'mightn', "mightn't", 'mustn', "mu
stn't", 'needn', "needn't", 'shan', "shan't", 'shouldn', "shouldn't", 'wasn', "wasn't", 'weren', "weren't", 'won', "wo
n't", 'wouldn', "wouldn't"]
```

In [20]:

```
filt_wrd_list=[]
for words in train_labeled['moment']:
    filtered_words = [word for word in words if word not in stop_words_eng]
    filt_wrd_list.append(filtered_words)
train_labeled['moment'] = filt_wrd_list

filt_wrd_list=[]
for words in train_unlabeled['moment']:
    filtered_words = [word for word in words if word not in stop_words_eng]
    filt_wrd_list.append(filtered_words)
train_unlabeled['moment'] = filt_wrd_list
```

In [21]:

```
train_labeled['moment']
```

Out[21]:

```
0                [happy, son, got, 90, marks, examination]
1                              [went, movies, friends, fun]
2        [hot, kiss, girl, friend, last, night, made, day]
3        [son, woke, fantastic, breakfast, eggs, specia...
4        [older, daughter, keeps, patting, younger, dau...
                               ...
10555                        [husband, called, tell, loved]
10556                  [worked, always, makes, feel, good]
10557    [finally, got, watch, new, resident, evil, movie]
10558     [got, talk, old, friend, reminisce, good, times]
10559    [great, meeting, yesterday, work, boss, collea...
Name: moment, Length: 10560, dtype: object
```

In [22]:

```
train_unlabeled['moment']
```

Out[22]:
```
0        [went, successful, date, someone, felt, sympat...
1                                [went, gym, morning, yoga]
2                                  [meditated, last, night]
3        [made, new, recipe, peasant, bread, came, spec...
4          [got, gift, elder, brother, really, surprising]
                                ...
72319                                [spent, time, daughter]
72320    [husband, announced, getting, decent, bonus, q...
72321                                          [pepsi, drink]
72322                  [cuddling, girlfriend, last, night]
72323                        [great, workout, last, night]
Name: moment, Length: 72324, dtype: object
```

Lemmatizer

In [23]:
```
nltk.download('wordnet')
from nltk.stem import WordNetLemmatizer
lemmatizer = WordNetLemmatizer()
```

```
[nltk_data] Downloading package wordnet to
[nltk_data]     C:\Users\parit\AppData\Roaming\nltk_data...
[nltk_data]   Package wordnet is already up-to-date!
```

In [24]:
```
# lemm_wrd_list=[]
# for words in train_labeled['moment']:
#     lemm_words = [lemmatizer.lemmatize(word) for word in words]
#     lemm_wrd_list.append(lemm_words)

# train_labeled['moment'] = lemm_wrd_list
lemm_wrd_list=[]
for words in train_labeled['moment']:
    lemm_words = [lemmatizer.lemmatize(word) for word in words]
    lemm_string = "";
    for i in range(0, len(lemm_words)):
        lemm_string += lemm_words[i] + " "
    lemm_wrd_list.append(lemm_string.strip())
train_labeled['moment'] = lemm_wrd_list
```

In [25]:
```
train_labeled.head()
```

Out[25]:

	hmid	moment	concepts	agency	social	age	country	gender	married	parenthood	reflection	duration
0	27674	happy son got 90 mark examination	education|family	no	yes	29.0	IND	m	married	y	24h	half_a_day
1	27685	went movie friend fun	entertainment	yes	yes	29.0	IND	m	single	y	24h	half_a_day
2	27691	hot kiss girl friend last night made day	romance	yes	yes	25.0	IND	m	married	y	24h	at_least_one_hour
3	27701	son woke fantastic breakfast egg special hambu...	family|food	no	yes	79	USA	f	widowed	y	24h	all_day_im_still_feeling_it
4	27712	older daughter keep patting younger daughter head	family	no	yes	30	USA	f	married	y	24h	a_few_moment

In [26]:

```
# lemm_wrd_list=[]
# for words in train_unlabeled['moment']:
#     lemm_words = [lemmatizer.lemmatize(word) for word in words]
#     lemm_wrd_list.append(lemm_words)

lemm_wrd_list=[]
for words in train_unlabeled['moment']:
    lemm_words = [lemmatizer.lemmatize(word) for word in words]
    lemm_string = "";
    for i in range(0, len(lemm_words)):
        lemm_string += lemm_words[i] + " "
    lemm_wrd_list.append(lemm_string.strip())

train_unlabeled['moment'] = lemm_wrd_list
```

In [27]:

```
concepts_list = []
for i in range(0, len(train_labeled['concepts'])):
    arr = train_labeled['concepts'][i].split("|")
    concept_string = ""
    for j in range(0, len(arr)):
```

```
        concept_string += arr[j] + " "
    concepts_list.append(concept_string.strip())
train_labeled['concepts'] = concepts_list
```

In [28]:
```
train_labeled.head()
```

Out[28]:

	hmid	moment	concepts	agency	social	age	country	gender	married	parenthood	reflection	duration
0	27674	happy son got 90 mark examination	education family	no	yes	29.0	IND	m	married	y	24h	half_a_day
1	27685	went movie friend fun	entertainment	yes	yes	29.0	IND	m	single	y	24h	half_a_day
2	27691	hot kiss girl friend last night made day	romance	yes	yes	25.0	IND	m	married	y	24h	at_least_one_hour
3	27701	son woke fantastic breakfast egg special hambu...	family food	no	yes	79	USA	f	widowed	y	24h	all_day_im_still_feeling_it
4	27712	older daughter keep patting younger daughter head	family	no	yes	30	USA	f	married	y	24h	a_few_moment

Preprocessing Other Columns

In [29]:
```
train_labeled['country'].unique()
```

Out[29]:
```
array(['IND', 'USA', 'VEN', 'DNK', 'FIN', 'PER', 'GBR', 'SRB', 'DOM',
       'ARM', 'PAK', 'SGP', 'FRA', 'JAM', 'LTU', 'TUR', 'PHL', 'PRT',
       'ESP', 'THA', 'MEX', 'ARE', 'IDN', 'BRA', 'IRL', 'NGA', 'CAN',
       'BGR', 'DEU', nan, 'DZA', 'MKD', 'ETH', 'RUS', 'EGY', 'NLD', 'ALB',
       'BEL', 'MDA', 'ISR', 'NZL', 'AUS', 'ZAF', 'SWE', 'VNM', 'KAZ',
       'GRC', 'TTO', 'UGA', 'MAR', 'URY', 'ISL', 'SUR', 'KOR', 'BHS',
       'COL', 'ITA', 'CZE', 'BRB', 'MLT', 'MYS', 'KEN', 'KWT', 'PRI',
       'ROU', 'SVN', 'MAC', 'GTM', 'NOR', 'AFG'], dtype=object)
```

In [30]:
```
train_unlabeled['country'].unique()
```

Out[30]:
```
array(['USA', 'IND', 'VNM', 'KWT', 'GBR', 'FIN', 'AUS', 'BGD', 'IDN',
       'BEL', 'CAN', 'SGP', 'IRL', 'PHL', 'VEN', 'LTU', 'BGR', 'DNK',
       'URY', 'SRB', 'JAM', 'ITA', 'KEN', 'DOM', 'EGY', 'PER', 'PRT',
       'ESP', 'NGA', 'BRA', 'MEX', 'TUR', 'MKD', 'FRA', 'COL', 'GRC', nan,
       'MDA', 'POL', 'ARM', 'PAK', 'DZA', 'UGA', 'MYS', 'ZAF', 'THA',
       'ARE', 'AUT', 'LKA', 'DEU', 'ROU', 'ETH', 'NZL', 'NIC', 'NLD',
       'ALB', 'RUS', 'UMI', 'ISR', 'MAR', 'SWE', 'KAZ', 'ASM', 'TTO',
       'JPN', 'PRI', 'AFG', 'KNA', 'CYP', 'TUN', 'HRV', 'ECU', 'KOR',
       'BRB', 'CZE', 'EST', 'BHS', 'GTM', 'GHA', 'GMB', 'ISL', 'SAU',
       'SUR', 'MLT', 'TCA', 'IRQ', 'ARG', 'TWN', 'CHL', 'MAC', 'SVN',
       'NPL', 'VIR', 'SLV', 'NOR', 'LVA'], dtype=object)
```

- First issue the unlabelled data set has more terms different from the labelled data
- Agency and Social are TARGET

In [31]:
```
train_labeled.columns
```

Out[31]:
```
Index(['hmid', 'moment', 'concepts', 'agency', 'social', 'age', 'country',
       'gender', 'married', 'parenthood', 'reflection', 'duration'],
      dtype='object')
```

In [32]:
```
# print(train_labeled['married'].unique())
# print(train_labeled['gender'].unique())
# print(train_labeled['age'].unique())
# print(train_labeled['duration'].unique())
# print(train_labeled['reflection'].unique())
# print(train_labeled['parenthood'].unique())
# print(train_labeled['concepts'].unique())
```

In [33]:
```
print(train_labeled.isna().sum())
```

```
hmid           0
moment         0
concepts       0
agency         0
social         0
age            9
country       22
gender         6
married       15
parenthood     9
```

```
reflection     0
duration      31
dtype: int64
```

In [34]:
```
print(train_unlabeled.isna().sum())
```

```
hmid            0
moment          0
age            96
country       124
gender         47
married        95
parenthood     50
reflection      0
duration      226
dtype: int64
```

In [35]:
```
print(test_labeled.isna().sum())
```

```
hmid            0
moment          0
reflection      0
age             0
country       262
gender         50
duration        0
married       215
parenthood    122
concepts        0
agency          0
social          0
dtype: int64
```

In [36]:
```
print(test_unlabeled.isna().sum())
```

```
hmid            0
moment          0
reflection      0
age             0
country       262
gender         50
duration        0
married       215
```

```
parenthood    122
dtype: int64
```

Remove all the nan, null and prefer not to say values

In [37]:
```
train_labeled.shape
```

Out[37]:
```
(10560, 12)
```

In [38]:
```
train_labeled = train_labeled.dropna()
print(train_labeled.shape)
```

```
(10485, 12)
```

In [39]:
```
train_unlabeled.shape
```

Out[39]:
```
(72324, 9)
```

In [40]:
```
train_unlabeled = train_unlabeled.dropna()
train_unlabeled.shape
```

Out[40]:
```
(71771, 9)
```

In [41]:
```
test_labeled = test_labeled.dropna()
test_labeled.shape
```

Out[41]:
```
(16665, 12)
```

In [42]:
```
test_unlabeled = test_unlabeled.dropna()
test_unlabeled.shape
```

Out[42]:
```
(16665, 9)
```

In [43]:
```
# print(train_labeled['married'].unique())
# print(train_labeled['gender'].unique())
# print(train_labeled['duration'].unique())
```

```
# print(train_labeled['reflection'].unique())
# print(train_labeled['parenthood'].unique())
# print(train_labeled['age'].unique())
# print(train_labeled['country'].unique())
# print(train_labeled['country'].describe())
```

In [44]:

```
#print(train_labeled.shape)
train_labeled = train_labeled[train_labeled["age"].str.contains("prefer not to say") == False]
#print(train_labeled.shape)

train_labeled['age'] = train_labeled['age'].astype(float)
```

In [45]:

```
# print(test_labeled['married'].unique())
# print(test_labeled['gender'].unique())
print(test_labeled['duration'].unique())

cnt=0
for i in test_labeled['duration']:
    if i=='select one':
        cnt+=1;
print('\nRows with "Select One" word ',cnt,'\n')



# print(test_labeled['reflection'].unique())
# print(test_labeled['parenthood'].unique())
print(test_labeled['age'].unique())
# print(test_labeled['country'].unique())
print(test_labeled['country'].describe())
```

```
['all_day_im_still_feeling_it' 'at_least_one_hour' 'half_a_day'
 'a_few_minutes' 'select one']

Rows with "Select One" word  45

['28' '24' '34' '27' '31' '21' '57' '36' '71' '32' '40' '43' '38' '30'
 '49' '25' '46' '35' '69' '26' '29' '19' '33' '54' '23' '45' '72' '41'
 '22' '56' '70' '60' '37' '51' '50' '48' '39' '55' '47' '62' '74' '61'
 '68' '65' '59' '20' '67' '{}' '42' '44' '66' '64' '18' '76' '58' '63'
 '52' '53' '78' '73' '2' '3' '119' '5' '37years' '80' ',30' '247' '586']
count     16665
unique       61
```

```
top         USA
freq      13952
Name: country, dtype: object
```

In [46]:

```
print(train_unlabeled['married'].unique())
print(train_unlabeled['gender'].unique())
print(train_unlabeled['duration'].unique())
print(train_unlabeled['reflection'].unique())
print(train_unlabeled['parenthood'].unique())
print(train_unlabeled['age'].unique())
```

```
['single' 'married' 'divorced' 'separated' 'widowed']
['m' 'f' 'o']
['at_least_one_hour' 'half_a_day' 'all_day_im_still_feeling_it'
 'a_few_moment' 'a_few_minutes']
['24h' '3m']
['n' 'y']
[ 35.  30.  23.  25.  41.  37.  29.  39.  28.  38.  27.  22.  47.  26.
  64.  32.  33.  48.  61.  66.  36.  18.  56.  31.  42.  24.  62.  44.
  21.  45.  46.  40.  55.   3.  52.  19.  34.  53.  49.  65.  43.  20.
  51.  50.  54.  69.  57.  63.  60.  73.  58.  71.  98.  70.  59. 227.
  68.  72.  83.   2.  78.  76.  67.  74.  81. 233.  79.  95.  80.  88.
  75.  77.]
```

In [47]:

```
print(test_unlabeled['married'].unique())
print(test_unlabeled['gender'].unique())
print(test_unlabeled['duration'].unique())
print(test_unlabeled['reflection'].unique())
print(test_unlabeled['parenthood'].unique())
print(test_unlabeled['age'].unique())
```

```
['single' 'married' 'divorced' 'separated' 'widowed']
['m' 'f' 'o']
['all_day_im_still_feeling_it' 'at_least_one_hour' 'half_a_day'
 'a_few_minutes' 'select one']
['24h' '3m']
['n' 'y']
['28' '24' '34' '27' '31' '21' '57' '36' '71' '32' '40' '43' '38' '30'
 '49' '25' '46' '35' '69' '26' '29' '19' '33' '54' '23' '45' '72' '41'
 '22' '56' '70' '60' '37' '51' '50' '48' '39' '55' '47' '62' '74' '61'
 '68' '65' '59' '20' '67' '{}' '42' '44' '66' '64' '18' '76' '58' '63'
 '52' '53' '78' '73' '2' '3' '119' '5' '37years' '80' ',30' '247' '586']
```

In [ ]:

In [48]:
```
print(test_labeled['married'].unique())
print(test_labeled['gender'].unique())
print(test_labeled['duration'].unique())
print(test_labeled['reflection'].unique())
print(test_labeled['parenthood'].unique())
```

```
['single' 'married' 'divorced' 'separated' 'widowed']
['m' 'f' 'o']
['all_day_im_still_feeling_it' 'at_least_one_hour' 'half_a_day'
 'a_few_minutes' 'select one']
['24h' '3m']
['n' 'y']
```

In [ ]:
```

```

In [49]:
```
print(train_labeled['agency'].unique())
print(train_labeled['social'].unique())
```

```
['no' 'yes']
['yes' 'no']
```

In [50]:
```
train_unlabeled.columns
```

Out[50]:
```
Index(['hmid', 'moment', 'age', 'country', 'gender', 'married', 'parenthood',
       'reflection', 'duration'],
      dtype='object')
```

In [51]:
```
train_labeled.columns
```

Out[51]:
```
Index(['hmid', 'moment', 'concepts', 'agency', 'social', 'age', 'country',
       'gender', 'married', 'parenthood', 'reflection', 'duration'],
      dtype='object')
```

In [52]:
```
test_labeled.columns
```

Out[52]:
```
Index(['hmid', 'moment', 'reflection', 'age', 'country', 'gender', 'duration',
       'married', 'parenthood', 'concepts', 'agency', 'social'],
      dtype='object')
```

In [53]:
```
test_unlabeled.columns
```

Out[53]:
```
Index(['hmid', 'moment', 'reflection', 'age', 'country', 'gender', 'duration',
       'married', 'parenthood'],
      dtype='object')
```

Encoding the columns

In [54]:
```
# Dealing with yes->1 and No->0 # for agency and social#
train_labeled['social'].replace({'yes':1,'no':0},inplace=True)
train_labeled['agency'].replace({'yes':1,'no':0},inplace=True)
```

In [55]:
```
# Dealing with yes->1 and No->0 # for agency and social#
test_labeled['social'].replace({'yes':1,'no':0},inplace=True)
test_labeled['agency'].replace({'yes':1,'no':0},inplace=True)
```

In [56]:
```
list1 = []
for i in train_labeled['country']:
    if i=='USA':
        list1.append(1)
    else:
        list1.append(0)

train_labeled['country'] = list1

list1 = []
for i in train_unlabeled['country']:
    if i=='USA':
        list1.append(1)
    else:
        list1.append(0)

train_unlabeled['country'] = list1
```

In [57]:
```
list2 = []
for i in test_labeled['country']:
    if i=='USA':
        list2.append(1)
```

```
    else:
        list2.append(0)

test_labeled['country'] = list2

list2 = []
for i in test_unlabeled['country']:
    if i=='USA':
        list2.append(1)
    else:
        list2.append(0)

test_unlabeled['country'] = list2
```

In [58]:
```
from sklearn.preprocessing import MinMaxScaler
```

In [59]:
```
from sklearn.preprocessing import OrdinalEncoder,LabelEncoder,OneHotEncoder
```

In [60]:
```
label_enc_age = LabelEncoder()
label_enc_gender = LabelEncoder()
label_enc_parenthood = LabelEncoder()
label_enc_reflection = LabelEncoder()
label_enc_country = LabelEncoder()
label_enc_married = LabelEncoder()
label_enc_duration = LabelEncoder()

label_enc_age_test = LabelEncoder()
label_enc_duration_test = LabelEncoder()

label_enc_age_test_unl = LabelEncoder()
```

In [61]:
```
#train_labeled['age'] = label_enc_age.fit_transform(train_labeled['age'])
train_labeled['gender'] = label_enc_gender.fit_transform(train_labeled['gender'])
train_labeled['parenthood'] = label_enc_parenthood.fit_transform(train_labeled['parenthood'])
train_labeled['reflection'] = label_enc_reflection.fit_transform(train_labeled['reflection'])
train_labeled['country'] = label_enc_country.fit_transform(train_labeled['country'])
train_labeled['duration'] = label_enc_duration.fit_transform(train_labeled['duration'])
train_labeled['married'] = label_enc_married.fit_transform(train_labeled['married'])

#train_unlabeled['age'] = label_enc_age_new.fit_transform(train_unlabeled['age'])
```

```
train_unlabeled['gender'] = label_enc_gender.fit_transform(train_unlabeled['gender'])
train_unlabeled['parenthood'] = label_enc_parenthood.fit_transform(train_unlabeled['parenthood'])
train_unlabeled['reflection'] = label_enc_reflection.fit_transform(train_unlabeled['reflection'])
train_unlabeled['country'] = label_enc_country.fit_transform(train_unlabeled['country'])
train_unlabeled['duration'] = label_enc_duration.fit_transform(train_unlabeled['duration'])
train_unlabeled['married'] = label_enc_married.fit_transform(train_unlabeled['married'])


#test_labeled['age'] = label_enc_age_test.fit_transform(test_labeled['age'])
test_labeled['duration'] = label_enc_duration_test.fit_transform(test_labeled['duration'])
test_labeled['gender'] = label_enc_gender.fit_transform(test_labeled['gender'])
test_labeled['parenthood'] = label_enc_parenthood.fit_transform(test_labeled['parenthood'])
test_labeled['reflection'] = label_enc_reflection.fit_transform(test_labeled['reflection'])
test_labeled['country'] = label_enc_country.fit_transform(test_labeled['country'])
test_labeled['married'] = label_enc_married.fit_transform(test_labeled['married'])


#test_labeled['age'] = label_enc_age_test.fit_transform(test_labeled['age'])
test_unlabeled['duration'] = label_enc_duration_test.fit_transform(test_unlabeled['duration'])
test_unlabeled['gender'] = label_enc_gender.fit_transform(test_unlabeled['gender'])
test_unlabeled['parenthood'] = label_enc_parenthood.fit_transform(test_unlabeled['parenthood'])
test_unlabeled['reflection'] = label_enc_reflection.fit_transform(test_unlabeled['reflection'])
test_unlabeled['country'] = label_enc_country.fit_transform(test_unlabeled['country'])
test_unlabeled['married'] = label_enc_married.fit_transform(test_unlabeled['married'])
```

In [62]:

```
train_labeled
```

Out[62]:

	hmid	moment	concepts	agency	social	age	country	gender	married	parenthood	reflection	duration
0	27674	happy son got 90 mark examination	education family	0	1	29.0	0	1	1	1	0	4
1	27685	went movie friend fun	entertainment	1	1	29.0	0	1	3	1	0	4
2	27691	hot kiss girl friend last night made day	romance	1	1	25.0	0	1	1	1	0	3
3	27701	son woke fantastic breakfast egg special hambu...	family food	0	1	79.0	1	0	4	1	0	2
4	27712	older daughter keep patting younger daughter head	family	0	1	30.0	1	0	1	1	0	1
...	...	...	...	...	...	...	...	...	...	...	...	...

	hmid	moment	concepts	agency	social	age	country	gender	married	parenthood	reflection	duration
10555	128748	husband called tell loved	romance family	0	1	58.0	1	0	1	0	0	0
10556	128753	worked always make feel good	career	1	0	24.0	1	1	1	1	0	3
10557	128754	finally got watch new resident evil movie	entertainment	1	0	34.0	1	1	0	1	0	3
10558	128757	got talk old friend reminisce good time	conversation	1	1	28.0	1	0	3	1	0	3
10559	128765	great meeting yesterday work bos colleague wen...	career	1	1	56.0	1	0	1	0	0	2

10483 rows × 12 columns

In [63]:
```
train_unlabeled
```

Out[63]:

	hmid	moment	age	country	gender	married	parenthood	reflection	duration
0	27673	went successful date someone felt sympathy con...	35.0	1	1	3	0	0	3
1	27675	went gym morning yoga	30.0	1	0	1	1	0	3
2	27678	meditated last night	23.0	0	1	3	0	0	3
3	27679	made new recipe peasant bread came spectacular	30.0	1	1	3	0	0	4
4	27680	got gift elder brother really surprising	23.0	0	1	3	0	0	3
...	...	...	...	...	...	...	...	...	...
72319	128761	spent time daughter	40.0	1	0	3	1	0	4
72320	128762	husband announced getting decent bonus quarter	48.0	1	0	1	1	0	3
72321	128763	pepsi drink	29.0	1	1	3	0	0	0
72322	128764	cuddling girlfriend last night	23.0	1	1	3	0	0	2
72323	128766	great workout last night	35.0	1	1	3	0	0	3

71771 rows × 9 columns

In [64]:
```
print(train_labeled['country'].unique())
print(train_labeled['country'].describe())
```

```
[0 1]
count    10483.000000
mean         0.799580
std          0.400334
min          0.000000
25%          1.000000
50%          1.000000
75%          1.000000
max          1.000000
Name: country, dtype: float64
```

In [65]:
```
train_labeled.corr()['social']
```

Out[65]:
```
hmid          -0.021528
agency        -0.257795
social         1.000000
age            0.054685
country       -0.033266
gender        -0.084028
married       -0.122568
parenthood     0.164944
reflection     0.041243
duration       0.044728
Name: social, dtype: float64
```

In [66]:
```
train_labeled.corr()['agency']
```

Out[66]:
```
hmid          -0.002089
agency         1.000000
social        -0.257795
age           -0.083176
country       -0.006700
gender         0.073615
married        0.097052
parenthood    -0.124688
reflection    -0.023294
duration       0.069562
Name: agency, dtype: float64
```

In [67]:
```
# run this in conda terminal
# conda install -c conda-forge spacy
# python -m spacy download en_core_web_sm
```

In [68]:
```
!python -m spacy download en_core_web_md
```

```
Collecting en-core-web-md==3.2.0
  Downloading https://github.com/explosion/spacy-models/releases/download/en_core_web_md-3.2.0/en_core_web_md-3.2.0-py3-none-any.whl (45.7 MB)
Requirement already satisfied: spacy<3.3.0,>=3.2.0 in c:\users\parit\anaconda3\lib\site-packages (from en-core-web-md==3.2.0) (3.2.1)
Requirement already satisfied: srsly<3.0.0,>=2.4.1 in c:\users\parit\anaconda3\lib\site-packages (from spacy<3.3.0,>=3.2.0->en-core-web-md==3.2.0) (2.4.2)
Requirement already satisfied: preshed<3.1.0,>=3.0.2 in c:\users\parit\anaconda3\lib\site-packages (from spacy<3.3.0,>=3.2.0->en-core-web-md==3.2.0) (3.0.6)
Requirement already satisfied: pathy>=0.3.5 in c:\users\parit\anaconda3\lib\site-packages (from spacy<3.3.0,>=3.2.0->en-core-web-md==3.2.0) (0.6.1)
Requirement already satisfied: jinja2 in c:\users\parit\anaconda3\lib\site-packages (from spacy<3.3.0,>=3.2.0->en-core-web-md==3.2.0) (2.11.3)
Requirement already satisfied: spacy-legacy<3.1.0,>=3.0.8 in c:\users\parit\anaconda3\lib\site-packages (from spacy<3.3.0,>=3.2.0->en-core-web-md==3.2.0) (3.0.8)
Requirement already satisfied: langcodes<4.0.0,>=3.2.0 in c:\users\parit\anaconda3\lib\site-packages (from spacy<3.3.0,>=3.2.0->en-core-web-md==3.2.0) (3.3.0)
Requirement already satisfied: numpy>=1.15.0 in c:\users\parit\anaconda3\lib\site-packages (from spacy<3.3.0,>=3.2.0->en-core-web-md==3.2.0) (1.21.5)
Requirement already satisfied: typer<0.5.0,>=0.3.0 in c:\users\parit\anaconda3\lib\site-packages (from spacy<3.3.0,>=3.2.0->en-core-web-md==3.2.0) (0.4.0)
Requirement already satisfied: pydantic!=1.8,!=1.8.1,<1.9.0,>=1.7.4 in c:\users\parit\anaconda3\lib\site-packages (from spacy<3.3.0,>=3.2.0->en-core-web-md==3.2.0) (1.8.2)
Requirement already satisfied: spacy-loggers<2.0.0,>=1.0.0 in c:\users\parit\anaconda3\lib\site-packages (from spacy<3.3.0,>=3.2.0->en-core-web-md==3.2.0) (1.0.1)
Requirement already satisfied: thinc<8.1.0,>=8.0.12 in c:\users\parit\anaconda3\lib\site-packages (from spacy<3.3.0,>=3.2.0->en-core-web-md==3.2.0) (8.0.13)
Requirement already satisfied: requests<3.0.0,>=2.13.0 in c:\users\parit\anaconda3\lib\site-packages (from spacy<3.3.0,>=3.2.0->en-core-web-md==3.2.0) (2.27.1)
Requirement already satisfied: setuptools in c:\users\parit\anaconda3\lib\site-packages (from spacy<3.3.0,>=3.2.0->en-core-web-md==3.2.0) (58.0.4)
Requirement already satisfied: wasabi<1.1.0,>=0.8.1 in c:\users\parit\anaconda3\lib\site-packages (from spacy<3.3.0,>=3.2.0->en-core-web-md==3.2.0) (0.9.0)
Requirement already satisfied: cymem<2.1.0,>=2.0.2 in c:\users\parit\anaconda3\lib\site-packages (from spacy<3.3.0,>=3.2.0->en-core-web-md==3.2.0) (2.0.6)
Requirement already satisfied: catalogue<2.1.0,>=2.0.6 in c:\users\parit\anaconda3\lib\site-packages (from spacy<3.3.0,>=3.2.0->en-core-web-md==3.2.0) (2.0.6)
Requirement already satisfied: blis<0.8.0,>=0.4.0 in c:\users\parit\anaconda3\lib\site-packages (from spacy<3.3.0,>=3.2.0
```

```
->en-core-web-md==3.2.0) (0.7.5)
Requirement already satisfied: packaging>=20.0 in c:\users\parit\anaconda3\lib\site-packages (from spacy<3.3.0,>=3.2.0->e
n-core-web-md==3.2.0) (21.3)
Requirement already satisfied: tqdm<5.0.0,>=4.38.0 in c:\users\parit\anaconda3\lib\site-packages (from spacy<3.3.0,>=3.2.
0->en-core-web-md==3.2.0) (4.63.1)
Requirement already satisfied: murmurhash<1.1.0,>=0.28.0 in c:\users\parit\anaconda3\lib\site-packages (from spacy<3.3.0,
>=3.2.0->en-core-web-md==3.2.0) (1.0.6)
Requirement already satisfied: pyparsing!=3.0.5,>=2.0.2 in c:\users\parit\anaconda3\lib\site-packages (from packaging>=2
0.0->spacy<3.3.0,>=3.2.0->en-core-web-md==3.2.0) (3.0.4)
Requirement already satisfied: smart-open<6.0.0,>=5.0.0 in c:\users\parit\anaconda3\lib\site-packages (from pathy>=0.3.5-
>spacy<3.3.0,>=3.2.0->en-core-web-md==3.2.0) (5.2.1)
Requirement already satisfied: typing-extensions>=3.7.4.3 in c:\users\parit\anaconda3\lib\site-packages (from pydantic!=
1.8,!=1.8.1,<1.9.0,>=1.7.4->spacy<3.3.0,>=3.2.0->en-core-web-md==3.2.0) (4.1.1)
Requirement already satisfied: certifi>=2017.4.17 in c:\users\parit\anaconda3\lib\site-packages (from requests<3.0.0,>=2.
13.0->spacy<3.3.0,>=3.2.0->en-core-web-md==3.2.0) (2021.10.8)
Requirement already satisfied: idna<4,>=2.5 in c:\users\parit\anaconda3\lib\site-packages (from requests<3.0.0,>=2.13.0->
spacy<3.3.0,>=3.2.0->en-core-web-md==3.2.0) (3.3)
Requirement already satisfied: charset-normalizer~=2.0.0 in c:\users\parit\anaconda3\lib\site-packages (from requests<3.
0.0,>=2.13.0->spacy<3.3.0,>=3.2.0->en-core-web-md==3.2.0) (2.0.12)
Requirement already satisfied: urllib3<1.27,>=1.21.1 in c:\users\parit\anaconda3\lib\site-packages (from requests<3.0.0,>
=2.13.0->spacy<3.3.0,>=3.2.0->en-core-web-md==3.2.0) (1.26.8)
Requirement already satisfied: colorama in c:\users\parit\anaconda3\lib\site-packages (from tqdm<5.0.0,>=4.38.0->spacy<3.
3.0,>=3.2.0->en-core-web-md==3.2.0) (0.4.4)
Requirement already satisfied: click<9.0.0,>=7.1.1 in c:\users\parit\anaconda3\lib\site-packages (from typer<0.5.0,>=0.3.
0->spacy<3.3.0,>=3.2.0->en-core-web-md==3.2.0) (8.0.4)
Requirement already satisfied: MarkupSafe>=0.23 in c:\users\parit\anaconda3\lib\site-packages (from jinja2->spacy<3.3.0,>
=3.2.0->en-core-web-md==3.2.0) (1.1.1)
[+] Download and installation successful
You can now load the package via spacy.load('en_core_web_md')
2022-03-25 03:04:57.216587: W tensorflow/stream_executor/platform/default/dso_loader.cc:64] Could not load dynamic librar
y 'cudart64_110.dll'; dlerror: cudart64_110.dll not found
2022-03-25 03:04:57.216772: I tensorflow/stream_executor/cuda/cudart_stub.cc:29] Ignore above cudart dlerror if you do no
t have a GPU set up on your machine.
```

In [69]:

```
def vectors(nlp, data):
    vectors = []
    for row in data[:, 0]:
        doc = nlp(row)
        vectors.append(doc.vector)
    return np.array(vectors)
```

In [70]:

```
train_cols = [1, 2, 5, 6, 7, 8, 9, 10, 11]
X_labeled_train = train_labeled.iloc[:, train_cols].values
```

```
y_agency_labeled_train = train_labeled.iloc[:, 3].values
y_social_labeled_train = train_labeled.iloc[:, 4].values
```

In [71]:
```
import spacy
nlp = spacy.load('en_core_web_md')
train_vectors = vectors(nlp, X_labeled_train)
```

In [72]:
```
test_cols = [1, 2, 3, 4, 5, 6, 7, 8, 9]
X_labeled_test = test_labeled.iloc[:, test_cols].values
y_agency_labeled_test = test_labeled.iloc[:, 10].values
y_social_labeled_test = test_labeled.iloc[:, 11].values
test_vectors = vectors(nlp, X_labeled_test)
```

Random Forest Classifier

In [73]:
```
from sklearn.ensemble import RandomForestClassifier
rf_model_agency = RandomForestClassifier(n_estimators = 200)
rf_model_agency.fit(train_vectors, y_agency_labeled_train)
y_pred_rf_agency = rf_model_agency.predict(test_vectors)
```

In [74]:
```
from sklearn.metrics import accuracy_score, f1_score, precision_score, recall_score, confusion_matrix
def evaluate(y_true, y_pred):
    # print evaluation results for model
    # print confusion matrix
    print("Confusion Matrix:")
    print(confusion_matrix(y_true, y_pred))
    # accuracy
    print("Accuracy: ", accuracy_score(y_true, y_pred))
    # precision
    print("Precision: ", precision_score(y_true, y_pred))
    # recall
    print("Recall ", recall_score(y_true, y_pred))
    # f-measure
    print("F1: ", f1_score(y_true, y_pred))
```

In [75]:
```
evaluate(y_agency_labeled_test, y_pred_rf_agency)
```

```
Confusion Matrix:
[[  590  4309]
 [  206 11560]]
Accuracy:  0.729072907290729
Precision:  0.7284643014682715
Recall  0.9824919258881523
F1:  0.8366202279717748
```

In [76]:
```
rf_model_social = RandomForestClassifier(n_estimators = 200)
rf_model_social.fit(train_vectors, y_social_labeled_train)
y_pred_rf_social = rf_model_social.predict(test_vectors)
```

In [77]:
```
evaluate(y_social_labeled_test, y_pred_rf_social)
```

```
Confusion Matrix:
[[4829 2322]
 [ 675 8839]]
Accuracy:  0.8201620162016202
Precision:  0.7919541259743751
Recall  0.9290519234811856
F1:  0.8550423216444983
```

SVM Classifier

In [78]:
```
from sklearn import svm
svm_model_agency = svm.SVC()
svm_model_agency.fit(train_vectors, y_agency_labeled_train)
y_pred_svm_agency = svm_model_agency.predict(test_vectors)
```

In [79]:
```
evaluate(y_agency_labeled_test, y_pred_svm_agency)
```

```
Confusion Matrix:
[[ 1324  3575]
 [  561 11205]]
Accuracy:  0.7518151815181519
Precision:  0.7581190798376184
Recall  0.952320244773075
F1:  0.8441949822948843
```

In [80]:
```
svm_model_social = svm.SVC()
```

```
svm_model_social.fit(train_vectors, y_social_labeled_train)
y_pred_svm_social = svm_model_social.predict(test_vectors)
```

In [81]:
```
evaluate(y_social_labeled_test, y_pred_svm_social)
```

```
Confusion Matrix:
[[6190  961]
 [1159 8355]]
Accuracy:  0.8727872787278728
Precision:  0.8968441391155002
Recall  0.878179524910658
F1:  0.8874137015400957
```

XGBoost Classifier

In [82]:
```
from xgboost import XGBClassifier
xg_model_agency = XGBClassifier()
xg_model_agency.fit(train_vectors, y_agency_labeled_train)
y_pred_xg_agency = xg_model_agency.predict(test_vectors)
```

```
C:\Users\parit\anaconda3\lib\site-packages\xgboost\compat.py:36: FutureWarning: pandas.Int64Index is deprecated and will
be removed from pandas in a future version. Use pandas.Index with the appropriate dtype instead.
  from pandas import MultiIndex, Int64Index
C:\Users\parit\anaconda3\lib\site-packages\xgboost\sklearn.py:1224: UserWarning: The use of label encoder in XGBClassifie
r is deprecated and will be removed in a future release. To remove this warning, do the following: 1) Pass option use_lab
el_encoder=False when constructing XGBClassifier object; and 2) Encode your labels (y) as integers starting with 0, i.e.
0, 1, 2, ..., [num_class - 1].
  warnings.warn(label_encoder_deprecation_msg, UserWarning)
[03:08:42] WARNING: C:/Users/Administrator/workspace/xgboost-win64_release_1.5.0/src/learner.cc:1115: Starting in XGBoost
1.3.0, the default evaluation metric used with the objective 'binary:logistic' was changed from 'error' to 'logloss'. Exp
licitly set eval_metric if you'd like to restore the old behavior.
```

In [83]:
```
evaluate(y_agency_labeled_test, y_pred_xg_agency)
```

```
Confusion Matrix:
[[ 2239  2660]
 [ 1588 10178]]
Accuracy:  0.7450945094509451
Precision:  0.7928026172300982
Recall  0.8650348461669216
F1:  0.827345147130548
```

In [84]:
```
xg_model_social = XGBClassifier()
xg_model_social.fit(train_vectors, y_social_labeled_train)
y_pred_xg_social = xg_model_social.predict(test_vectors)
```

```
[03:08:48] WARNING: C:/Users/Administrator/workspace/xgboost-win64_release_1.5.0/src/learner.cc:1115: Starting in XGBoost 1.3.0, the default evaluation metric used with the objective 'binary:logistic' was changed from 'error' to 'logloss'. Explicitly set eval_metric if you'd like to restore the old behavior.
C:\Users\parit\anaconda3\lib\site-packages\xgboost\sklearn.py:1224: UserWarning: The use of label encoder in XGBClassifier is deprecated and 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) Encode your labels (y) as integers starting with 0, i.e. 0, 1, 2, ..., [num_class - 1].
  warnings.warn(label_encoder_deprecation_msg, UserWarning)
```

In [85]:
```
evaluate(y_social_labeled_test, y_pred_xg_social)
```

```
Confusion Matrix:
[[4259 2892]
 [ 562 8952]]
Accuracy:  0.7927392739273927
Precision:  0.7558257345491388
Recall  0.9409291570317427
F1:  0.8382807378968068
```

CatBoost Classifier

In [86]:
```
from catboost import CatBoostClassifier
cb_model_agency = CatBoostClassifier()
cb_model_agency.fit(train_vectors, y_agency_labeled_train)
y_pred_cb_agency = cb_model_agency.predict(test_vectors)
```

```
Learning rate set to 0.028098
0:      learn: 0.6844458        total: 177ms    remaining: 2m 57s
1:      learn: 0.6756154        total: 199ms    remaining: 1m 39s
2:      learn: 0.6670529        total: 221ms    remaining: 1m 13s
3:      learn: 0.6594306        total: 242ms    remaining: 1m
4:      learn: 0.6513131        total: 262ms    remaining: 52.2s
5:      learn: 0.6439651        total: 312ms    remaining: 51.7s
6:      learn: 0.6369594        total: 332ms    remaining: 47.1s
7:      learn: 0.6298898        total: 352ms    remaining: 43.7s
8:      learn: 0.6234484        total: 372ms    remaining: 41s
9:      learn: 0.6170745        total: 393ms    remaining: 38.9s
```

```
10:     learn: 0.6122808        total: 419ms    remaining: 37.6s
11:     learn: 0.6069741        total: 439ms    remaining: 36.2s
12:     learn: 0.6017464        total: 460ms    remaining: 34.9s
13:     learn: 0.5961827        total: 484ms    remaining: 34.1s
14:     learn: 0.5923722        total: 505ms    remaining: 33.1s
15:     learn: 0.5876744        total: 524ms    remaining: 32.3s
16:     learn: 0.5833652        total: 544ms    remaining: 31.5s
17:     learn: 0.5793022        total: 564ms    remaining: 30.8s
18:     learn: 0.5758030        total: 584ms    remaining: 30.2s
19:     learn: 0.5718848        total: 605ms    remaining: 29.6s
20:     learn: 0.5683605        total: 626ms    remaining: 29.2s
21:     learn: 0.5653380        total: 648ms    remaining: 28.8s
22:     learn: 0.5622854        total: 670ms    remaining: 28.4s
23:     learn: 0.5590823        total: 691ms    remaining: 28.1s
24:     learn: 0.5561186        total: 712ms    remaining: 27.8s
25:     learn: 0.5532635        total: 732ms    remaining: 27.4s
26:     learn: 0.5504796        total: 752ms    remaining: 27.1s
27:     learn: 0.5480022        total: 771ms    remaining: 26.8s
28:     learn: 0.5457376        total: 791ms    remaining: 26.5s
29:     learn: 0.5434442        total: 813ms    remaining: 26.3s
30:     learn: 0.5412405        total: 834ms    remaining: 26.1s
31:     learn: 0.5393566        total: 855ms    remaining: 25.9s
32:     learn: 0.5371778        total: 877ms    remaining: 25.7s
33:     learn: 0.5349258        total: 897ms    remaining: 25.5s
34:     learn: 0.5330095        total: 917ms    remaining: 25.3s
35:     learn: 0.5310939        total: 938ms    remaining: 25.1s
36:     learn: 0.5292499        total: 958ms    remaining: 24.9s
37:     learn: 0.5274044        total: 978ms    remaining: 24.8s
38:     learn: 0.5253316        total: 1s       remaining: 24.7s
39:     learn: 0.5238748        total: 1.02s    remaining: 24.5s
40:     learn: 0.5221907        total: 1.04s    remaining: 24.4s
41:     learn: 0.5205920        total: 1.06s    remaining: 24.2s
42:     learn: 0.5187645        total: 1.08s    remaining: 24.1s
43:     learn: 0.5171177        total: 1.1s     remaining: 24s
44:     learn: 0.5156425        total: 1.12s    remaining: 23.8s
45:     learn: 0.5140527        total: 1.14s    remaining: 23.7s
46:     learn: 0.5128011        total: 1.16s    remaining: 23.6s
47:     learn: 0.5116887        total: 1.18s    remaining: 23.5s
48:     learn: 0.5103552        total: 1.21s    remaining: 23.4s
49:     learn: 0.5089044        total: 1.23s    remaining: 23.3s
50:     learn: 0.5077686        total: 1.25s    remaining: 23.2s
51:     learn: 0.5063024        total: 1.27s    remaining: 23.2s
52:     learn: 0.5048806        total: 1.29s    remaining: 23.1s
53:     learn: 0.5036743        total: 1.31s    remaining: 23s
54:     learn: 0.5025363        total: 1.34s    remaining: 23s
```

```
55:     learn: 0.5014113        total: 1.36s    remaining: 22.9s
56:     learn: 0.5001219        total: 1.38s    remaining: 22.9s
57:     learn: 0.4991855        total: 1.4s     remaining: 22.8s
58:     learn: 0.4980264        total: 1.42s    remaining: 22.7s
59:     learn: 0.4969738        total: 1.45s    remaining: 22.7s
60:     learn: 0.4958867        total: 1.47s    remaining: 22.6s
61:     learn: 0.4949893        total: 1.49s    remaining: 22.5s
62:     learn: 0.4940639        total: 1.51s    remaining: 22.5s
63:     learn: 0.4930828        total: 1.54s    remaining: 22.5s
64:     learn: 0.4919733        total: 1.56s    remaining: 22.5s
65:     learn: 0.4909394        total: 1.59s    remaining: 22.5s
66:     learn: 0.4900454        total: 1.61s    remaining: 22.5s
67:     learn: 0.4892325        total: 1.64s    remaining: 22.5s
68:     learn: 0.4882186        total: 1.67s    remaining: 22.5s
69:     learn: 0.4873065        total: 1.69s    remaining: 22.4s
70:     learn: 0.4864359        total: 1.71s    remaining: 22.4s
71:     learn: 0.4856106        total: 1.74s    remaining: 22.4s
72:     learn: 0.4847840        total: 1.76s    remaining: 22.4s
73:     learn: 0.4838776        total: 1.8s     remaining: 22.5s
74:     learn: 0.4828632        total: 1.83s    remaining: 22.5s
75:     learn: 0.4819748        total: 1.85s    remaining: 22.5s
76:     learn: 0.4812220        total: 1.88s    remaining: 22.5s
77:     learn: 0.4804293        total: 1.9s     remaining: 22.5s
78:     learn: 0.4796591        total: 1.92s    remaining: 22.4s
79:     learn: 0.4788786        total: 1.95s    remaining: 22.4s
80:     learn: 0.4780968        total: 1.97s    remaining: 22.4s
81:     learn: 0.4773671        total: 2s       remaining: 22.3s
82:     learn: 0.4766709        total: 2.02s    remaining: 22.3s
83:     learn: 0.4758861        total: 2.05s    remaining: 22.3s
84:     learn: 0.4750992        total: 2.07s    remaining: 22.3s
85:     learn: 0.4743864        total: 2.11s    remaining: 22.4s
86:     learn: 0.4735902        total: 2.13s    remaining: 22.4s
87:     learn: 0.4727015        total: 2.15s    remaining: 22.3s
88:     learn: 0.4720758        total: 2.18s    remaining: 22.3s
89:     learn: 0.4714527        total: 2.2s     remaining: 22.3s
90:     learn: 0.4708225        total: 2.23s    remaining: 22.3s
91:     learn: 0.4701489        total: 2.25s    remaining: 22.2s
92:     learn: 0.4695711        total: 2.27s    remaining: 22.2s
93:     learn: 0.4690176        total: 2.3s     remaining: 22.2s
94:     learn: 0.4683987        total: 2.32s    remaining: 22.1s
95:     learn: 0.4677433        total: 2.35s    remaining: 22.1s
96:     learn: 0.4671000        total: 2.37s    remaining: 22.1s
97:     learn: 0.4664120        total: 2.4s     remaining: 22.1s
98:     learn: 0.4658595        total: 2.42s    remaining: 22s
99:     learn: 0.4652757        total: 2.45s    remaining: 22s
```

```
100:    learn: 0.4646499        total: 2.47s    remaining: 22s
101:    learn: 0.4640049        total: 2.49s    remaining: 22s
102:    learn: 0.4634217        total: 2.52s    remaining: 21.9s
103:    learn: 0.4628182        total: 2.55s    remaining: 22s
104:    learn: 0.4622853        total: 2.57s    remaining: 21.9s
105:    learn: 0.4616525        total: 2.6s     remaining: 21.9s
106:    learn: 0.4610017        total: 2.62s    remaining: 21.9s
107:    learn: 0.4604211        total: 2.65s    remaining: 21.9s
108:    learn: 0.4597561        total: 2.67s    remaining: 21.8s
109:    learn: 0.4590816        total: 2.7s     remaining: 21.8s
110:    learn: 0.4583709        total: 2.72s    remaining: 21.8s
111:    learn: 0.4578311        total: 2.75s    remaining: 21.8s
112:    learn: 0.4571366        total: 2.77s    remaining: 21.8s
113:    learn: 0.4565901        total: 2.79s    remaining: 21.7s
114:    learn: 0.4559767        total: 2.82s    remaining: 21.7s
115:    learn: 0.4555258        total: 2.84s    remaining: 21.7s
116:    learn: 0.4549994        total: 2.87s    remaining: 21.7s
117:    learn: 0.4544916        total: 2.89s    remaining: 21.6s
118:    learn: 0.4539140        total: 2.92s    remaining: 21.6s
119:    learn: 0.4534181        total: 2.94s    remaining: 21.6s
120:    learn: 0.4528086        total: 2.96s    remaining: 21.5s
121:    learn: 0.4524428        total: 2.99s    remaining: 21.5s
122:    learn: 0.4519885        total: 3.01s    remaining: 21.5s
123:    learn: 0.4514473        total: 3.04s    remaining: 21.5s
124:    learn: 0.4510065        total: 3.06s    remaining: 21.4s
125:    learn: 0.4505276        total: 3.09s    remaining: 21.4s
126:    learn: 0.4501385        total: 3.11s    remaining: 21.4s
127:    learn: 0.4496969        total: 3.13s    remaining: 21.4s
128:    learn: 0.4491550        total: 3.16s    remaining: 21.3s
129:    learn: 0.4486620        total: 3.18s    remaining: 21.3s
130:    learn: 0.4481074        total: 3.21s    remaining: 21.3s
131:    learn: 0.4476376        total: 3.23s    remaining: 21.2s
132:    learn: 0.4471560        total: 3.25s    remaining: 21.2s
133:    learn: 0.4466880        total: 3.28s    remaining: 21.2s
134:    learn: 0.4462139        total: 3.3s     remaining: 21.2s
135:    learn: 0.4457953        total: 3.33s    remaining: 21.1s
136:    learn: 0.4453227        total: 3.35s    remaining: 21.1s
137:    learn: 0.4448801        total: 3.38s    remaining: 21.1s
138:    learn: 0.4444754        total: 3.4s     remaining: 21.1s
139:    learn: 0.4440001        total: 3.43s    remaining: 21.1s
140:    learn: 0.4435882        total: 3.46s    remaining: 21.1s
141:    learn: 0.4430421        total: 3.48s    remaining: 21.1s
142:    learn: 0.4425632        total: 3.51s    remaining: 21s
143:    learn: 0.4420305        total: 3.54s    remaining: 21s
144:    learn: 0.4415856        total: 3.56s    remaining: 21s
```

```
145:    learn: 0.4410044        total: 3.58s    remaining: 21s
146:    learn: 0.4407338        total: 3.61s    remaining: 20.9s
147:    learn: 0.4402649        total: 3.63s    remaining: 20.9s
148:    learn: 0.4398482        total: 3.66s    remaining: 20.9s
149:    learn: 0.4394676        total: 3.68s    remaining: 20.9s
150:    learn: 0.4390320        total: 3.7s     remaining: 20.8s
151:    learn: 0.4386531        total: 3.73s    remaining: 20.8s
152:    learn: 0.4382398        total: 3.75s    remaining: 20.8s
153:    learn: 0.4378918        total: 3.77s    remaining: 20.7s
154:    learn: 0.4375459        total: 3.8s     remaining: 20.7s
155:    learn: 0.4370972        total: 3.82s    remaining: 20.7s
156:    learn: 0.4366822        total: 3.85s    remaining: 20.6s
157:    learn: 0.4363093        total: 3.87s    remaining: 20.6s
158:    learn: 0.4357702        total: 3.89s    remaining: 20.6s
159:    learn: 0.4353997        total: 3.91s    remaining: 20.5s
160:    learn: 0.4350511        total: 3.94s    remaining: 20.5s
161:    learn: 0.4346337        total: 3.96s    remaining: 20.5s
162:    learn: 0.4342842        total: 3.98s    remaining: 20.5s
163:    learn: 0.4338985        total: 4.01s    remaining: 20.4s
164:    learn: 0.4335867        total: 4.03s    remaining: 20.4s
165:    learn: 0.4331049        total: 4.05s    remaining: 20.4s
166:    learn: 0.4326848        total: 4.08s    remaining: 20.3s
167:    learn: 0.4322844        total: 4.1s     remaining: 20.3s
168:    learn: 0.4319566        total: 4.12s    remaining: 20.3s
169:    learn: 0.4316352        total: 4.15s    remaining: 20.3s
170:    learn: 0.4311610        total: 4.17s    remaining: 20.2s
171:    learn: 0.4307213        total: 4.19s    remaining: 20.2s
172:    learn: 0.4303182        total: 4.22s    remaining: 20.2s
173:    learn: 0.4299437        total: 4.24s    remaining: 20.1s
174:    learn: 0.4294583        total: 4.27s    remaining: 20.1s
175:    learn: 0.4290845        total: 4.29s    remaining: 20.1s
176:    learn: 0.4286909        total: 4.32s    remaining: 20.1s
177:    learn: 0.4283582        total: 4.34s    remaining: 20s
178:    learn: 0.4279451        total: 4.36s    remaining: 20s
179:    learn: 0.4275597        total: 4.39s    remaining: 20s
180:    learn: 0.4271289        total: 4.41s    remaining: 20s
181:    learn: 0.4267648        total: 4.44s    remaining: 19.9s
182:    learn: 0.4263623        total: 4.46s    remaining: 19.9s
183:    learn: 0.4260189        total: 4.49s    remaining: 19.9s
184:    learn: 0.4257205        total: 4.53s    remaining: 19.9s
185:    learn: 0.4253212        total: 4.55s    remaining: 19.9s
186:    learn: 0.4249112        total: 4.58s    remaining: 19.9s
187:    learn: 0.4243962        total: 4.62s    remaining: 20s
188:    learn: 0.4239287        total: 4.65s    remaining: 19.9s
189:    learn: 0.4236167        total: 4.67s    remaining: 19.9s
```

```
190:    learn: 0.4232101        total: 4.7s     remaining: 19.9s
191:    learn: 0.4228602        total: 4.72s    remaining: 19.9s
192:    learn: 0.4223911        total: 4.74s    remaining: 19.8s
193:    learn: 0.4220598        total: 4.77s    remaining: 19.8s
194:    learn: 0.4216224        total: 4.79s    remaining: 19.8s
195:    learn: 0.4212895        total: 4.82s    remaining: 19.8s
196:    learn: 0.4209572        total: 4.84s    remaining: 19.7s
197:    learn: 0.4206126        total: 4.87s    remaining: 19.7s
198:    learn: 0.4202351        total: 4.89s    remaining: 19.7s
199:    learn: 0.4199090        total: 4.91s    remaining: 19.7s
200:    learn: 0.4196531        total: 4.94s    remaining: 19.6s
201:    learn: 0.4192556        total: 4.96s    remaining: 19.6s
202:    learn: 0.4189676        total: 4.99s    remaining: 19.6s
203:    learn: 0.4186546        total: 5.01s    remaining: 19.6s
204:    learn: 0.4183452        total: 5.04s    remaining: 19.5s
205:    learn: 0.4178949        total: 5.06s    remaining: 19.5s
206:    learn: 0.4175183        total: 5.09s    remaining: 19.5s
207:    learn: 0.4171247        total: 5.11s    remaining: 19.5s
208:    learn: 0.4167715        total: 5.14s    remaining: 19.5s
209:    learn: 0.4164550        total: 5.17s    remaining: 19.4s
210:    learn: 0.4161566        total: 5.19s    remaining: 19.4s
211:    learn: 0.4157777        total: 5.21s    remaining: 19.4s
212:    learn: 0.4154724        total: 5.24s    remaining: 19.4s
213:    learn: 0.4151427        total: 5.27s    remaining: 19.3s
214:    learn: 0.4148183        total: 5.29s    remaining: 19.3s
215:    learn: 0.4144393        total: 5.32s    remaining: 19.3s
216:    learn: 0.4141088        total: 5.34s    remaining: 19.3s
217:    learn: 0.4135980        total: 5.37s    remaining: 19.3s
218:    learn: 0.4131891        total: 5.4s     remaining: 19.2s
219:    learn: 0.4128489        total: 5.42s    remaining: 19.2s
220:    learn: 0.4124250        total: 5.45s    remaining: 19.2s
221:    learn: 0.4122398        total: 5.47s    remaining: 19.2s
222:    learn: 0.4119075        total: 5.5s     remaining: 19.2s
223:    learn: 0.4116134        total: 5.53s    remaining: 19.2s
224:    learn: 0.4113345        total: 5.55s    remaining: 19.1s
225:    learn: 0.4109690        total: 5.58s    remaining: 19.1s
226:    learn: 0.4106649        total: 5.6s     remaining: 19.1s
227:    learn: 0.4103565        total: 5.63s    remaining: 19.1s
228:    learn: 0.4099893        total: 5.66s    remaining: 19s
229:    learn: 0.4097047        total: 5.68s    remaining: 19s
230:    learn: 0.4094342        total: 5.71s    remaining: 19s
231:    learn: 0.4091431        total: 5.73s    remaining: 19s
232:    learn: 0.4087521        total: 5.76s    remaining: 19s
233:    learn: 0.4084815        total: 5.78s    remaining: 18.9s
234:    learn: 0.4081980        total: 5.81s    remaining: 18.9s
```

```
235:    learn: 0.4078909        total: 5.83s    remaining: 18.9s
236:    learn: 0.4075185        total: 5.86s    remaining: 18.9s
237:    learn: 0.4071637        total: 5.88s    remaining: 18.8s
238:    learn: 0.4068072        total: 5.91s    remaining: 18.8s
239:    learn: 0.4064926        total: 5.94s    remaining: 18.8s
240:    learn: 0.4063035        total: 5.96s    remaining: 18.8s
241:    learn: 0.4059760        total: 5.99s    remaining: 18.8s
242:    learn: 0.4057131        total: 6.01s    remaining: 18.7s
243:    learn: 0.4054681        total: 6.04s    remaining: 18.7s
244:    learn: 0.4051283        total: 6.06s    remaining: 18.7s
245:    learn: 0.4047869        total: 6.09s    remaining: 18.7s
246:    learn: 0.4044333        total: 6.12s    remaining: 18.7s
247:    learn: 0.4041605        total: 6.14s    remaining: 18.6s
248:    learn: 0.4038479        total: 6.17s    remaining: 18.6s
249:    learn: 0.4034945        total: 6.2s     remaining: 18.6s
250:    learn: 0.4030775        total: 6.23s    remaining: 18.6s
251:    learn: 0.4027715        total: 6.25s    remaining: 18.6s
252:    learn: 0.4024621        total: 6.28s    remaining: 18.5s
253:    learn: 0.4021636        total: 6.3s     remaining: 18.5s
254:    learn: 0.4018530        total: 6.33s    remaining: 18.5s
255:    learn: 0.4015221        total: 6.35s    remaining: 18.5s
256:    learn: 0.4012709        total: 6.38s    remaining: 18.4s
257:    learn: 0.4009317        total: 6.4s     remaining: 18.4s
258:    learn: 0.4005238        total: 6.42s    remaining: 18.4s
259:    learn: 0.4002590        total: 6.45s    remaining: 18.4s
260:    learn: 0.3999803        total: 6.47s    remaining: 18.3s
261:    learn: 0.3996590        total: 6.49s    remaining: 18.3s
262:    learn: 0.3993640        total: 6.52s    remaining: 18.3s
263:    learn: 0.3990171        total: 6.54s    remaining: 18.2s
264:    learn: 0.3987446        total: 6.57s    remaining: 18.2s
265:    learn: 0.3984735        total: 6.59s    remaining: 18.2s
266:    learn: 0.3981395        total: 6.61s    remaining: 18.2s
267:    learn: 0.3978129        total: 6.64s    remaining: 18.1s
268:    learn: 0.3975170        total: 6.66s    remaining: 18.1s
269:    learn: 0.3972996        total: 6.69s    remaining: 18.1s
270:    learn: 0.3969832        total: 6.72s    remaining: 18.1s
271:    learn: 0.3966956        total: 6.74s    remaining: 18s
272:    learn: 0.3963917        total: 6.76s    remaining: 18s
273:    learn: 0.3960955        total: 6.79s    remaining: 18s
274:    learn: 0.3958358        total: 6.81s    remaining: 18s
275:    learn: 0.3955636        total: 6.84s    remaining: 17.9s
276:    learn: 0.3952701        total: 6.87s    remaining: 17.9s
277:    learn: 0.3949952        total: 6.89s    remaining: 17.9s
278:    learn: 0.3947750        total: 6.92s    remaining: 17.9s
279:    learn: 0.3944712        total: 6.94s    remaining: 17.8s
```

```
280:    learn: 0.3941391        total: 6.96s    remaining: 17.8s
281:    learn: 0.3938527        total: 6.99s    remaining: 17.8s
282:    learn: 0.3935497        total: 7.01s    remaining: 17.8s
283:    learn: 0.3933083        total: 7.04s    remaining: 17.7s
284:    learn: 0.3930953        total: 7.07s    remaining: 17.7s
285:    learn: 0.3926768        total: 7.1s     remaining: 17.7s
286:    learn: 0.3922509        total: 7.12s    remaining: 17.7s
287:    learn: 0.3918705        total: 7.14s    remaining: 17.7s
288:    learn: 0.3915517        total: 7.17s    remaining: 17.6s
289:    learn: 0.3913158        total: 7.19s    remaining: 17.6s
290:    learn: 0.3909591        total: 7.21s    remaining: 17.6s
291:    learn: 0.3905925        total: 7.24s    remaining: 17.5s
292:    learn: 0.3902312        total: 7.26s    remaining: 17.5s
293:    learn: 0.3900290        total: 7.28s    remaining: 17.5s
294:    learn: 0.3896986        total: 7.31s    remaining: 17.5s
295:    learn: 0.3894541        total: 7.33s    remaining: 17.4s
296:    learn: 0.3891552        total: 7.36s    remaining: 17.4s
297:    learn: 0.3889555        total: 7.38s    remaining: 17.4s
298:    learn: 0.3886679        total: 7.4s     remaining: 17.4s
299:    learn: 0.3884022        total: 7.42s    remaining: 17.3s
300:    learn: 0.3881085        total: 7.45s    remaining: 17.3s
301:    learn: 0.3879172        total: 7.47s    remaining: 17.3s
302:    learn: 0.3876432        total: 7.5s     remaining: 17.2s
303:    learn: 0.3873051        total: 7.52s    remaining: 17.2s
304:    learn: 0.3869669        total: 7.55s    remaining: 17.2s
305:    learn: 0.3866028        total: 7.57s    remaining: 17.2s
306:    learn: 0.3861930        total: 7.61s    remaining: 17.2s
307:    learn: 0.3859469        total: 7.63s    remaining: 17.2s
308:    learn: 0.3857466        total: 7.66s    remaining: 17.1s
309:    learn: 0.3854275        total: 7.68s    remaining: 17.1s
310:    learn: 0.3852169        total: 7.71s    remaining: 17.1s
311:    learn: 0.3849612        total: 7.73s    remaining: 17.1s
312:    learn: 0.3846478        total: 7.77s    remaining: 17s
313:    learn: 0.3843826        total: 7.79s    remaining: 17s
314:    learn: 0.3840540        total: 7.82s    remaining: 17s
315:    learn: 0.3838326        total: 7.85s    remaining: 17s
316:    learn: 0.3835020        total: 7.87s    remaining: 17s
317:    learn: 0.3832658        total: 7.89s    remaining: 16.9s
318:    learn: 0.3830466        total: 7.92s    remaining: 16.9s
319:    learn: 0.3826513        total: 7.94s    remaining: 16.9s
320:    learn: 0.3822940        total: 7.97s    remaining: 16.9s
321:    learn: 0.3820007        total: 8s       remaining: 16.9s
322:    learn: 0.3816955        total: 8.03s    remaining: 16.8s
323:    learn: 0.3813144        total: 8.05s    remaining: 16.8s
324:    learn: 0.3810708        total: 8.08s    remaining: 16.8s
```

```
325:    learn: 0.3807885        total: 8.1s     remaining: 16.8s
326:    learn: 0.3805052        total: 8.13s    remaining: 16.7s
327:    learn: 0.3801850        total: 8.16s    remaining: 16.7s
328:    learn: 0.3798358        total: 8.19s    remaining: 16.7s
329:    learn: 0.3795914        total: 8.21s    remaining: 16.7s
330:    learn: 0.3792704        total: 8.24s    remaining: 16.6s
331:    learn: 0.3789292        total: 8.26s    remaining: 16.6s
332:    learn: 0.3786624        total: 8.29s    remaining: 16.6s
333:    learn: 0.3783415        total: 8.31s    remaining: 16.6s
334:    learn: 0.3780880        total: 8.34s    remaining: 16.5s
335:    learn: 0.3778491        total: 8.36s    remaining: 16.5s
336:    learn: 0.3775008        total: 8.38s    remaining: 16.5s
337:    learn: 0.3772001        total: 8.41s    remaining: 16.5s
338:    learn: 0.3769318        total: 8.43s    remaining: 16.4s
339:    learn: 0.3766235        total: 8.45s    remaining: 16.4s
340:    learn: 0.3763051        total: 8.48s    remaining: 16.4s
341:    learn: 0.3760574        total: 8.5s     remaining: 16.4s
342:    learn: 0.3757885        total: 8.52s    remaining: 16.3s
343:    learn: 0.3755310        total: 8.55s    remaining: 16.3s
344:    learn: 0.3752318        total: 8.57s    remaining: 16.3s
345:    learn: 0.3749659        total: 8.6s     remaining: 16.2s
346:    learn: 0.3746677        total: 8.62s    remaining: 16.2s
347:    learn: 0.3743473        total: 8.64s    remaining: 16.2s
348:    learn: 0.3739755        total: 8.67s    remaining: 16.2s
349:    learn: 0.3735684        total: 8.69s    remaining: 16.1s
350:    learn: 0.3733185        total: 8.72s    remaining: 16.1s
351:    learn: 0.3729819        total: 8.74s    remaining: 16.1s
352:    learn: 0.3726646        total: 8.76s    remaining: 16.1s
353:    learn: 0.3724506        total: 8.79s    remaining: 16s
354:    learn: 0.3721428        total: 8.81s    remaining: 16s
355:    learn: 0.3719297        total: 8.84s    remaining: 16s
356:    learn: 0.3715919        total: 8.86s    remaining: 16s
357:    learn: 0.3712084        total: 8.88s    remaining: 15.9s
358:    learn: 0.3709031        total: 8.91s    remaining: 15.9s
359:    learn: 0.3705615        total: 8.93s    remaining: 15.9s
360:    learn: 0.3701867        total: 8.96s    remaining: 15.9s
361:    learn: 0.3699223        total: 8.98s    remaining: 15.8s
362:    learn: 0.3696622        total: 9s       remaining: 15.8s
363:    learn: 0.3693142        total: 9.03s    remaining: 15.8s
364:    learn: 0.3689454        total: 9.06s    remaining: 15.8s
365:    learn: 0.3685796        total: 9.09s    remaining: 15.7s
366:    learn: 0.3683107        total: 9.11s    remaining: 15.7s
367:    learn: 0.3679892        total: 9.14s    remaining: 15.7s
368:    learn: 0.3676282        total: 9.16s    remaining: 15.7s
369:    learn: 0.3672077        total: 9.19s    remaining: 15.6s
```

```
370:    learn: 0.3669252        total: 9.21s    remaining: 15.6s
371:    learn: 0.3665386        total: 9.23s    remaining: 15.6s
372:    learn: 0.3661222        total: 9.26s    remaining: 15.6s
373:    learn: 0.3657533        total: 9.28s    remaining: 15.5s
374:    learn: 0.3653899        total: 9.3s     remaining: 15.5s
375:    learn: 0.3651458        total: 9.33s    remaining: 15.5s
376:    learn: 0.3647554        total: 9.36s    remaining: 15.5s
377:    learn: 0.3643416        total: 9.38s    remaining: 15.4s
378:    learn: 0.3639692        total: 9.41s    remaining: 15.4s
379:    learn: 0.3636412        total: 9.43s    remaining: 15.4s
380:    learn: 0.3633102        total: 9.46s    remaining: 15.4s
381:    learn: 0.3629575        total: 9.48s    remaining: 15.3s
382:    learn: 0.3626535        total: 9.51s    remaining: 15.3s
383:    learn: 0.3622418        total: 9.53s    remaining: 15.3s
384:    learn: 0.3620090        total: 9.56s    remaining: 15.3s
385:    learn: 0.3616722        total: 9.58s    remaining: 15.2s
386:    learn: 0.3613710        total: 9.61s    remaining: 15.2s
387:    learn: 0.3610245        total: 9.64s    remaining: 15.2s
388:    learn: 0.3606805        total: 9.66s    remaining: 15.2s
389:    learn: 0.3602760        total: 9.69s    remaining: 15.2s
390:    learn: 0.3600645        total: 9.72s    remaining: 15.1s
391:    learn: 0.3596383        total: 9.74s    remaining: 15.1s
392:    learn: 0.3593750        total: 9.77s    remaining: 15.1s
393:    learn: 0.3589804        total: 9.79s    remaining: 15.1s
394:    learn: 0.3586009        total: 9.82s    remaining: 15s
395:    learn: 0.3581987        total: 9.85s    remaining: 15s
396:    learn: 0.3579881        total: 9.87s    remaining: 15s
397:    learn: 0.3577169        total: 9.9s     remaining: 15s
398:    learn: 0.3574558        total: 9.92s    remaining: 14.9s
399:    learn: 0.3570349        total: 9.95s    remaining: 14.9s
400:    learn: 0.3567511        total: 9.97s    remaining: 14.9s
401:    learn: 0.3564206        total: 10s      remaining: 14.9s
402:    learn: 0.3560347        total: 10s      remaining: 14.8s
403:    learn: 0.3557431        total: 10s      remaining: 14.8s
404:    learn: 0.3553909        total: 10.1s    remaining: 14.8s
405:    learn: 0.3550726        total: 10.1s    remaining: 14.8s
406:    learn: 0.3547204        total: 10.1s    remaining: 14.7s
407:    learn: 0.3543675        total: 10.1s    remaining: 14.7s
408:    learn: 0.3539879        total: 10.2s    remaining: 14.7s
409:    learn: 0.3535784        total: 10.2s    remaining: 14.7s
410:    learn: 0.3532502        total: 10.2s    remaining: 14.6s
411:    learn: 0.3528322        total: 10.2s    remaining: 14.6s
412:    learn: 0.3525102        total: 10.3s    remaining: 14.6s
413:    learn: 0.3521568        total: 10.3s    remaining: 14.6s
414:    learn: 0.3518772        total: 10.3s    remaining: 14.5s
```

```
415:    learn: 0.3515233        total: 10.3s    remaining: 14.5s
416:    learn: 0.3511205        total: 10.4s    remaining: 14.5s
417:    learn: 0.3507285        total: 10.4s    remaining: 14.5s
418:    learn: 0.3504079        total: 10.4s    remaining: 14.4s
419:    learn: 0.3501345        total: 10.4s    remaining: 14.4s
420:    learn: 0.3496960        total: 10.5s    remaining: 14.4s
421:    learn: 0.3494180        total: 10.5s    remaining: 14.4s
422:    learn: 0.3491027        total: 10.5s    remaining: 14.3s
423:    learn: 0.3488004        total: 10.5s    remaining: 14.3s
424:    learn: 0.3485472        total: 10.5s    remaining: 14.3s
425:    learn: 0.3482548        total: 10.6s    remaining: 14.2s
426:    learn: 0.3477928        total: 10.6s    remaining: 14.2s
427:    learn: 0.3474964        total: 10.6s    remaining: 14.2s
428:    learn: 0.3471271        total: 10.6s    remaining: 14.1s
429:    learn: 0.3467728        total: 10.6s    remaining: 14.1s
430:    learn: 0.3464375        total: 10.7s    remaining: 14.1s
431:    learn: 0.3460474        total: 10.7s    remaining: 14s
432:    learn: 0.3457769        total: 10.7s    remaining: 14s
433:    learn: 0.3454016        total: 10.7s    remaining: 14s
434:    learn: 0.3451784        total: 10.8s    remaining: 14s
435:    learn: 0.3448733        total: 10.8s    remaining: 14s
436:    learn: 0.3445391        total: 10.8s    remaining: 13.9s
437:    learn: 0.3443525        total: 10.8s    remaining: 13.9s
438:    learn: 0.3439931        total: 10.9s    remaining: 13.9s
439:    learn: 0.3437128        total: 10.9s    remaining: 13.8s
440:    learn: 0.3433293        total: 10.9s    remaining: 13.8s
441:    learn: 0.3429841        total: 10.9s    remaining: 13.8s
442:    learn: 0.3426010        total: 10.9s    remaining: 13.8s
443:    learn: 0.3423285        total: 11s      remaining: 13.7s
444:    learn: 0.3420052        total: 11s      remaining: 13.7s
445:    learn: 0.3416476        total: 11s      remaining: 13.7s
446:    learn: 0.3413839        total: 11s      remaining: 13.6s
447:    learn: 0.3410691        total: 11s      remaining: 13.6s
448:    learn: 0.3407025        total: 11.1s    remaining: 13.6s
449:    learn: 0.3404501        total: 11.1s    remaining: 13.6s
450:    learn: 0.3401571        total: 11.1s    remaining: 13.5s
451:    learn: 0.3398452        total: 11.1s    remaining: 13.5s
452:    learn: 0.3394953        total: 11.2s    remaining: 13.5s
453:    learn: 0.3391380        total: 11.2s    remaining: 13.4s
454:    learn: 0.3387494        total: 11.2s    remaining: 13.4s
455:    learn: 0.3384183        total: 11.2s    remaining: 13.4s
456:    learn: 0.3381139        total: 11.2s    remaining: 13.3s
457:    learn: 0.3377789        total: 11.3s    remaining: 13.3s
458:    learn: 0.3374738        total: 11.3s    remaining: 13.3s
459:    learn: 0.3371492        total: 11.3s    remaining: 13.3s
```

```
460:    learn: 0.3368119        total: 11.3s    remaining: 13.2s
461:    learn: 0.3365052        total: 11.3s    remaining: 13.2s
462:    learn: 0.3361483        total: 11.4s    remaining: 13.2s
463:    learn: 0.3358371        total: 11.4s    remaining: 13.1s
464:    learn: 0.3354624        total: 11.4s    remaining: 13.1s
465:    learn: 0.3351739        total: 11.4s    remaining: 13.1s
466:    learn: 0.3348452        total: 11.4s    remaining: 13.1s
467:    learn: 0.3345110        total: 11.5s    remaining: 13s
468:    learn: 0.3341559        total: 11.5s    remaining: 13s
469:    learn: 0.3337631        total: 11.5s    remaining: 13s
470:    learn: 0.3334510        total: 11.5s    remaining: 12.9s
471:    learn: 0.3330968        total: 11.5s    remaining: 12.9s
472:    learn: 0.3328555        total: 11.6s    remaining: 12.9s
473:    learn: 0.3325153        total: 11.6s    remaining: 12.8s
474:    learn: 0.3322911        total: 11.6s    remaining: 12.8s
475:    learn: 0.3319568        total: 11.6s    remaining: 12.8s
476:    learn: 0.3316018        total: 11.6s    remaining: 12.8s
477:    learn: 0.3312667        total: 11.7s    remaining: 12.7s
478:    learn: 0.3308856        total: 11.7s    remaining: 12.7s
479:    learn: 0.3304883        total: 11.7s    remaining: 12.7s
480:    learn: 0.3301359        total: 11.7s    remaining: 12.6s
481:    learn: 0.3298450        total: 11.7s    remaining: 12.6s
482:    learn: 0.3296032        total: 11.8s    remaining: 12.6s
483:    learn: 0.3292660        total: 11.8s    remaining: 12.6s
484:    learn: 0.3289452        total: 11.8s    remaining: 12.5s
485:    learn: 0.3286647        total: 11.8s    remaining: 12.5s
486:    learn: 0.3283974        total: 11.8s    remaining: 12.5s
487:    learn: 0.3281387        total: 11.9s    remaining: 12.5s
488:    learn: 0.3278908        total: 11.9s    remaining: 12.4s
489:    learn: 0.3275831        total: 11.9s    remaining: 12.4s
490:    learn: 0.3272292        total: 11.9s    remaining: 12.4s
491:    learn: 0.3268556        total: 12s      remaining: 12.3s
492:    learn: 0.3265178        total: 12s      remaining: 12.3s
493:    learn: 0.3262736        total: 12s      remaining: 12.3s
494:    learn: 0.3260047        total: 12s      remaining: 12.3s
495:    learn: 0.3256574        total: 12s      remaining: 12.2s
496:    learn: 0.3253682        total: 12.1s    remaining: 12.2s
497:    learn: 0.3251589        total: 12.1s    remaining: 12.2s
498:    learn: 0.3248232        total: 12.1s    remaining: 12.1s
499:    learn: 0.3244789        total: 12.1s    remaining: 12.1s
500:    learn: 0.3241215        total: 12.1s    remaining: 12.1s
501:    learn: 0.3238572        total: 12.2s    remaining: 12.1s
502:    learn: 0.3236463        total: 12.2s    remaining: 12s
503:    learn: 0.3233394        total: 12.2s    remaining: 12s
504:    learn: 0.3230638        total: 12.2s    remaining: 12s
```

```
505:    learn: 0.3228240        total: 12.2s    remaining: 12s
506:    learn: 0.3225156        total: 12.3s    remaining: 11.9s
507:    learn: 0.3221496        total: 12.3s    remaining: 11.9s
508:    learn: 0.3218636        total: 12.3s    remaining: 11.9s
509:    learn: 0.3216057        total: 12.3s    remaining: 11.8s
510:    learn: 0.3212639        total: 12.4s    remaining: 11.8s
511:    learn: 0.3209836        total: 12.4s    remaining: 11.8s
512:    learn: 0.3207361        total: 12.4s    remaining: 11.8s
513:    learn: 0.3203812        total: 12.4s    remaining: 11.7s
514:    learn: 0.3201500        total: 12.4s    remaining: 11.7s
515:    learn: 0.3198306        total: 12.5s    remaining: 11.7s
516:    learn: 0.3195134        total: 12.5s    remaining: 11.7s
517:    learn: 0.3191902        total: 12.5s    remaining: 11.6s
518:    learn: 0.3189021        total: 12.5s    remaining: 11.6s
519:    learn: 0.3186248        total: 12.5s    remaining: 11.6s
520:    learn: 0.3183247        total: 12.6s    remaining: 11.5s
521:    learn: 0.3181579        total: 12.6s    remaining: 11.5s
522:    learn: 0.3179523        total: 12.6s    remaining: 11.5s
523:    learn: 0.3176549        total: 12.6s    remaining: 11.5s
524:    learn: 0.3174138        total: 12.6s    remaining: 11.4s
525:    learn: 0.3171163        total: 12.7s    remaining: 11.4s
526:    learn: 0.3168692        total: 12.7s    remaining: 11.4s
527:    learn: 0.3165367        total: 12.7s    remaining: 11.4s
528:    learn: 0.3162982        total: 12.7s    remaining: 11.3s
529:    learn: 0.3160539        total: 12.7s    remaining: 11.3s
530:    learn: 0.3157764        total: 12.8s    remaining: 11.3s
531:    learn: 0.3154283        total: 12.8s    remaining: 11.2s
532:    learn: 0.3151338        total: 12.8s    remaining: 11.2s
533:    learn: 0.3148904        total: 12.8s    remaining: 11.2s
534:    learn: 0.3146673        total: 12.8s    remaining: 11.2s
535:    learn: 0.3143871        total: 12.9s    remaining: 11.1s
536:    learn: 0.3141398        total: 12.9s    remaining: 11.1s
537:    learn: 0.3138333        total: 12.9s    remaining: 11.1s
538:    learn: 0.3135474        total: 12.9s    remaining: 11.1s
539:    learn: 0.3132025        total: 12.9s    remaining: 11s
540:    learn: 0.3128732        total: 13s      remaining: 11s
541:    learn: 0.3125862        total: 13s      remaining: 11s
542:    learn: 0.3123135        total: 13s      remaining: 10.9s
543:    learn: 0.3120036        total: 13s      remaining: 10.9s
544:    learn: 0.3118522        total: 13s      remaining: 10.9s
545:    learn: 0.3115415        total: 13.1s    remaining: 10.9s
546:    learn: 0.3111996        total: 13.1s    remaining: 10.8s
547:    learn: 0.3109233        total: 13.1s    remaining: 10.8s
548:    learn: 0.3107015        total: 13.1s    remaining: 10.8s
549:    learn: 0.3103866        total: 13.2s    remaining: 10.8s
```

```
550:    learn: 0.3101004        total: 13.2s    remaining: 10.7s
551:    learn: 0.3097908        total: 13.2s    remaining: 10.7s
552:    learn: 0.3095117        total: 13.2s    remaining: 10.7s
553:    learn: 0.3092721        total: 13.2s    remaining: 10.7s
554:    learn: 0.3089411        total: 13.3s    remaining: 10.6s
555:    learn: 0.3086722        total: 13.3s    remaining: 10.6s
556:    learn: 0.3083558        total: 13.3s    remaining: 10.6s
557:    learn: 0.3080796        total: 13.3s    remaining: 10.5s
558:    learn: 0.3078114        total: 13.3s    remaining: 10.5s
559:    learn: 0.3075025        total: 13.3s    remaining: 10.5s
560:    learn: 0.3072552        total: 13.4s    remaining: 10.5s
561:    learn: 0.3069610        total: 13.4s    remaining: 10.4s
562:    learn: 0.3066680        total: 13.4s    remaining: 10.4s
563:    learn: 0.3063559        total: 13.4s    remaining: 10.4s
564:    learn: 0.3060349        total: 13.5s    remaining: 10.4s
565:    learn: 0.3058298        total: 13.5s    remaining: 10.3s
566:    learn: 0.3055497        total: 13.5s    remaining: 10.3s
567:    learn: 0.3052383        total: 13.5s    remaining: 10.3s
568:    learn: 0.3049205        total: 13.5s    remaining: 10.2s
569:    learn: 0.3046344        total: 13.5s    remaining: 10.2s
570:    learn: 0.3043869        total: 13.6s    remaining: 10.2s
571:    learn: 0.3041289        total: 13.6s    remaining: 10.2s
572:    learn: 0.3038541        total: 13.6s    remaining: 10.1s
573:    learn: 0.3035375        total: 13.6s    remaining: 10.1s
574:    learn: 0.3033003        total: 13.7s    remaining: 10.1s
575:    learn: 0.3030163        total: 13.7s    remaining: 10.1s
576:    learn: 0.3027825        total: 13.7s    remaining: 10s
577:    learn: 0.3025161        total: 13.7s    remaining: 10s
578:    learn: 0.3022420        total: 13.7s    remaining: 9.98s
579:    learn: 0.3019580        total: 13.8s    remaining: 9.96s
580:    learn: 0.3017504        total: 13.8s    remaining: 9.93s
581:    learn: 0.3014088        total: 13.8s    remaining: 9.91s
582:    learn: 0.3011627        total: 13.8s    remaining: 9.88s
583:    learn: 0.3008898        total: 13.8s    remaining: 9.86s
584:    learn: 0.3006028        total: 13.9s    remaining: 9.83s
585:    learn: 0.3003450        total: 13.9s    remaining: 9.8s
586:    learn: 0.3000863        total: 13.9s    remaining: 9.78s
587:    learn: 0.2998698        total: 13.9s    remaining: 9.75s
588:    learn: 0.2995593        total: 13.9s    remaining: 9.72s
589:    learn: 0.2994049        total: 14s      remaining: 9.7s
590:    learn: 0.2991247        total: 14s      remaining: 9.67s
591:    learn: 0.2988134        total: 14s      remaining: 9.65s
592:    learn: 0.2985554        total: 14s      remaining: 9.62s
593:    learn: 0.2982650        total: 14s      remaining: 9.6s
594:    learn: 0.2979918        total: 14.1s    remaining: 9.57s
```

```
595:    learn: 0.2977116        total: 14.1s    remaining: 9.54s
596:    learn: 0.2974091        total: 14.1s    remaining: 9.52s
597:    learn: 0.2971609        total: 14.1s    remaining: 9.49s
598:    learn: 0.2968787        total: 14.1s    remaining: 9.47s
599:    learn: 0.2966394        total: 14.2s    remaining: 9.44s
600:    learn: 0.2963251        total: 14.2s    remaining: 9.42s
601:    learn: 0.2960731        total: 14.2s    remaining: 9.39s
602:    learn: 0.2957961        total: 14.2s    remaining: 9.37s
603:    learn: 0.2955168        total: 14.3s    remaining: 9.34s
604:    learn: 0.2952627        total: 14.3s    remaining: 9.32s
605:    learn: 0.2949542        total: 14.3s    remaining: 9.29s
606:    learn: 0.2947358        total: 14.3s    remaining: 9.27s
607:    learn: 0.2944242        total: 14.3s    remaining: 9.24s
608:    learn: 0.2941688        total: 14.4s    remaining: 9.22s
609:    learn: 0.2938502        total: 14.4s    remaining: 9.19s
610:    learn: 0.2935391        total: 14.4s    remaining: 9.17s
611:    learn: 0.2932696        total: 14.4s    remaining: 9.14s
612:    learn: 0.2929667        total: 14.4s    remaining: 9.12s
613:    learn: 0.2926638        total: 14.5s    remaining: 9.09s
614:    learn: 0.2924003        total: 14.5s    remaining: 9.07s
615:    learn: 0.2921334        total: 14.5s    remaining: 9.05s
616:    learn: 0.2918402        total: 14.5s    remaining: 9.03s
617:    learn: 0.2916013        total: 14.6s    remaining: 9s
618:    learn: 0.2913453        total: 14.6s    remaining: 8.98s
619:    learn: 0.2910697        total: 14.6s    remaining: 8.95s
620:    learn: 0.2907922        total: 14.6s    remaining: 8.93s
621:    learn: 0.2905046        total: 14.6s    remaining: 8.9s
622:    learn: 0.2902630        total: 14.7s    remaining: 8.88s
623:    learn: 0.2900473        total: 14.7s    remaining: 8.86s
624:    learn: 0.2897558        total: 14.7s    remaining: 8.83s
625:    learn: 0.2895265        total: 14.7s    remaining: 8.81s
626:    learn: 0.2892882        total: 14.8s    remaining: 8.78s
627:    learn: 0.2890438        total: 14.8s    remaining: 8.76s
628:    learn: 0.2888111        total: 14.8s    remaining: 8.73s
629:    learn: 0.2885139        total: 14.8s    remaining: 8.71s
630:    learn: 0.2883127        total: 14.8s    remaining: 8.68s
631:    learn: 0.2880101        total: 14.9s    remaining: 8.66s
632:    learn: 0.2878301        total: 14.9s    remaining: 8.63s
633:    learn: 0.2875856        total: 14.9s    remaining: 8.61s
634:    learn: 0.2873608        total: 14.9s    remaining: 8.58s
635:    learn: 0.2871314        total: 15s      remaining: 8.56s
636:    learn: 0.2868380        total: 15s      remaining: 8.53s
637:    learn: 0.2865661        total: 15s      remaining: 8.51s
638:    learn: 0.2863471        total: 15s      remaining: 8.49s
639:    learn: 0.2860670        total: 15s      remaining: 8.46s
```

```
640:    learn: 0.2857708        total: 15.1s    remaining: 8.44s
641:    learn: 0.2855404        total: 15.1s    remaining: 8.41s
642:    learn: 0.2852816        total: 15.1s    remaining: 8.38s
643:    learn: 0.2850308        total: 15.1s    remaining: 8.36s
644:    learn: 0.2848330        total: 15.1s    remaining: 8.34s
645:    learn: 0.2845422        total: 15.2s    remaining: 8.31s
646:    learn: 0.2842949        total: 15.2s    remaining: 8.29s
647:    learn: 0.2841019        total: 15.2s    remaining: 8.26s
648:    learn: 0.2838260        total: 15.2s    remaining: 8.23s
649:    learn: 0.2836277        total: 15.2s    remaining: 8.21s
650:    learn: 0.2833306        total: 15.3s    remaining: 8.18s
651:    learn: 0.2830662        total: 15.3s    remaining: 8.16s
652:    learn: 0.2827754        total: 15.3s    remaining: 8.13s
653:    learn: 0.2825994        total: 15.3s    remaining: 8.11s
654:    learn: 0.2823164        total: 15.3s    remaining: 8.08s
655:    learn: 0.2820348        total: 15.4s    remaining: 8.06s
656:    learn: 0.2817743        total: 15.4s    remaining: 8.03s
657:    learn: 0.2815430        total: 15.4s    remaining: 8.01s
658:    learn: 0.2813135        total: 15.4s    remaining: 7.99s
659:    learn: 0.2810673        total: 15.5s    remaining: 7.96s
660:    learn: 0.2808229        total: 15.5s    remaining: 7.94s
661:    learn: 0.2805561        total: 15.5s    remaining: 7.92s
662:    learn: 0.2802854        total: 15.5s    remaining: 7.89s
663:    learn: 0.2800391        total: 15.6s    remaining: 7.87s
664:    learn: 0.2797672        total: 15.6s    remaining: 7.84s
665:    learn: 0.2795485        total: 15.6s    remaining: 7.82s
666:    learn: 0.2792807        total: 15.6s    remaining: 7.79s
667:    learn: 0.2790675        total: 15.6s    remaining: 7.77s
668:    learn: 0.2788214        total: 15.7s    remaining: 7.75s
669:    learn: 0.2785918        total: 15.7s    remaining: 7.72s
670:    learn: 0.2783458        total: 15.7s    remaining: 7.7s
671:    learn: 0.2781019        total: 15.7s    remaining: 7.67s
672:    learn: 0.2778411        total: 15.7s    remaining: 7.65s
673:    learn: 0.2776126        total: 15.8s    remaining: 7.62s
674:    learn: 0.2774044        total: 15.8s    remaining: 7.6s
675:    learn: 0.2772166        total: 15.8s    remaining: 7.57s
676:    learn: 0.2769719        total: 15.8s    remaining: 7.55s
677:    learn: 0.2767144        total: 15.8s    remaining: 7.52s
678:    learn: 0.2765192        total: 15.9s    remaining: 7.5s
679:    learn: 0.2762703        total: 15.9s    remaining: 7.47s
680:    learn: 0.2760731        total: 15.9s    remaining: 7.45s
681:    learn: 0.2758982        total: 15.9s    remaining: 7.42s
682:    learn: 0.2755916        total: 15.9s    remaining: 7.4s
683:    learn: 0.2753153        total: 16s      remaining: 7.37s
684:    learn: 0.2750675        total: 16s      remaining: 7.35s
```

```
685:    learn: 0.2748511        total: 16s      remaining: 7.32s
686:    learn: 0.2746440        total: 16s      remaining: 7.3s
687:    learn: 0.2743897        total: 16s      remaining: 7.27s
688:    learn: 0.2741806        total: 16.1s    remaining: 7.25s
689:    learn: 0.2739750        total: 16.1s    remaining: 7.22s
690:    learn: 0.2737536        total: 16.1s    remaining: 7.2s
691:    learn: 0.2734944        total: 16.1s    remaining: 7.17s
692:    learn: 0.2731891        total: 16.1s    remaining: 7.15s
693:    learn: 0.2728958        total: 16.2s    remaining: 7.13s
694:    learn: 0.2726559        total: 16.2s    remaining: 7.1s
695:    learn: 0.2723908        total: 16.2s    remaining: 7.08s
696:    learn: 0.2721487        total: 16.2s    remaining: 7.05s
697:    learn: 0.2719327        total: 16.2s    remaining: 7.03s
698:    learn: 0.2717062        total: 16.3s    remaining: 7s
699:    learn: 0.2714449        total: 16.3s    remaining: 6.98s
700:    learn: 0.2711560        total: 16.3s    remaining: 6.95s
701:    learn: 0.2710096        total: 16.3s    remaining: 6.93s
702:    learn: 0.2708179        total: 16.3s    remaining: 6.9s
703:    learn: 0.2705602        total: 16.4s    remaining: 6.88s
704:    learn: 0.2702840        total: 16.4s    remaining: 6.86s
705:    learn: 0.2700598        total: 16.4s    remaining: 6.83s
706:    learn: 0.2698078        total: 16.4s    remaining: 6.81s
707:    learn: 0.2696038        total: 16.4s    remaining: 6.78s
708:    learn: 0.2693383        total: 16.5s    remaining: 6.76s
709:    learn: 0.2690827        total: 16.5s    remaining: 6.73s
710:    learn: 0.2688354        total: 16.5s    remaining: 6.71s
711:    learn: 0.2686220        total: 16.5s    remaining: 6.68s
712:    learn: 0.2683860        total: 16.5s    remaining: 6.66s
713:    learn: 0.2681545        total: 16.6s    remaining: 6.63s
714:    learn: 0.2679118        total: 16.6s    remaining: 6.61s
715:    learn: 0.2676745        total: 16.6s    remaining: 6.58s
716:    learn: 0.2674168        total: 16.6s    remaining: 6.56s
717:    learn: 0.2671341        total: 16.6s    remaining: 6.54s
718:    learn: 0.2669177        total: 16.7s    remaining: 6.51s
719:    learn: 0.2667163        total: 16.7s    remaining: 6.49s
720:    learn: 0.2664333        total: 16.7s    remaining: 6.46s
721:    learn: 0.2661952        total: 16.7s    remaining: 6.44s
722:    learn: 0.2659938        total: 16.7s    remaining: 6.41s
723:    learn: 0.2657546        total: 16.8s    remaining: 6.39s
724:    learn: 0.2654868        total: 16.8s    remaining: 6.37s
725:    learn: 0.2652416        total: 16.8s    remaining: 6.34s
726:    learn: 0.2650166        total: 16.8s    remaining: 6.32s
727:    learn: 0.2648391        total: 16.8s    remaining: 6.29s
728:    learn: 0.2645912        total: 16.9s    remaining: 6.27s
729:    learn: 0.2643630        total: 16.9s    remaining: 6.25s
```

```
730:    learn: 0.2641160        total: 16.9s    remaining: 6.22s
731:    learn: 0.2639058        total: 16.9s    remaining: 6.2s
732:    learn: 0.2637402        total: 16.9s    remaining: 6.17s
733:    learn: 0.2635178        total: 17s      remaining: 6.15s
734:    learn: 0.2633001        total: 17s      remaining: 6.12s
735:    learn: 0.2630573        total: 17s      remaining: 6.1s
736:    learn: 0.2628000        total: 17s      remaining: 6.08s
737:    learn: 0.2625627        total: 17s      remaining: 6.05s
738:    learn: 0.2622948        total: 17.1s    remaining: 6.03s
739:    learn: 0.2620484        total: 17.1s    remaining: 6s
740:    learn: 0.2618296        total: 17.1s    remaining: 5.98s
741:    learn: 0.2616764        total: 17.1s    remaining: 5.96s
742:    learn: 0.2614264        total: 17.2s    remaining: 5.93s
743:    learn: 0.2612683        total: 17.2s    remaining: 5.91s
744:    learn: 0.2611211        total: 17.2s    remaining: 5.89s
745:    learn: 0.2609338        total: 17.2s    remaining: 5.86s
746:    learn: 0.2606617        total: 17.2s    remaining: 5.84s
747:    learn: 0.2604520        total: 17.3s    remaining: 5.81s
748:    learn: 0.2602867        total: 17.3s    remaining: 5.79s
749:    learn: 0.2600368        total: 17.3s    remaining: 5.77s
750:    learn: 0.2598549        total: 17.3s    remaining: 5.75s
751:    learn: 0.2595985        total: 17.4s    remaining: 5.72s
752:    learn: 0.2593542        total: 17.4s    remaining: 5.7s
753:    learn: 0.2591517        total: 17.4s    remaining: 5.67s
754:    learn: 0.2588957        total: 17.4s    remaining: 5.65s
755:    learn: 0.2586443        total: 17.4s    remaining: 5.63s
756:    learn: 0.2583968        total: 17.5s    remaining: 5.61s
757:    learn: 0.2581668        total: 17.5s    remaining: 5.58s
758:    learn: 0.2579359        total: 17.5s    remaining: 5.56s
759:    learn: 0.2576791        total: 17.5s    remaining: 5.54s
760:    learn: 0.2575303        total: 17.5s    remaining: 5.51s
761:    learn: 0.2573394        total: 17.6s    remaining: 5.49s
762:    learn: 0.2571374        total: 17.6s    remaining: 5.46s
763:    learn: 0.2569337        total: 17.6s    remaining: 5.44s
764:    learn: 0.2567048        total: 17.6s    remaining: 5.42s
765:    learn: 0.2564491        total: 17.6s    remaining: 5.39s
766:    learn: 0.2561815        total: 17.7s    remaining: 5.37s
767:    learn: 0.2559361        total: 17.7s    remaining: 5.34s
768:    learn: 0.2557290        total: 17.7s    remaining: 5.32s
769:    learn: 0.2555017        total: 17.7s    remaining: 5.3s
770:    learn: 0.2553283        total: 17.8s    remaining: 5.27s
771:    learn: 0.2550754        total: 17.8s    remaining: 5.25s
772:    learn: 0.2548905        total: 17.8s    remaining: 5.23s
773:    learn: 0.2547376        total: 17.8s    remaining: 5.2s
774:    learn: 0.2545360        total: 17.8s    remaining: 5.18s
```

```
775:    learn: 0.2543328        total: 17.9s    remaining: 5.16s
776:    learn: 0.2541190        total: 17.9s    remaining: 5.13s
777:    learn: 0.2538651        total: 17.9s    remaining: 5.11s
778:    learn: 0.2536735        total: 17.9s    remaining: 5.08s
779:    learn: 0.2534416        total: 17.9s    remaining: 5.06s
780:    learn: 0.2532231        total: 18s      remaining: 5.04s
781:    learn: 0.2529749        total: 18s      remaining: 5.01s
782:    learn: 0.2527256        total: 18s      remaining: 4.99s
783:    learn: 0.2525036        total: 18s      remaining: 4.97s
784:    learn: 0.2523085        total: 18s      remaining: 4.94s
785:    learn: 0.2521410        total: 18.1s    remaining: 4.92s
786:    learn: 0.2519057        total: 18.1s    remaining: 4.9s
787:    learn: 0.2516931        total: 18.1s    remaining: 4.87s
788:    learn: 0.2514939        total: 18.1s    remaining: 4.85s
789:    learn: 0.2512141        total: 18.2s    remaining: 4.83s
790:    learn: 0.2509643        total: 18.2s    remaining: 4.8s
791:    learn: 0.2507708        total: 18.2s    remaining: 4.78s
792:    learn: 0.2505456        total: 18.2s    remaining: 4.76s
793:    learn: 0.2503686        total: 18.2s    remaining: 4.73s
794:    learn: 0.2501745        total: 18.3s    remaining: 4.71s
795:    learn: 0.2499674        total: 18.3s    remaining: 4.68s
796:    learn: 0.2498039        total: 18.3s    remaining: 4.66s
797:    learn: 0.2495634        total: 18.3s    remaining: 4.64s
798:    learn: 0.2493800        total: 18.3s    remaining: 4.61s
799:    learn: 0.2492189        total: 18.4s    remaining: 4.59s
800:    learn: 0.2489808        total: 18.4s    remaining: 4.57s
801:    learn: 0.2487136        total: 18.4s    remaining: 4.54s
802:    learn: 0.2485384        total: 18.4s    remaining: 4.52s
803:    learn: 0.2483908        total: 18.4s    remaining: 4.5s
804:    learn: 0.2481951        total: 18.5s    remaining: 4.47s
805:    learn: 0.2480217        total: 18.5s    remaining: 4.45s
806:    learn: 0.2477990        total: 18.5s    remaining: 4.43s
807:    learn: 0.2475797        total: 18.5s    remaining: 4.4s
808:    learn: 0.2473465        total: 18.5s    remaining: 4.38s
809:    learn: 0.2471281        total: 18.6s    remaining: 4.36s
810:    learn: 0.2469043        total: 18.6s    remaining: 4.33s
811:    learn: 0.2466499        total: 18.6s    remaining: 4.31s
812:    learn: 0.2464286        total: 18.6s    remaining: 4.29s
813:    learn: 0.2462529        total: 18.7s    remaining: 4.26s
814:    learn: 0.2460333        total: 18.7s    remaining: 4.24s
815:    learn: 0.2457867        total: 18.7s    remaining: 4.22s
816:    learn: 0.2455640        total: 18.7s    remaining: 4.19s
817:    learn: 0.2453083        total: 18.7s    remaining: 4.17s
818:    learn: 0.2450688        total: 18.8s    remaining: 4.14s
819:    learn: 0.2448571        total: 18.8s    remaining: 4.12s
```

```
820:    learn: 0.2446638        total: 18.8s    remaining: 4.1s
821:    learn: 0.2444031        total: 18.8s    remaining: 4.08s
822:    learn: 0.2441508        total: 18.8s    remaining: 4.05s
823:    learn: 0.2440270        total: 18.9s    remaining: 4.03s
824:    learn: 0.2439071        total: 18.9s    remaining: 4s
825:    learn: 0.2436719        total: 18.9s    remaining: 3.98s
826:    learn: 0.2434943        total: 18.9s    remaining: 3.96s
827:    learn: 0.2433046        total: 18.9s    remaining: 3.94s
828:    learn: 0.2430989        total: 19s      remaining: 3.91s
829:    learn: 0.2429409        total: 19s      remaining: 3.89s
830:    learn: 0.2427701        total: 19s      remaining: 3.87s
831:    learn: 0.2425214        total: 19s      remaining: 3.84s
832:    learn: 0.2423225        total: 19.1s    remaining: 3.82s
833:    learn: 0.2421169        total: 19.1s    remaining: 3.8s
834:    learn: 0.2419471        total: 19.1s    remaining: 3.77s
835:    learn: 0.2417322        total: 19.1s    remaining: 3.75s
836:    learn: 0.2415674        total: 19.1s    remaining: 3.73s
837:    learn: 0.2413569        total: 19.2s    remaining: 3.7s
838:    learn: 0.2411416        total: 19.2s    remaining: 3.68s
839:    learn: 0.2409223        total: 19.2s    remaining: 3.66s
840:    learn: 0.2407814        total: 19.2s    remaining: 3.63s
841:    learn: 0.2406401        total: 19.2s    remaining: 3.61s
842:    learn: 0.2404336        total: 19.3s    remaining: 3.59s
843:    learn: 0.2402316        total: 19.3s    remaining: 3.56s
844:    learn: 0.2400250        total: 19.3s    remaining: 3.54s
845:    learn: 0.2398261        total: 19.3s    remaining: 3.52s
846:    learn: 0.2396375        total: 19.3s    remaining: 3.49s
847:    learn: 0.2394716        total: 19.4s    remaining: 3.47s
848:    learn: 0.2392328        total: 19.4s    remaining: 3.45s
849:    learn: 0.2390673        total: 19.4s    remaining: 3.42s
850:    learn: 0.2388833        total: 19.4s    remaining: 3.4s
851:    learn: 0.2387119        total: 19.4s    remaining: 3.38s
852:    learn: 0.2384795        total: 19.5s    remaining: 3.35s
853:    learn: 0.2382540        total: 19.5s    remaining: 3.33s
854:    learn: 0.2380906        total: 19.5s    remaining: 3.31s
855:    learn: 0.2378590        total: 19.5s    remaining: 3.28s
856:    learn: 0.2376515        total: 19.5s    remaining: 3.26s
857:    learn: 0.2374885        total: 19.6s    remaining: 3.24s
858:    learn: 0.2372860        total: 19.6s    remaining: 3.22s
859:    learn: 0.2370577        total: 19.6s    remaining: 3.19s
860:    learn: 0.2368314        total: 19.6s    remaining: 3.17s
861:    learn: 0.2366631        total: 19.7s    remaining: 3.15s
862:    learn: 0.2364689        total: 19.7s    remaining: 3.12s
863:    learn: 0.2362588        total: 19.7s    remaining: 3.1s
864:    learn: 0.2360211        total: 19.7s    remaining: 3.08s
```

```
865:    learn: 0.2358792        total: 19.7s    remaining: 3.05s
866:    learn: 0.2356505        total: 19.8s    remaining: 3.03s
867:    learn: 0.2354659        total: 19.8s    remaining: 3.01s
868:    learn: 0.2352415        total: 19.8s    remaining: 2.98s
869:    learn: 0.2350413        total: 19.8s    remaining: 2.96s
870:    learn: 0.2348227        total: 19.8s    remaining: 2.94s
871:    learn: 0.2346122        total: 19.9s    remaining: 2.92s
872:    learn: 0.2344487        total: 19.9s    remaining: 2.89s
873:    learn: 0.2342131        total: 19.9s    remaining: 2.87s
874:    learn: 0.2339764        total: 19.9s    remaining: 2.85s
875:    learn: 0.2337412        total: 19.9s    remaining: 2.82s
876:    learn: 0.2335349        total: 20s      remaining: 2.8s
877:    learn: 0.2333584        total: 20s      remaining: 2.78s
878:    learn: 0.2331934        total: 20s      remaining: 2.75s
879:    learn: 0.2330128        total: 20s      remaining: 2.73s
880:    learn: 0.2327812        total: 20s      remaining: 2.71s
881:    learn: 0.2325985        total: 20.1s    remaining: 2.68s
882:    learn: 0.2324253        total: 20.1s    remaining: 2.66s
883:    learn: 0.2322135        total: 20.1s    remaining: 2.64s
884:    learn: 0.2320185        total: 20.1s    remaining: 2.61s
885:    learn: 0.2318525        total: 20.1s    remaining: 2.59s
886:    learn: 0.2316226        total: 20.2s    remaining: 2.57s
887:    learn: 0.2314097        total: 20.2s    remaining: 2.54s
888:    learn: 0.2312550        total: 20.2s    remaining: 2.52s
889:    learn: 0.2310341        total: 20.2s    remaining: 2.5s
890:    learn: 0.2308222        total: 20.2s    remaining: 2.48s
891:    learn: 0.2306362        total: 20.3s    remaining: 2.45s
892:    learn: 0.2304704        total: 20.3s    remaining: 2.43s
893:    learn: 0.2302500        total: 20.3s    remaining: 2.41s
894:    learn: 0.2300601        total: 20.3s    remaining: 2.38s
895:    learn: 0.2298495        total: 20.3s    remaining: 2.36s
896:    learn: 0.2296172        total: 20.4s    remaining: 2.34s
897:    learn: 0.2294476        total: 20.4s    remaining: 2.31s
898:    learn: 0.2292483        total: 20.4s    remaining: 2.29s
899:    learn: 0.2290280        total: 20.4s    remaining: 2.27s
900:    learn: 0.2288323        total: 20.4s    remaining: 2.25s
901:    learn: 0.2286321        total: 20.5s    remaining: 2.22s
902:    learn: 0.2284233        total: 20.5s    remaining: 2.2s
903:    learn: 0.2282402        total: 20.5s    remaining: 2.18s
904:    learn: 0.2280085        total: 20.5s    remaining: 2.15s
905:    learn: 0.2278090        total: 20.5s    remaining: 2.13s
906:    learn: 0.2275793        total: 20.6s    remaining: 2.11s
907:    learn: 0.2273498        total: 20.6s    remaining: 2.08s
908:    learn: 0.2272015        total: 20.6s    remaining: 2.06s
909:    learn: 0.2269675        total: 20.6s    remaining: 2.04s
```

```
910:    learn: 0.2267678        total: 20.6s    remaining: 2.02s
911:    learn: 0.2266075        total: 20.7s    remaining: 1.99s
912:    learn: 0.2264288        total: 20.7s    remaining: 1.97s
913:    learn: 0.2262353        total: 20.7s    remaining: 1.95s
914:    learn: 0.2260408        total: 20.7s    remaining: 1.93s
915:    learn: 0.2259117        total: 20.7s    remaining: 1.9s
916:    learn: 0.2257076        total: 20.8s    remaining: 1.88s
917:    learn: 0.2254841        total: 20.8s    remaining: 1.86s
918:    learn: 0.2253074        total: 20.8s    remaining: 1.83s
919:    learn: 0.2251219        total: 20.8s    remaining: 1.81s
920:    learn: 0.2249300        total: 20.8s    remaining: 1.79s
921:    learn: 0.2247321        total: 20.9s    remaining: 1.76s
922:    learn: 0.2245418        total: 20.9s    remaining: 1.74s
923:    learn: 0.2243614        total: 20.9s    remaining: 1.72s
924:    learn: 0.2241468        total: 20.9s    remaining: 1.7s
925:    learn: 0.2239728        total: 21s      remaining: 1.67s
926:    learn: 0.2237691        total: 21s      remaining: 1.65s
927:    learn: 0.2235971        total: 21s      remaining: 1.63s
928:    learn: 0.2234744        total: 21s      remaining: 1.61s
929:    learn: 0.2232856        total: 21s      remaining: 1.58s
930:    learn: 0.2230869        total: 21.1s    remaining: 1.56s
931:    learn: 0.2229012        total: 21.1s    remaining: 1.54s
932:    learn: 0.2226765        total: 21.1s    remaining: 1.52s
933:    learn: 0.2224677        total: 21.2s    remaining: 1.5s
934:    learn: 0.2222692        total: 21.2s    remaining: 1.47s
935:    learn: 0.2220624        total: 21.2s    remaining: 1.45s
936:    learn: 0.2218640        total: 21.2s    remaining: 1.43s
937:    learn: 0.2216794        total: 21.3s    remaining: 1.4s
938:    learn: 0.2215193        total: 21.3s    remaining: 1.38s
939:    learn: 0.2213179        total: 21.3s    remaining: 1.36s
940:    learn: 0.2211117        total: 21.3s    remaining: 1.34s
941:    learn: 0.2208927        total: 21.3s    remaining: 1.31s
942:    learn: 0.2206843        total: 21.4s    remaining: 1.29s
943:    learn: 0.2204921        total: 21.4s    remaining: 1.27s
944:    learn: 0.2203032        total: 21.4s    remaining: 1.25s
945:    learn: 0.2200917        total: 21.4s    remaining: 1.22s
946:    learn: 0.2198992        total: 21.4s    remaining: 1.2s
947:    learn: 0.2197683        total: 21.5s    remaining: 1.18s
948:    learn: 0.2195693        total: 21.5s    remaining: 1.15s
949:    learn: 0.2193891        total: 21.5s    remaining: 1.13s
950:    learn: 0.2192084        total: 21.5s    remaining: 1.11s
951:    learn: 0.2190495        total: 21.6s    remaining: 1.09s
952:    learn: 0.2188927        total: 21.6s    remaining: 1.06s
953:    learn: 0.2187058        total: 21.6s    remaining: 1.04s
954:    learn: 0.2185103        total: 21.6s    remaining: 1.02s
```

```
955:    learn: 0.2183792        total: 21.6s    remaining: 996ms
956:    learn: 0.2182485        total: 21.7s    remaining: 973ms
957:    learn: 0.2180558        total: 21.7s    remaining: 950ms
958:    learn: 0.2179170        total: 21.7s    remaining: 928ms
959:    learn: 0.2177338        total: 21.7s    remaining: 905ms
960:    learn: 0.2175341        total: 21.7s    remaining: 882ms
961:    learn: 0.2173705        total: 21.8s    remaining: 860ms
962:    learn: 0.2171936        total: 21.8s    remaining: 837ms
963:    learn: 0.2170104        total: 21.8s    remaining: 814ms
964:    learn: 0.2168024        total: 21.8s    remaining: 792ms
965:    learn: 0.2166148        total: 21.8s    remaining: 769ms
966:    learn: 0.2164101        total: 21.9s    remaining: 746ms
967:    learn: 0.2162472        total: 21.9s    remaining: 724ms
968:    learn: 0.2160426        total: 21.9s    remaining: 701ms
969:    learn: 0.2158549        total: 21.9s    remaining: 678ms
970:    learn: 0.2156752        total: 21.9s    remaining: 656ms
971:    learn: 0.2154945        total: 22s      remaining: 633ms
972:    learn: 0.2153705        total: 22s      remaining: 610ms
973:    learn: 0.2152060        total: 22s      remaining: 588ms
974:    learn: 0.2150156        total: 22s      remaining: 565ms
975:    learn: 0.2148433        total: 22.1s    remaining: 542ms
976:    learn: 0.2146661        total: 22.1s    remaining: 520ms
977:    learn: 0.2145291        total: 22.1s    remaining: 497ms
978:    learn: 0.2143566        total: 22.1s    remaining: 475ms
979:    learn: 0.2141695        total: 22.1s    remaining: 452ms
980:    learn: 0.2139749        total: 22.2s    remaining: 429ms
981:    learn: 0.2137989        total: 22.2s    remaining: 407ms
982:    learn: 0.2135971        total: 22.2s    remaining: 384ms
983:    learn: 0.2134233        total: 22.2s    remaining: 361ms
984:    learn: 0.2132327        total: 22.2s    remaining: 339ms
985:    learn: 0.2130343        total: 22.3s    remaining: 316ms
986:    learn: 0.2128935        total: 22.3s    remaining: 294ms
987:    learn: 0.2127495        total: 22.3s    remaining: 271ms
988:    learn: 0.2126035        total: 22.3s    remaining: 248ms
989:    learn: 0.2123793        total: 22.4s    remaining: 226ms
990:    learn: 0.2122289        total: 22.4s    remaining: 203ms
991:    learn: 0.2120561        total: 22.4s    remaining: 181ms
992:    learn: 0.2119515        total: 22.4s    remaining: 158ms
993:    learn: 0.2117351        total: 22.4s    remaining: 135ms
994:    learn: 0.2115516        total: 22.5s    remaining: 113ms
995:    learn: 0.2113906        total: 22.5s    remaining: 90.3ms
996:    learn: 0.2112000        total: 22.5s    remaining: 67.7ms
997:    learn: 0.2111009        total: 22.5s    remaining: 45.1ms
998:    learn: 0.2109106        total: 22.5s    remaining: 22.6ms
999:    learn: 0.2107878        total: 22.6s    remaining: 0us
```

In [87]:
```
evaluate(y_agency_labeled_test, y_pred_cb_agency)
```

```
Confusion Matrix:
[[ 2098  2801]
 [ 1175 10591]]
Accuracy:  0.7614161416141614
Precision:  0.7908452807646356
Recall  0.9001359850416454
F1:  0.8419588202559822
```

In [88]:
```
cb_model_social = CatBoostClassifier()
cb_model_social.fit(train_vectors, y_social_labeled_train)
y_pred_cb_social = cb_model_social.predict(test_vectors)
```

```
Learning rate set to 0.028098
0:      learn: 0.6809370        total: 21.9ms   remaining: 21.9s
1:      learn: 0.6691491        total: 42.4ms   remaining: 21.2s
2:      learn: 0.6581171        total: 64.1ms   remaining: 21.3s
3:      learn: 0.6477904        total: 85.3ms   remaining: 21.3s
4:      learn: 0.6379094        total: 106ms    remaining: 21.1s
5:      learn: 0.6290149        total: 129ms    remaining: 21.3s
6:      learn: 0.6197538        total: 150ms    remaining: 21.3s
7:      learn: 0.6108653        total: 171ms    remaining: 21.2s
8:      learn: 0.6024124        total: 193ms    remaining: 21.2s
9:      learn: 0.5944800        total: 214ms    remaining: 21.2s
10:     learn: 0.5869220        total: 241ms    remaining: 21.7s
11:     learn: 0.5796954        total: 269ms    remaining: 22.2s
12:     learn: 0.5716302        total: 290ms    remaining: 22s
13:     learn: 0.5643178        total: 311ms    remaining: 21.9s
14:     learn: 0.5571106        total: 330ms    remaining: 21.7s
15:     learn: 0.5494138        total: 351ms    remaining: 21.6s
16:     learn: 0.5440624        total: 371ms    remaining: 21.5s
17:     learn: 0.5381954        total: 392ms    remaining: 21.4s
18:     learn: 0.5318027        total: 412ms    remaining: 21.3s
19:     learn: 0.5261565        total: 433ms    remaining: 21.2s
20:     learn: 0.5211758        total: 452ms    remaining: 21.1s
21:     learn: 0.5160492        total: 474ms    remaining: 21.1s
22:     learn: 0.5110169        total: 495ms    remaining: 21s
23:     learn: 0.5062515        total: 517ms    remaining: 21s
24:     learn: 0.5009292        total: 538ms    remaining: 21s
25:     learn: 0.4963968        total: 560ms    remaining: 21s
26:     learn: 0.4922242        total: 584ms    remaining: 21.1s
27:     learn: 0.4878871        total: 606ms    remaining: 21.1s
```

```
28:     learn: 0.4838972        total: 627ms    remaining: 21s
29:     learn: 0.4800325        total: 648ms    remaining: 20.9s
30:     learn: 0.4759210        total: 669ms    remaining: 20.9s
31:     learn: 0.4726957        total: 691ms    remaining: 20.9s
32:     learn: 0.4691035        total: 711ms    remaining: 20.8s
33:     learn: 0.4650736        total: 732ms    remaining: 20.8s
34:     learn: 0.4621920        total: 754ms    remaining: 20.8s
35:     learn: 0.4588452        total: 775ms    remaining: 20.8s
36:     learn: 0.4552965        total: 797ms    remaining: 20.7s
37:     learn: 0.4518041        total: 818ms    remaining: 20.7s
38:     learn: 0.4489027        total: 840ms    remaining: 20.7s
39:     learn: 0.4461273        total: 861ms    remaining: 20.7s
40:     learn: 0.4430055        total: 882ms    remaining: 20.6s
41:     learn: 0.4400883        total: 903ms    remaining: 20.6s
42:     learn: 0.4370741        total: 924ms    remaining: 20.6s
43:     learn: 0.4342160        total: 944ms    remaining: 20.5s
44:     learn: 0.4315786        total: 964ms    remaining: 20.5s
45:     learn: 0.4287493        total: 984ms    remaining: 20.4s
46:     learn: 0.4263953        total: 1s       remaining: 20.4s
47:     learn: 0.4238608        total: 1.02s    remaining: 20.3s
48:     learn: 0.4214906        total: 1.04s    remaining: 20.3s
49:     learn: 0.4191856        total: 1.07s    remaining: 20.3s
50:     learn: 0.4165821        total: 1.09s    remaining: 20.2s
51:     learn: 0.4142581        total: 1.11s    remaining: 20.2s
52:     learn: 0.4117726        total: 1.13s    remaining: 20.1s
53:     learn: 0.4094455        total: 1.15s    remaining: 20.1s
54:     learn: 0.4074167        total: 1.17s    remaining: 20.1s
55:     learn: 0.4054569        total: 1.19s    remaining: 20.1s
56:     learn: 0.4035235        total: 1.21s    remaining: 20s
57:     learn: 0.4018918        total: 1.23s    remaining: 20s
58:     learn: 0.4001278        total: 1.25s    remaining: 20s
59:     learn: 0.3983167        total: 1.27s    remaining: 19.9s
60:     learn: 0.3964205        total: 1.29s    remaining: 19.9s
61:     learn: 0.3948431        total: 1.31s    remaining: 19.9s
62:     learn: 0.3930939        total: 1.33s    remaining: 19.8s
63:     learn: 0.3917744        total: 1.35s    remaining: 19.8s
64:     learn: 0.3903100        total: 1.37s    remaining: 19.7s
65:     learn: 0.3885209        total: 1.39s    remaining: 19.7s
66:     learn: 0.3867808        total: 1.41s    remaining: 19.7s
67:     learn: 0.3853399        total: 1.44s    remaining: 19.7s
68:     learn: 0.3838226        total: 1.46s    remaining: 19.7s
69:     learn: 0.3823324        total: 1.48s    remaining: 19.6s
70:     learn: 0.3807607        total: 1.5s     remaining: 19.6s
71:     learn: 0.3791800        total: 1.52s    remaining: 19.6s
72:     learn: 0.3779470        total: 1.54s    remaining: 19.5s
```

```
73:     learn: 0.3766748        total: 1.56s    remaining: 19.5s
74:     learn: 0.3753100        total: 1.59s    remaining: 19.6s
75:     learn: 0.3738441        total: 1.61s    remaining: 19.6s
76:     learn: 0.3724465        total: 1.64s    remaining: 19.6s
77:     learn: 0.3712379        total: 1.66s    remaining: 19.6s
78:     learn: 0.3697914        total: 1.69s    remaining: 19.7s
79:     learn: 0.3686177        total: 1.71s    remaining: 19.7s
80:     learn: 0.3672400        total: 1.73s    remaining: 19.7s
81:     learn: 0.3658934        total: 1.75s    remaining: 19.7s
82:     learn: 0.3647414        total: 1.78s    remaining: 19.6s
83:     learn: 0.3633626        total: 1.8s     remaining: 19.6s
84:     learn: 0.3621098        total: 1.82s    remaining: 19.6s
85:     learn: 0.3606816        total: 1.84s    remaining: 19.5s
86:     learn: 0.3595002        total: 1.86s    remaining: 19.5s
87:     learn: 0.3584350        total: 1.88s    remaining: 19.5s
88:     learn: 0.3572550        total: 1.9s     remaining: 19.5s
89:     learn: 0.3563968        total: 1.92s    remaining: 19.4s
90:     learn: 0.3551078        total: 1.94s    remaining: 19.4s
91:     learn: 0.3540894        total: 1.96s    remaining: 19.4s
92:     learn: 0.3527746        total: 1.98s    remaining: 19.4s
93:     learn: 0.3515382        total: 2s       remaining: 19.3s
94:     learn: 0.3504227        total: 2.04s    remaining: 19.4s
95:     learn: 0.3493973        total: 2.06s    remaining: 19.4s
96:     learn: 0.3484428        total: 2.09s    remaining: 19.5s
97:     learn: 0.3475047        total: 2.11s    remaining: 19.4s
98:     learn: 0.3464667        total: 2.13s    remaining: 19.4s
99:     learn: 0.3454769        total: 2.15s    remaining: 19.4s
100:    learn: 0.3445882        total: 2.17s    remaining: 19.4s
101:    learn: 0.3437125        total: 2.19s    remaining: 19.3s
102:    learn: 0.3426712        total: 2.22s    remaining: 19.3s
103:    learn: 0.3417584        total: 2.24s    remaining: 19.3s
104:    learn: 0.3409513        total: 2.26s    remaining: 19.2s
105:    learn: 0.3399086        total: 2.29s    remaining: 19.3s
106:    learn: 0.3391141        total: 2.31s    remaining: 19.3s
107:    learn: 0.3381755        total: 2.33s    remaining: 19.3s
108:    learn: 0.3373682        total: 2.37s    remaining: 19.3s
109:    learn: 0.3364391        total: 2.39s    remaining: 19.3s
110:    learn: 0.3356077        total: 2.41s    remaining: 19.3s
111:    learn: 0.3347371        total: 2.43s    remaining: 19.3s
112:    learn: 0.3339679        total: 2.45s    remaining: 19.2s
113:    learn: 0.3331790        total: 2.47s    remaining: 19.2s
114:    learn: 0.3321389        total: 2.49s    remaining: 19.2s
115:    learn: 0.3313658        total: 2.51s    remaining: 19.1s
116:    learn: 0.3306348        total: 2.53s    remaining: 19.1s
117:    learn: 0.3299523        total: 2.55s    remaining: 19.1s
```

```
118:    learn: 0.3289806        total: 2.57s    remaining: 19.1s
119:    learn: 0.3282024        total: 2.6s     remaining: 19s
120:    learn: 0.3275070        total: 2.62s    remaining: 19s
121:    learn: 0.3267178        total: 2.64s    remaining: 19s
122:    learn: 0.3259227        total: 2.66s    remaining: 19s
123:    learn: 0.3252207        total: 2.68s    remaining: 19s
124:    learn: 0.3243726        total: 2.7s     remaining: 18.9s
125:    learn: 0.3236080        total: 2.72s    remaining: 18.9s
126:    learn: 0.3229013        total: 2.75s    remaining: 18.9s
127:    learn: 0.3223440        total: 2.77s    remaining: 18.8s
128:    learn: 0.3216367        total: 2.79s    remaining: 18.8s
129:    learn: 0.3210046        total: 2.81s    remaining: 18.8s
130:    learn: 0.3203009        total: 2.83s    remaining: 18.8s
131:    learn: 0.3196725        total: 2.86s    remaining: 18.8s
132:    learn: 0.3191195        total: 2.88s    remaining: 18.8s
133:    learn: 0.3184077        total: 2.9s     remaining: 18.8s
134:    learn: 0.3176930        total: 2.92s    remaining: 18.7s
135:    learn: 0.3170725        total: 2.94s    remaining: 18.7s
136:    learn: 0.3164162        total: 2.96s    remaining: 18.7s
137:    learn: 0.3157673        total: 2.98s    remaining: 18.7s
138:    learn: 0.3151646        total: 3.01s    remaining: 18.6s
139:    learn: 0.3145299        total: 3.03s    remaining: 18.6s
140:    learn: 0.3139483        total: 3.05s    remaining: 18.6s
141:    learn: 0.3132677        total: 3.07s    remaining: 18.5s
142:    learn: 0.3126265        total: 3.09s    remaining: 18.5s
143:    learn: 0.3119260        total: 3.11s    remaining: 18.5s
144:    learn: 0.3112606        total: 3.13s    remaining: 18.5s
145:    learn: 0.3105613        total: 3.15s    remaining: 18.4s
146:    learn: 0.3100054        total: 3.17s    remaining: 18.4s
147:    learn: 0.3093498        total: 3.19s    remaining: 18.4s
148:    learn: 0.3087416        total: 3.22s    remaining: 18.4s
149:    learn: 0.3080302        total: 3.24s    remaining: 18.3s
150:    learn: 0.3074045        total: 3.26s    remaining: 18.3s
151:    learn: 0.3069269        total: 3.28s    remaining: 18.3s
152:    learn: 0.3063161        total: 3.3s     remaining: 18.3s
153:    learn: 0.3056523        total: 3.32s    remaining: 18.3s
154:    learn: 0.3051047        total: 3.34s    remaining: 18.2s
155:    learn: 0.3046439        total: 3.36s    remaining: 18.2s
156:    learn: 0.3040725        total: 3.38s    remaining: 18.2s
157:    learn: 0.3034809        total: 3.41s    remaining: 18.2s
158:    learn: 0.3028964        total: 3.43s    remaining: 18.1s
159:    learn: 0.3023484        total: 3.45s    remaining: 18.1s
160:    learn: 0.3018394        total: 3.48s    remaining: 18.1s
161:    learn: 0.3012665        total: 3.5s     remaining: 18.1s
162:    learn: 0.3007412        total: 3.52s    remaining: 18.1s
```

```
163:    learn: 0.3002939        total: 3.54s    remaining: 18s
164:    learn: 0.2997573        total: 3.56s    remaining: 18s
165:    learn: 0.2991372        total: 3.58s    remaining: 18s
166:    learn: 0.2986199        total: 3.6s     remaining: 18s
167:    learn: 0.2980811        total: 3.62s    remaining: 17.9s
168:    learn: 0.2974922        total: 3.64s    remaining: 17.9s
169:    learn: 0.2970911        total: 3.66s    remaining: 17.9s
170:    learn: 0.2965798        total: 3.68s    remaining: 17.9s
171:    learn: 0.2959553        total: 3.7s     remaining: 17.8s
172:    learn: 0.2953829        total: 3.72s    remaining: 17.8s
173:    learn: 0.2949662        total: 3.74s    remaining: 17.8s
174:    learn: 0.2944127        total: 3.76s    remaining: 17.7s
175:    learn: 0.2939060        total: 3.78s    remaining: 17.7s
176:    learn: 0.2933536        total: 3.81s    remaining: 17.7s
177:    learn: 0.2927475        total: 3.83s    remaining: 17.7s
178:    learn: 0.2922085        total: 3.85s    remaining: 17.7s
179:    learn: 0.2917025        total: 3.87s    remaining: 17.6s
180:    learn: 0.2912161        total: 3.89s    remaining: 17.6s
181:    learn: 0.2908650        total: 3.91s    remaining: 17.6s
182:    learn: 0.2904044        total: 3.93s    remaining: 17.6s
183:    learn: 0.2898774        total: 3.96s    remaining: 17.5s
184:    learn: 0.2894529        total: 3.98s    remaining: 17.5s
185:    learn: 0.2889929        total: 4s       remaining: 17.5s
186:    learn: 0.2884670        total: 4.01s    remaining: 17.5s
187:    learn: 0.2879818        total: 4.04s    remaining: 17.4s
188:    learn: 0.2875273        total: 4.06s    remaining: 17.4s
189:    learn: 0.2871827        total: 4.09s    remaining: 17.4s
190:    learn: 0.2867548        total: 4.11s    remaining: 17.4s
191:    learn: 0.2862780        total: 4.13s    remaining: 17.4s
192:    learn: 0.2858039        total: 4.15s    remaining: 17.3s
193:    learn: 0.2853792        total: 4.17s    remaining: 17.3s
194:    learn: 0.2850335        total: 4.19s    remaining: 17.3s
195:    learn: 0.2845357        total: 4.21s    remaining: 17.3s
196:    learn: 0.2841825        total: 4.23s    remaining: 17.2s
197:    learn: 0.2838016        total: 4.25s    remaining: 17.2s
198:    learn: 0.2833147        total: 4.27s    remaining: 17.2s
199:    learn: 0.2828770        total: 4.3s     remaining: 17.2s
200:    learn: 0.2824362        total: 4.32s    remaining: 17.2s
201:    learn: 0.2820021        total: 4.34s    remaining: 17.1s
202:    learn: 0.2816156        total: 4.36s    remaining: 17.1s
203:    learn: 0.2811657        total: 4.38s    remaining: 17.1s
204:    learn: 0.2806910        total: 4.4s     remaining: 17.1s
205:    learn: 0.2802665        total: 4.42s    remaining: 17s
206:    learn: 0.2797717        total: 4.44s    remaining: 17s
207:    learn: 0.2793331        total: 4.46s    remaining: 17s
```

```
208:    learn: 0.2789003        total: 4.48s    remaining: 17s
209:    learn: 0.2784816        total: 4.5s     remaining: 16.9s
210:    learn: 0.2779971        total: 4.52s    remaining: 16.9s
211:    learn: 0.2776740        total: 4.54s    remaining: 16.9s
212:    learn: 0.2773070        total: 4.56s    remaining: 16.9s
213:    learn: 0.2768912        total: 4.59s    remaining: 16.9s
214:    learn: 0.2764746        total: 4.62s    remaining: 16.9s
215:    learn: 0.2760566        total: 4.64s    remaining: 16.8s
216:    learn: 0.2756892        total: 4.66s    remaining: 16.8s
217:    learn: 0.2753026        total: 4.68s    remaining: 16.8s
218:    learn: 0.2749218        total: 4.7s     remaining: 16.8s
219:    learn: 0.2745407        total: 4.72s    remaining: 16.7s
220:    learn: 0.2742177        total: 4.74s    remaining: 16.7s
221:    learn: 0.2737946        total: 4.76s    remaining: 16.7s
222:    learn: 0.2733911        total: 4.78s    remaining: 16.7s
223:    learn: 0.2730552        total: 4.8s     remaining: 16.6s
224:    learn: 0.2726911        total: 4.82s    remaining: 16.6s
225:    learn: 0.2723172        total: 4.84s    remaining: 16.6s
226:    learn: 0.2719131        total: 4.86s    remaining: 16.6s
227:    learn: 0.2715537        total: 4.88s    remaining: 16.5s
228:    learn: 0.2712244        total: 4.91s    remaining: 16.5s
229:    learn: 0.2707392        total: 4.92s    remaining: 16.5s
230:    learn: 0.2703466        total: 4.95s    remaining: 16.5s
231:    learn: 0.2699227        total: 4.96s    remaining: 16.4s
232:    learn: 0.2696239        total: 4.99s    remaining: 16.4s
233:    learn: 0.2691779        total: 5.01s    remaining: 16.4s
234:    learn: 0.2688043        total: 5.03s    remaining: 16.4s
235:    learn: 0.2684095        total: 5.05s    remaining: 16.3s
236:    learn: 0.2680406        total: 5.07s    remaining: 16.3s
237:    learn: 0.2677395        total: 5.09s    remaining: 16.3s
238:    learn: 0.2674056        total: 5.11s    remaining: 16.3s
239:    learn: 0.2670243        total: 5.13s    remaining: 16.2s
240:    learn: 0.2666305        total: 5.15s    remaining: 16.2s
241:    learn: 0.2662744        total: 5.17s    remaining: 16.2s
242:    learn: 0.2659963        total: 5.19s    remaining: 16.2s
243:    learn: 0.2656171        total: 5.21s    remaining: 16.1s
244:    learn: 0.2652677        total: 5.23s    remaining: 16.1s
245:    learn: 0.2648945        total: 5.25s    remaining: 16.1s
246:    learn: 0.2645484        total: 5.27s    remaining: 16.1s
247:    learn: 0.2641214        total: 5.3s     remaining: 16.1s
248:    learn: 0.2637910        total: 5.32s    remaining: 16s
249:    learn: 0.2634309        total: 5.34s    remaining: 16s
250:    learn: 0.2630724        total: 5.36s    remaining: 16s
251:    learn: 0.2627887        total: 5.38s    remaining: 16s
252:    learn: 0.2624455        total: 5.41s    remaining: 16s
```

```
253:    learn: 0.2621477        total: 5.43s    remaining: 15.9s
254:    learn: 0.2618018        total: 5.45s    remaining: 15.9s
255:    learn: 0.2615381        total: 5.47s    remaining: 15.9s
256:    learn: 0.2612144        total: 5.49s    remaining: 15.9s
257:    learn: 0.2608849        total: 5.51s    remaining: 15.8s
258:    learn: 0.2605486        total: 5.53s    remaining: 15.8s
259:    learn: 0.2602500        total: 5.55s    remaining: 15.8s
260:    learn: 0.2599871        total: 5.57s    remaining: 15.8s
261:    learn: 0.2595939        total: 5.59s    remaining: 15.8s
262:    learn: 0.2592649        total: 5.62s    remaining: 15.7s
263:    learn: 0.2590017        total: 5.63s    remaining: 15.7s
264:    learn: 0.2586763        total: 5.66s    remaining: 15.7s
265:    learn: 0.2582701        total: 5.68s    remaining: 15.7s
266:    learn: 0.2579094        total: 5.7s     remaining: 15.6s
267:    learn: 0.2575726        total: 5.72s    remaining: 15.6s
268:    learn: 0.2572437        total: 5.74s    remaining: 15.6s
269:    learn: 0.2568678        total: 5.76s    remaining: 15.6s
270:    learn: 0.2565080        total: 5.78s    remaining: 15.5s
271:    learn: 0.2561754        total: 5.8s     remaining: 15.5s
272:    learn: 0.2558391        total: 5.82s    remaining: 15.5s
273:    learn: 0.2555014        total: 5.84s    remaining: 15.5s
274:    learn: 0.2551768        total: 5.86s    remaining: 15.5s
275:    learn: 0.2549304        total: 5.88s    remaining: 15.4s
276:    learn: 0.2546373        total: 5.9s     remaining: 15.4s
277:    learn: 0.2543214        total: 5.92s    remaining: 15.4s
278:    learn: 0.2539637        total: 5.94s    remaining: 15.4s
279:    learn: 0.2536592        total: 5.96s    remaining: 15.3s
280:    learn: 0.2532939        total: 5.99s    remaining: 15.3s
281:    learn: 0.2529551        total: 6.01s    remaining: 15.3s
282:    learn: 0.2526303        total: 6.05s    remaining: 15.3s
283:    learn: 0.2522934        total: 6.07s    remaining: 15.3s
284:    learn: 0.2519592        total: 6.09s    remaining: 15.3s
285:    learn: 0.2516169        total: 6.11s    remaining: 15.3s
286:    learn: 0.2512910        total: 6.14s    remaining: 15.3s
287:    learn: 0.2509875        total: 6.16s    remaining: 15.2s
288:    learn: 0.2506147        total: 6.18s    remaining: 15.2s
289:    learn: 0.2503070        total: 6.22s    remaining: 15.2s
290:    learn: 0.2499600        total: 6.24s    remaining: 15.2s
291:    learn: 0.2495972        total: 6.26s    remaining: 15.2s
292:    learn: 0.2492580        total: 6.28s    remaining: 15.2s
293:    learn: 0.2489138        total: 6.3s     remaining: 15.1s
294:    learn: 0.2486467        total: 6.32s    remaining: 15.1s
295:    learn: 0.2484000        total: 6.34s    remaining: 15.1s
296:    learn: 0.2481128        total: 6.37s    remaining: 15.1s
297:    learn: 0.2478017        total: 6.4s     remaining: 15.1s
```

```
298:    learn: 0.2475141        total: 6.42s    remaining: 15s
299:    learn: 0.2472567        total: 6.44s    remaining: 15s
300:    learn: 0.2469735        total: 6.46s    remaining: 15s
301:    learn: 0.2466671        total: 6.48s    remaining: 15s
302:    learn: 0.2462803        total: 6.5s     remaining: 15s
303:    learn: 0.2459379        total: 6.52s    remaining: 14.9s
304:    learn: 0.2457030        total: 6.54s    remaining: 14.9s
305:    learn: 0.2454084        total: 6.57s    remaining: 14.9s
306:    learn: 0.2451619        total: 6.59s    remaining: 14.9s
307:    learn: 0.2448162        total: 6.61s    remaining: 14.8s
308:    learn: 0.2444438        total: 6.63s    remaining: 14.8s
309:    learn: 0.2441970        total: 6.65s    remaining: 14.8s
310:    learn: 0.2439045        total: 6.67s    remaining: 14.8s
311:    learn: 0.2435639        total: 6.7s     remaining: 14.8s
312:    learn: 0.2432485        total: 6.72s    remaining: 14.7s
313:    learn: 0.2429471        total: 6.75s    remaining: 14.8s
314:    learn: 0.2426091        total: 6.77s    remaining: 14.7s
315:    learn: 0.2423194        total: 6.79s    remaining: 14.7s
316:    learn: 0.2420650        total: 6.82s    remaining: 14.7s
317:    learn: 0.2417894        total: 6.84s    remaining: 14.7s
318:    learn: 0.2414792        total: 6.86s    remaining: 14.6s
319:    learn: 0.2411251        total: 6.88s    remaining: 14.6s
320:    learn: 0.2407092        total: 6.9s     remaining: 14.6s
321:    learn: 0.2403543        total: 6.92s    remaining: 14.6s
322:    learn: 0.2400157        total: 6.94s    remaining: 14.5s
323:    learn: 0.2396963        total: 6.97s    remaining: 14.5s
324:    learn: 0.2394116        total: 6.99s    remaining: 14.5s
325:    learn: 0.2390730        total: 7.01s    remaining: 14.5s
326:    learn: 0.2387769        total: 7.03s    remaining: 14.5s
327:    learn: 0.2384736        total: 7.05s    remaining: 14.5s
328:    learn: 0.2381950        total: 7.07s    remaining: 14.4s
329:    learn: 0.2378506        total: 7.11s    remaining: 14.4s
330:    learn: 0.2374676        total: 7.13s    remaining: 14.4s
331:    learn: 0.2372092        total: 7.15s    remaining: 14.4s
332:    learn: 0.2368965        total: 7.17s    remaining: 14.4s
333:    learn: 0.2366409        total: 7.19s    remaining: 14.3s
334:    learn: 0.2363275        total: 7.21s    remaining: 14.3s
335:    learn: 0.2360304        total: 7.23s    remaining: 14.3s
336:    learn: 0.2356570        total: 7.25s    remaining: 14.3s
337:    learn: 0.2353335        total: 7.27s    remaining: 14.2s
338:    learn: 0.2350361        total: 7.29s    remaining: 14.2s
339:    learn: 0.2347073        total: 7.32s    remaining: 14.2s
340:    learn: 0.2343506        total: 7.34s    remaining: 14.2s
341:    learn: 0.2340225        total: 7.36s    remaining: 14.2s
342:    learn: 0.2336747        total: 7.38s    remaining: 14.1s
```

```
343:    learn: 0.2334233        total: 7.4s     remaining: 14.1s
344:    learn: 0.2331217        total: 7.42s    remaining: 14.1s
345:    learn: 0.2328096        total: 7.44s    remaining: 14.1s
346:    learn: 0.2325848        total: 7.46s    remaining: 14s
347:    learn: 0.2322412        total: 7.49s    remaining: 14s
348:    learn: 0.2318924        total: 7.51s    remaining: 14s
349:    learn: 0.2316002        total: 7.53s    remaining: 14s
350:    learn: 0.2312849        total: 7.55s    remaining: 14s
351:    learn: 0.2309862        total: 7.57s    remaining: 13.9s
352:    learn: 0.2307214        total: 7.59s    remaining: 13.9s
353:    learn: 0.2304274        total: 7.62s    remaining: 13.9s
354:    learn: 0.2300922        total: 7.64s    remaining: 13.9s
355:    learn: 0.2297798        total: 7.66s    remaining: 13.9s
356:    learn: 0.2293961        total: 7.68s    remaining: 13.8s
357:    learn: 0.2291133        total: 7.7s     remaining: 13.8s
358:    learn: 0.2288383        total: 7.72s    remaining: 13.8s
359:    learn: 0.2285427        total: 7.74s    remaining: 13.8s
360:    learn: 0.2281712        total: 7.76s    remaining: 13.7s
361:    learn: 0.2278371        total: 7.78s    remaining: 13.7s
362:    learn: 0.2275269        total: 7.8s     remaining: 13.7s
363:    learn: 0.2272273        total: 7.83s    remaining: 13.7s
364:    learn: 0.2268887        total: 7.85s    remaining: 13.7s
365:    learn: 0.2266332        total: 7.87s    remaining: 13.6s
366:    learn: 0.2263493        total: 7.89s    remaining: 13.6s
367:    learn: 0.2260002        total: 7.91s    remaining: 13.6s
368:    learn: 0.2256536        total: 7.93s    remaining: 13.6s
369:    learn: 0.2253082        total: 7.96s    remaining: 13.5s
370:    learn: 0.2249911        total: 7.98s    remaining: 13.5s
371:    learn: 0.2245935        total: 8s       remaining: 13.5s
372:    learn: 0.2242762        total: 8.02s    remaining: 13.5s
373:    learn: 0.2239247        total: 8.04s    remaining: 13.5s
374:    learn: 0.2236001        total: 8.07s    remaining: 13.4s
375:    learn: 0.2232676        total: 8.09s    remaining: 13.4s
376:    learn: 0.2229501        total: 8.11s    remaining: 13.4s
377:    learn: 0.2225785        total: 8.14s    remaining: 13.4s
378:    learn: 0.2223242        total: 8.17s    remaining: 13.4s
379:    learn: 0.2220070        total: 8.19s    remaining: 13.4s
380:    learn: 0.2217559        total: 8.21s    remaining: 13.3s
381:    learn: 0.2215281        total: 8.23s    remaining: 13.3s
382:    learn: 0.2211592        total: 8.26s    remaining: 13.3s
383:    learn: 0.2208660        total: 8.28s    remaining: 13.3s
384:    learn: 0.2205345        total: 8.3s     remaining: 13.3s
385:    learn: 0.2201835        total: 8.32s    remaining: 13.2s
386:    learn: 0.2198631        total: 8.34s    remaining: 13.2s
387:    learn: 0.2195756        total: 8.36s    remaining: 13.2s
```

```
388:    learn: 0.2192908        total: 8.39s    remaining: 13.2s
389:    learn: 0.2189293        total: 8.41s    remaining: 13.2s
390:    learn: 0.2185825        total: 8.43s    remaining: 13.1s
391:    learn: 0.2182033        total: 8.45s    remaining: 13.1s
392:    learn: 0.2178400        total: 8.47s    remaining: 13.1s
393:    learn: 0.2176052        total: 8.49s    remaining: 13.1s
394:    learn: 0.2172702        total: 8.52s    remaining: 13s
395:    learn: 0.2169171        total: 8.54s    remaining: 13s
396:    learn: 0.2166133        total: 8.56s    remaining: 13s
397:    learn: 0.2162882        total: 8.59s    remaining: 13s
398:    learn: 0.2159069        total: 8.61s    remaining: 13s
399:    learn: 0.2155781        total: 8.63s    remaining: 12.9s
400:    learn: 0.2152496        total: 8.65s    remaining: 12.9s
401:    learn: 0.2149361        total: 8.68s    remaining: 12.9s
402:    learn: 0.2146484        total: 8.7s     remaining: 12.9s
403:    learn: 0.2143874        total: 8.72s    remaining: 12.9s
404:    learn: 0.2140385        total: 8.74s    remaining: 12.8s
405:    learn: 0.2137977        total: 8.77s    remaining: 12.8s
406:    learn: 0.2134917        total: 8.79s    remaining: 12.8s
407:    learn: 0.2131817        total: 8.81s    remaining: 12.8s
408:    learn: 0.2128594        total: 8.83s    remaining: 12.8s
409:    learn: 0.2125390        total: 8.85s    remaining: 12.7s
410:    learn: 0.2122915        total: 8.88s    remaining: 12.7s
411:    learn: 0.2119783        total: 8.9s     remaining: 12.7s
412:    learn: 0.2117639        total: 8.92s    remaining: 12.7s
413:    learn: 0.2114819        total: 8.94s    remaining: 12.7s
414:    learn: 0.2112473        total: 8.96s    remaining: 12.6s
415:    learn: 0.2108971        total: 8.98s    remaining: 12.6s
416:    learn: 0.2105557        total: 9.01s    remaining: 12.6s
417:    learn: 0.2102339        total: 9.03s    remaining: 12.6s
418:    learn: 0.2099703        total: 9.05s    remaining: 12.6s
419:    learn: 0.2096653        total: 9.08s    remaining: 12.5s
420:    learn: 0.2093420        total: 9.1s     remaining: 12.5s
421:    learn: 0.2090406        total: 9.12s    remaining: 12.5s
422:    learn: 0.2087221        total: 9.15s    remaining: 12.5s
423:    learn: 0.2084022        total: 9.18s    remaining: 12.5s
424:    learn: 0.2080974        total: 9.2s     remaining: 12.4s
425:    learn: 0.2077950        total: 9.22s    remaining: 12.4s
426:    learn: 0.2075371        total: 9.24s    remaining: 12.4s
427:    learn: 0.2072521        total: 9.26s    remaining: 12.4s
428:    learn: 0.2069573        total: 9.28s    remaining: 12.4s
429:    learn: 0.2066509        total: 9.3s     remaining: 12.3s
430:    learn: 0.2063180        total: 9.32s    remaining: 12.3s
431:    learn: 0.2060133        total: 9.34s    remaining: 12.3s
432:    learn: 0.2056778        total: 9.36s    remaining: 12.3s
```

```
433:    learn: 0.2053405        total: 9.38s    remaining: 12.2s
434:    learn: 0.2050801        total: 9.4s     remaining: 12.2s
435:    learn: 0.2047577        total: 9.43s    remaining: 12.2s
436:    learn: 0.2044615        total: 9.45s    remaining: 12.2s
437:    learn: 0.2041793        total: 9.47s    remaining: 12.1s
438:    learn: 0.2038866        total: 9.49s    remaining: 12.1s
439:    learn: 0.2035769        total: 9.51s    remaining: 12.1s
440:    learn: 0.2032952        total: 9.53s    remaining: 12.1s
441:    learn: 0.2030066        total: 9.55s    remaining: 12.1s
442:    learn: 0.2027414        total: 9.57s    remaining: 12s
443:    learn: 0.2025007        total: 9.6s     remaining: 12s
444:    learn: 0.2022069        total: 9.62s    remaining: 12s
445:    learn: 0.2019030        total: 9.64s    remaining: 12s
446:    learn: 0.2015971        total: 9.66s    remaining: 12s
447:    learn: 0.2013460        total: 9.69s    remaining: 11.9s
448:    learn: 0.2010407        total: 9.71s    remaining: 11.9s
449:    learn: 0.2008027        total: 9.73s    remaining: 11.9s
450:    learn: 0.2005080        total: 9.75s    remaining: 11.9s
451:    learn: 0.2001816        total: 9.78s    remaining: 11.9s
452:    learn: 0.1999171        total: 9.8s     remaining: 11.8s
453:    learn: 0.1996628        total: 9.82s    remaining: 11.8s
454:    learn: 0.1993417        total: 9.85s    remaining: 11.8s
455:    learn: 0.1990485        total: 9.87s    remaining: 11.8s
456:    learn: 0.1987918        total: 9.89s    remaining: 11.8s
457:    learn: 0.1984786        total: 9.92s    remaining: 11.7s
458:    learn: 0.1982670        total: 9.94s    remaining: 11.7s
459:    learn: 0.1979506        total: 9.96s    remaining: 11.7s
460:    learn: 0.1977066        total: 9.99s    remaining: 11.7s
461:    learn: 0.1973972        total: 10s      remaining: 11.7s
462:    learn: 0.1970711        total: 10s      remaining: 11.6s
463:    learn: 0.1967759        total: 10.1s    remaining: 11.6s
464:    learn: 0.1964749        total: 10.1s    remaining: 11.6s
465:    learn: 0.1961866        total: 10.1s    remaining: 11.6s
466:    learn: 0.1959393        total: 10.1s    remaining: 11.6s
467:    learn: 0.1956502        total: 10.2s    remaining: 11.5s
468:    learn: 0.1953354        total: 10.2s    remaining: 11.5s
469:    learn: 0.1950654        total: 10.2s    remaining: 11.5s
470:    learn: 0.1947828        total: 10.2s    remaining: 11.5s
471:    learn: 0.1945165        total: 10.2s    remaining: 11.5s
472:    learn: 0.1942345        total: 10.3s    remaining: 11.4s
473:    learn: 0.1939831        total: 10.3s    remaining: 11.4s
474:    learn: 0.1936931        total: 10.3s    remaining: 11.4s
475:    learn: 0.1934025        total: 10.3s    remaining: 11.4s
476:    learn: 0.1931139        total: 10.4s    remaining: 11.4s
477:    learn: 0.1928586        total: 10.4s    remaining: 11.3s
```

```
478:    learn: 0.1925522        total: 10.4s    remaining: 11.3s
479:    learn: 0.1923706        total: 10.4s    remaining: 11.3s
480:    learn: 0.1921062        total: 10.4s    remaining: 11.3s
481:    learn: 0.1918198        total: 10.5s    remaining: 11.2s
482:    learn: 0.1915399        total: 10.5s    remaining: 11.2s
483:    learn: 0.1912680        total: 10.5s    remaining: 11.2s
484:    learn: 0.1909869        total: 10.5s    remaining: 11.2s
485:    learn: 0.1907799        total: 10.6s    remaining: 11.2s
486:    learn: 0.1905378        total: 10.6s    remaining: 11.1s
487:    learn: 0.1903135        total: 10.6s    remaining: 11.1s
488:    learn: 0.1900666        total: 10.6s    remaining: 11.1s
489:    learn: 0.1897973        total: 10.6s    remaining: 11.1s
490:    learn: 0.1895420        total: 10.7s    remaining: 11.1s
491:    learn: 0.1893415        total: 10.7s    remaining: 11s
492:    learn: 0.1890843        total: 10.7s    remaining: 11s
493:    learn: 0.1888087        total: 10.7s    remaining: 11s
494:    learn: 0.1885470        total: 10.8s    remaining: 11s
495:    learn: 0.1882956        total: 10.8s    remaining: 11s
496:    learn: 0.1880368        total: 10.8s    remaining: 10.9s
497:    learn: 0.1877206        total: 10.8s    remaining: 10.9s
498:    learn: 0.1875526        total: 10.9s    remaining: 10.9s
499:    learn: 0.1872870        total: 10.9s    remaining: 10.9s
500:    learn: 0.1869976        total: 10.9s    remaining: 10.9s
501:    learn: 0.1867891        total: 10.9s    remaining: 10.8s
502:    learn: 0.1865569        total: 10.9s    remaining: 10.8s
503:    learn: 0.1863268        total: 11s      remaining: 10.8s
504:    learn: 0.1860487        total: 11s      remaining: 10.8s
505:    learn: 0.1858049        total: 11s      remaining: 10.7s
506:    learn: 0.1855124        total: 11s      remaining: 10.7s
507:    learn: 0.1852311        total: 11.1s    remaining: 10.7s
508:    learn: 0.1849878        total: 11.1s    remaining: 10.7s
509:    learn: 0.1847772        total: 11.1s    remaining: 10.7s
510:    learn: 0.1845272        total: 11.1s    remaining: 10.7s
511:    learn: 0.1842863        total: 11.2s    remaining: 10.6s
512:    learn: 0.1840372        total: 11.2s    remaining: 10.6s
513:    learn: 0.1837545        total: 11.2s    remaining: 10.6s
514:    learn: 0.1834403        total: 11.2s    remaining: 10.6s
515:    learn: 0.1832363        total: 11.3s    remaining: 10.6s
516:    learn: 0.1830315        total: 11.3s    remaining: 10.6s
517:    learn: 0.1827687        total: 11.3s    remaining: 10.6s
518:    learn: 0.1824910        total: 11.4s    remaining: 10.5s
519:    learn: 0.1822441        total: 11.4s    remaining: 10.5s
520:    learn: 0.1819817        total: 11.4s    remaining: 10.5s
521:    learn: 0.1817475        total: 11.4s    remaining: 10.5s
522:    learn: 0.1815316        total: 11.5s    remaining: 10.4s
```

```
523:    learn: 0.1813047        total: 11.5s    remaining: 10.4s
524:    learn: 0.1810734        total: 11.5s    remaining: 10.4s
525:    learn: 0.1808277        total: 11.5s    remaining: 10.4s
526:    learn: 0.1806209        total: 11.6s    remaining: 10.4s
527:    learn: 0.1803413        total: 11.6s    remaining: 10.4s
528:    learn: 0.1801238        total: 11.6s    remaining: 10.3s
529:    learn: 0.1799463        total: 11.6s    remaining: 10.3s
530:    learn: 0.1796344        total: 11.7s    remaining: 10.3s
531:    learn: 0.1793695        total: 11.7s    remaining: 10.3s
532:    learn: 0.1790656        total: 11.7s    remaining: 10.3s
533:    learn: 0.1788323        total: 11.7s    remaining: 10.2s
534:    learn: 0.1786066        total: 11.7s    remaining: 10.2s
535:    learn: 0.1784686        total: 11.8s    remaining: 10.2s
536:    learn: 0.1782114        total: 11.8s    remaining: 10.2s
537:    learn: 0.1779841        total: 11.8s    remaining: 10.1s
538:    learn: 0.1777667        total: 11.8s    remaining: 10.1s
539:    learn: 0.1775553        total: 11.9s    remaining: 10.1s
540:    learn: 0.1773036        total: 11.9s    remaining: 10.1s
541:    learn: 0.1771192        total: 11.9s    remaining: 10.1s
542:    learn: 0.1768748        total: 11.9s    remaining: 10s
543:    learn: 0.1766339        total: 12s      remaining: 10s
544:    learn: 0.1764056        total: 12s      remaining: 10s
545:    learn: 0.1762125        total: 12s      remaining: 9.98s
546:    learn: 0.1759528        total: 12s      remaining: 9.96s
547:    learn: 0.1756987        total: 12s      remaining: 9.93s
548:    learn: 0.1755279        total: 12.1s    remaining: 9.91s
549:    learn: 0.1753683        total: 12.1s    remaining: 9.89s
550:    learn: 0.1751534        total: 12.1s    remaining: 9.87s
551:    learn: 0.1748948        total: 12.1s    remaining: 9.85s
552:    learn: 0.1746929        total: 12.2s    remaining: 9.83s
553:    learn: 0.1744657        total: 12.2s    remaining: 9.8s
554:    learn: 0.1742393        total: 12.2s    remaining: 9.78s
555:    learn: 0.1739448        total: 12.2s    remaining: 9.76s
556:    learn: 0.1736902        total: 12.3s    remaining: 9.74s
557:    learn: 0.1734608        total: 12.3s    remaining: 9.72s
558:    learn: 0.1732410        total: 12.3s    remaining: 9.7s
559:    learn: 0.1730011        total: 12.3s    remaining: 9.68s
560:    learn: 0.1727513        total: 12.3s    remaining: 9.66s
561:    learn: 0.1725542        total: 12.4s    remaining: 9.64s
562:    learn: 0.1723774        total: 12.4s    remaining: 9.62s
563:    learn: 0.1721254        total: 12.4s    remaining: 9.6s
564:    learn: 0.1718890        total: 12.4s    remaining: 9.58s
565:    learn: 0.1716293        total: 12.5s    remaining: 9.56s
566:    learn: 0.1713986        total: 12.5s    remaining: 9.54s
567:    learn: 0.1711341        total: 12.5s    remaining: 9.53s
```

```
568:    learn: 0.1709658        total: 12.6s    remaining: 9.51s
569:    learn: 0.1707373        total: 12.6s    remaining: 9.49s
570:    learn: 0.1704933        total: 12.6s    remaining: 9.47s
571:    learn: 0.1702492        total: 12.6s    remaining: 9.45s
572:    learn: 0.1700347        total: 12.6s    remaining: 9.42s
573:    learn: 0.1698082        total: 12.7s    remaining: 9.4s
574:    learn: 0.1696189        total: 12.7s    remaining: 9.38s
575:    learn: 0.1694212        total: 12.7s    remaining: 9.36s
576:    learn: 0.1691652        total: 12.7s    remaining: 9.34s
577:    learn: 0.1688870        total: 12.8s    remaining: 9.32s
578:    learn: 0.1686592        total: 12.8s    remaining: 9.29s
579:    learn: 0.1684380        total: 12.8s    remaining: 9.27s
580:    learn: 0.1682248        total: 12.8s    remaining: 9.25s
581:    learn: 0.1679684        total: 12.8s    remaining: 9.23s
582:    learn: 0.1677417        total: 12.9s    remaining: 9.21s
583:    learn: 0.1675259        total: 12.9s    remaining: 9.19s
584:    learn: 0.1673276        total: 12.9s    remaining: 9.16s
585:    learn: 0.1670862        total: 12.9s    remaining: 9.14s
586:    learn: 0.1668623        total: 13s      remaining: 9.12s
587:    learn: 0.1666942        total: 13s      remaining: 9.1s
588:    learn: 0.1665332        total: 13s      remaining: 9.07s
589:    learn: 0.1663180        total: 13s      remaining: 9.05s
590:    learn: 0.1661237        total: 13.1s    remaining: 9.03s
591:    learn: 0.1659311        total: 13.1s    remaining: 9.01s
592:    learn: 0.1657190        total: 13.1s    remaining: 8.99s
593:    learn: 0.1655174        total: 13.1s    remaining: 8.96s
594:    learn: 0.1653261        total: 13.1s    remaining: 8.94s
595:    learn: 0.1651187        total: 13.2s    remaining: 8.92s
596:    learn: 0.1649285        total: 13.2s    remaining: 8.89s
597:    learn: 0.1646891        total: 13.2s    remaining: 8.87s
598:    learn: 0.1645132        total: 13.2s    remaining: 8.85s
599:    learn: 0.1643617        total: 13.2s    remaining: 8.83s
600:    learn: 0.1641209        total: 13.3s    remaining: 8.8s
601:    learn: 0.1638667        total: 13.3s    remaining: 8.78s
602:    learn: 0.1636540        total: 13.3s    remaining: 8.76s
603:    learn: 0.1634145        total: 13.3s    remaining: 8.74s
604:    learn: 0.1632547        total: 13.3s    remaining: 8.72s
605:    learn: 0.1630508        total: 13.4s    remaining: 8.69s
606:    learn: 0.1628437        total: 13.4s    remaining: 8.67s
607:    learn: 0.1626043        total: 13.4s    remaining: 8.65s
608:    learn: 0.1623873        total: 13.4s    remaining: 8.63s
609:    learn: 0.1621454        total: 13.5s    remaining: 8.6s
610:    learn: 0.1619225        total: 13.5s    remaining: 8.58s
611:    learn: 0.1617646        total: 13.5s    remaining: 8.56s
612:    learn: 0.1615368        total: 13.5s    remaining: 8.54s
```

```
613:    learn: 0.1613821        total: 13.5s    remaining: 8.51s
614:    learn: 0.1611495        total: 13.6s    remaining: 8.49s
615:    learn: 0.1610705        total: 13.6s    remaining: 8.47s
616:    learn: 0.1608796        total: 13.6s    remaining: 8.45s
617:    learn: 0.1606327        total: 13.6s    remaining: 8.42s
618:    learn: 0.1604956        total: 13.7s    remaining: 8.4s
619:    learn: 0.1602895        total: 13.7s    remaining: 8.38s
620:    learn: 0.1600710        total: 13.7s    remaining: 8.36s
621:    learn: 0.1598920        total: 13.7s    remaining: 8.33s
622:    learn: 0.1596837        total: 13.7s    remaining: 8.31s
623:    learn: 0.1594908        total: 13.8s    remaining: 8.29s
624:    learn: 0.1592519        total: 13.8s    remaining: 8.27s
625:    learn: 0.1590086        total: 13.8s    remaining: 8.24s
626:    learn: 0.1588751        total: 13.8s    remaining: 8.22s
627:    learn: 0.1586464        total: 13.8s    remaining: 8.2s
628:    learn: 0.1584048        total: 13.9s    remaining: 8.18s
629:    learn: 0.1582365        total: 13.9s    remaining: 8.15s
630:    learn: 0.1580288        total: 13.9s    remaining: 8.13s
631:    learn: 0.1578213        total: 13.9s    remaining: 8.11s
632:    learn: 0.1576526        total: 14s      remaining: 8.09s
633:    learn: 0.1574362        total: 14s      remaining: 8.07s
634:    learn: 0.1572479        total: 14s      remaining: 8.04s
635:    learn: 0.1570573        total: 14s      remaining: 8.02s
636:    learn: 0.1568453        total: 14s      remaining: 8s
637:    learn: 0.1566177        total: 14.1s    remaining: 7.98s
638:    learn: 0.1563698        total: 14.1s    remaining: 7.96s
639:    learn: 0.1561228        total: 14.1s    remaining: 7.93s
640:    learn: 0.1559468        total: 14.1s    remaining: 7.91s
641:    learn: 0.1557252        total: 14.1s    remaining: 7.89s
642:    learn: 0.1555549        total: 14.2s    remaining: 7.87s
643:    learn: 0.1553751        total: 14.2s    remaining: 7.85s
644:    learn: 0.1551420        total: 14.2s    remaining: 7.83s
645:    learn: 0.1549624        total: 14.2s    remaining: 7.8s
646:    learn: 0.1547679        total: 14.3s    remaining: 7.78s
647:    learn: 0.1545569        total: 14.3s    remaining: 7.76s
648:    learn: 0.1543764        total: 14.3s    remaining: 7.74s
649:    learn: 0.1541659        total: 14.3s    remaining: 7.72s
650:    learn: 0.1540149        total: 14.4s    remaining: 7.69s
651:    learn: 0.1538108        total: 14.4s    remaining: 7.67s
652:    learn: 0.1537425        total: 14.4s    remaining: 7.65s
653:    learn: 0.1535399        total: 14.4s    remaining: 7.63s
654:    learn: 0.1533915        total: 14.4s    remaining: 7.6s
655:    learn: 0.1531853        total: 14.5s    remaining: 7.58s
656:    learn: 0.1530212        total: 14.5s    remaining: 7.56s
657:    learn: 0.1528321        total: 14.5s    remaining: 7.54s
```

```
658:    learn: 0.1526741        total: 14.5s    remaining: 7.52s
659:    learn: 0.1525365        total: 14.5s    remaining: 7.5s
660:    learn: 0.1523260        total: 14.6s    remaining: 7.47s
661:    learn: 0.1521333        total: 14.6s    remaining: 7.45s
662:    learn: 0.1519170        total: 14.6s    remaining: 7.43s
663:    learn: 0.1517439        total: 14.6s    remaining: 7.41s
664:    learn: 0.1515890        total: 14.7s    remaining: 7.39s
665:    learn: 0.1513781        total: 14.7s    remaining: 7.37s
666:    learn: 0.1511931        total: 14.7s    remaining: 7.34s
667:    learn: 0.1510355        total: 14.7s    remaining: 7.32s
668:    learn: 0.1508362        total: 14.8s    remaining: 7.3s
669:    learn: 0.1506773        total: 14.8s    remaining: 7.28s
670:    learn: 0.1504780        total: 14.8s    remaining: 7.25s
671:    learn: 0.1502787        total: 14.8s    remaining: 7.23s
672:    learn: 0.1500665        total: 14.8s    remaining: 7.21s
673:    learn: 0.1499309        total: 14.9s    remaining: 7.19s
674:    learn: 0.1497194        total: 14.9s    remaining: 7.17s
675:    learn: 0.1495504        total: 14.9s    remaining: 7.14s
676:    learn: 0.1493819        total: 14.9s    remaining: 7.12s
677:    learn: 0.1492060        total: 14.9s    remaining: 7.1s
678:    learn: 0.1490215        total: 15s      remaining: 7.08s
679:    learn: 0.1488755        total: 15s      remaining: 7.05s
680:    learn: 0.1486813        total: 15s      remaining: 7.03s
681:    learn: 0.1485030        total: 15s      remaining: 7.01s
682:    learn: 0.1482729        total: 15.1s    remaining: 6.99s
683:    learn: 0.1480966        total: 15.1s    remaining: 6.96s
684:    learn: 0.1479101        total: 15.1s    remaining: 6.94s
685:    learn: 0.1476897        total: 15.1s    remaining: 6.92s
686:    learn: 0.1475430        total: 15.1s    remaining: 6.9s
687:    learn: 0.1473727        total: 15.2s    remaining: 6.88s
688:    learn: 0.1472285        total: 15.2s    remaining: 6.85s
689:    learn: 0.1470544        total: 15.2s    remaining: 6.83s
690:    learn: 0.1468332        total: 15.2s    remaining: 6.81s
691:    learn: 0.1466309        total: 15.3s    remaining: 6.79s
692:    learn: 0.1464351        total: 15.3s    remaining: 6.76s
693:    learn: 0.1462226        total: 15.3s    remaining: 6.74s
694:    learn: 0.1460038        total: 15.3s    remaining: 6.72s
695:    learn: 0.1458036        total: 15.3s    remaining: 6.7s
696:    learn: 0.1455893        total: 15.4s    remaining: 6.68s
697:    learn: 0.1454046        total: 15.4s    remaining: 6.65s
698:    learn: 0.1452417        total: 15.4s    remaining: 6.63s
699:    learn: 0.1450473        total: 15.4s    remaining: 6.61s
700:    learn: 0.1449186        total: 15.4s    remaining: 6.59s
701:    learn: 0.1447757        total: 15.5s    remaining: 6.56s
702:    learn: 0.1445979        total: 15.5s    remaining: 6.54s
```

```
703:    learn: 0.1444524        total: 15.5s    remaining: 6.52s
704:    learn: 0.1442240        total: 15.5s    remaining: 6.5s
705:    learn: 0.1439833        total: 15.6s    remaining: 6.48s
706:    learn: 0.1437856        total: 15.6s    remaining: 6.45s
707:    learn: 0.1436107        total: 15.6s    remaining: 6.43s
708:    learn: 0.1434543        total: 15.6s    remaining: 6.41s
709:    learn: 0.1432491        total: 15.6s    remaining: 6.39s
710:    learn: 0.1431003        total: 15.7s    remaining: 6.36s
711:    learn: 0.1428885        total: 15.7s    remaining: 6.34s
712:    learn: 0.1426956        total: 15.7s    remaining: 6.32s
713:    learn: 0.1425533        total: 15.7s    remaining: 6.3s
714:    learn: 0.1423275        total: 15.7s    remaining: 6.28s
715:    learn: 0.1421067        total: 15.8s    remaining: 6.25s
716:    learn: 0.1418951        total: 15.8s    remaining: 6.24s
717:    learn: 0.1417146        total: 15.8s    remaining: 6.21s
718:    learn: 0.1415508        total: 15.8s    remaining: 6.19s
719:    learn: 0.1413631        total: 15.9s    remaining: 6.17s
720:    learn: 0.1412102        total: 15.9s    remaining: 6.15s
721:    learn: 0.1410322        total: 15.9s    remaining: 6.12s
722:    learn: 0.1408591        total: 15.9s    remaining: 6.1s
723:    learn: 0.1406712        total: 16s      remaining: 6.08s
724:    learn: 0.1404800        total: 16s      remaining: 6.06s
725:    learn: 0.1403385        total: 16s      remaining: 6.05s
726:    learn: 0.1401525        total: 16.1s    remaining: 6.03s
727:    learn: 0.1399659        total: 16.1s    remaining: 6s
728:    learn: 0.1397956        total: 16.1s    remaining: 5.98s
729:    learn: 0.1396216        total: 16.1s    remaining: 5.96s
730:    learn: 0.1394534        total: 16.1s    remaining: 5.94s
731:    learn: 0.1393185        total: 16.2s    remaining: 5.92s
732:    learn: 0.1391484        total: 16.2s    remaining: 5.89s
733:    learn: 0.1389088        total: 16.2s    remaining: 5.87s
734:    learn: 0.1387030        total: 16.2s    remaining: 5.85s
735:    learn: 0.1385179        total: 16.2s    remaining: 5.83s
736:    learn: 0.1383441        total: 16.3s    remaining: 5.8s
737:    learn: 0.1381967        total: 16.3s    remaining: 5.78s
738:    learn: 0.1380623        total: 16.3s    remaining: 5.76s
739:    learn: 0.1378907        total: 16.3s    remaining: 5.74s
740:    learn: 0.1376838        total: 16.4s    remaining: 5.72s
741:    learn: 0.1374895        total: 16.4s    remaining: 5.7s
742:    learn: 0.1373700        total: 16.4s    remaining: 5.67s
743:    learn: 0.1372136        total: 16.4s    remaining: 5.65s
744:    learn: 0.1370490        total: 16.5s    remaining: 5.63s
745:    learn: 0.1368505        total: 16.5s    remaining: 5.61s
746:    learn: 0.1367332        total: 16.5s    remaining: 5.59s
747:    learn: 0.1365559        total: 16.5s    remaining: 5.57s
```

```
748:    learn: 0.1363558        total: 16.5s    remaining: 5.54s
749:    learn: 0.1361666        total: 16.6s    remaining: 5.52s
750:    learn: 0.1360017        total: 16.6s    remaining: 5.5s
751:    learn: 0.1358321        total: 16.6s    remaining: 5.48s
752:    learn: 0.1356552        total: 16.6s    remaining: 5.45s
753:    learn: 0.1354782        total: 16.6s    remaining: 5.43s
754:    learn: 0.1353411        total: 16.7s    remaining: 5.41s
755:    learn: 0.1351941        total: 16.7s    remaining: 5.39s
756:    learn: 0.1349881        total: 16.7s    remaining: 5.37s
757:    learn: 0.1348108        total: 16.7s    remaining: 5.34s
758:    learn: 0.1346691        total: 16.8s    remaining: 5.32s
759:    learn: 0.1345287        total: 16.8s    remaining: 5.3s
760:    learn: 0.1343678        total: 16.8s    remaining: 5.28s
761:    learn: 0.1342386        total: 16.8s    remaining: 5.25s
762:    learn: 0.1340588        total: 16.8s    remaining: 5.23s
763:    learn: 0.1339065        total: 16.9s    remaining: 5.21s
764:    learn: 0.1337594        total: 16.9s    remaining: 5.19s
765:    learn: 0.1335954        total: 16.9s    remaining: 5.17s
766:    learn: 0.1334205        total: 16.9s    remaining: 5.14s
767:    learn: 0.1332337        total: 17s      remaining: 5.12s
768:    learn: 0.1330723        total: 17s      remaining: 5.1s
769:    learn: 0.1329452        total: 17s      remaining: 5.08s
770:    learn: 0.1327860        total: 17s      remaining: 5.06s
771:    learn: 0.1325921        total: 17.1s    remaining: 5.04s
772:    learn: 0.1324426        total: 17.1s    remaining: 5.02s
773:    learn: 0.1322692        total: 17.1s    remaining: 4.99s
774:    learn: 0.1320961        total: 17.1s    remaining: 4.98s
775:    learn: 0.1319541        total: 17.2s    remaining: 4.96s
776:    learn: 0.1318154        total: 17.2s    remaining: 4.94s
777:    learn: 0.1316553        total: 17.2s    remaining: 4.92s
778:    learn: 0.1315585        total: 17.3s    remaining: 4.89s
779:    learn: 0.1313978        total: 17.3s    remaining: 4.87s
780:    learn: 0.1312294        total: 17.3s    remaining: 4.85s
781:    learn: 0.1311082        total: 17.3s    remaining: 4.83s
782:    learn: 0.1309561        total: 17.3s    remaining: 4.81s
783:    learn: 0.1307934        total: 17.4s    remaining: 4.79s
784:    learn: 0.1305969        total: 17.4s    remaining: 4.76s
785:    learn: 0.1304482        total: 17.4s    remaining: 4.74s
786:    learn: 0.1302832        total: 17.4s    remaining: 4.72s
787:    learn: 0.1300869        total: 17.5s    remaining: 4.7s
788:    learn: 0.1299272        total: 17.5s    remaining: 4.67s
789:    learn: 0.1297749        total: 17.5s    remaining: 4.65s
790:    learn: 0.1296298        total: 17.5s    remaining: 4.63s
791:    learn: 0.1294527        total: 17.5s    remaining: 4.61s
792:    learn: 0.1292667        total: 17.6s    remaining: 4.58s
```

```
793:    learn: 0.1291005        total: 17.6s    remaining: 4.56s
794:    learn: 0.1289582        total: 17.6s    remaining: 4.54s
795:    learn: 0.1287595        total: 17.6s    remaining: 4.52s
796:    learn: 0.1285559        total: 17.7s    remaining: 4.5s
797:    learn: 0.1284178        total: 17.7s    remaining: 4.47s
798:    learn: 0.1283124        total: 17.7s    remaining: 4.45s
799:    learn: 0.1281806        total: 17.7s    remaining: 4.43s
800:    learn: 0.1280193        total: 17.7s    remaining: 4.41s
801:    learn: 0.1278378        total: 17.8s    remaining: 4.38s
802:    learn: 0.1277125        total: 17.8s    remaining: 4.36s
803:    learn: 0.1275532        total: 17.8s    remaining: 4.34s
804:    learn: 0.1274299        total: 17.8s    remaining: 4.32s
805:    learn: 0.1273052        total: 17.8s    remaining: 4.29s
806:    learn: 0.1272194        total: 17.9s    remaining: 4.27s
807:    learn: 0.1270491        total: 17.9s    remaining: 4.25s
808:    learn: 0.1269156        total: 17.9s    remaining: 4.23s
809:    learn: 0.1267519        total: 17.9s    remaining: 4.21s
810:    learn: 0.1265727        total: 17.9s    remaining: 4.18s
811:    learn: 0.1263790        total: 18s      remaining: 4.16s
812:    learn: 0.1261798        total: 18s      remaining: 4.14s
813:    learn: 0.1260730        total: 18s      remaining: 4.12s
814:    learn: 0.1258996        total: 18s      remaining: 4.09s
815:    learn: 0.1257425        total: 18.1s    remaining: 4.07s
816:    learn: 0.1256506        total: 18.1s    remaining: 4.05s
817:    learn: 0.1255151        total: 18.1s    remaining: 4.03s
818:    learn: 0.1253394        total: 18.1s    remaining: 4s
819:    learn: 0.1252624        total: 18.1s    remaining: 3.98s
820:    learn: 0.1251193        total: 18.2s    remaining: 3.96s
821:    learn: 0.1249896        total: 18.2s    remaining: 3.94s
822:    learn: 0.1248590        total: 18.2s    remaining: 3.91s
823:    learn: 0.1246938        total: 18.2s    remaining: 3.89s
824:    learn: 0.1245739        total: 18.2s    remaining: 3.87s
825:    learn: 0.1243987        total: 18.3s    remaining: 3.85s
826:    learn: 0.1242391        total: 18.3s    remaining: 3.82s
827:    learn: 0.1241426        total: 18.3s    remaining: 3.8s
828:    learn: 0.1239599        total: 18.3s    remaining: 3.78s
829:    learn: 0.1238333        total: 18.3s    remaining: 3.76s
830:    learn: 0.1236704        total: 18.4s    remaining: 3.73s
831:    learn: 0.1235817        total: 18.4s    remaining: 3.71s
832:    learn: 0.1234407        total: 18.4s    remaining: 3.69s
833:    learn: 0.1233018        total: 18.4s    remaining: 3.67s
834:    learn: 0.1231340        total: 18.4s    remaining: 3.64s
835:    learn: 0.1229729        total: 18.5s    remaining: 3.62s
836:    learn: 0.1228319        total: 18.5s    remaining: 3.6s
837:    learn: 0.1226832        total: 18.5s    remaining: 3.58s
```

```
838:    learn: 0.1225713        total: 18.5s    remaining: 3.56s
839:    learn: 0.1224645        total: 18.5s    remaining: 3.53s
840:    learn: 0.1223351        total: 18.6s    remaining: 3.51s
841:    learn: 0.1221485        total: 18.6s    remaining: 3.49s
842:    learn: 0.1220459        total: 18.6s    remaining: 3.47s
843:    learn: 0.1218766        total: 18.6s    remaining: 3.44s
844:    learn: 0.1217159        total: 18.7s    remaining: 3.42s
845:    learn: 0.1215590        total: 18.7s    remaining: 3.4s
846:    learn: 0.1213663        total: 18.7s    remaining: 3.38s
847:    learn: 0.1211900        total: 18.7s    remaining: 3.36s
848:    learn: 0.1210326        total: 18.7s    remaining: 3.33s
849:    learn: 0.1208659        total: 18.8s    remaining: 3.31s
850:    learn: 0.1207122        total: 18.8s    remaining: 3.29s
851:    learn: 0.1205698        total: 18.8s    remaining: 3.27s
852:    learn: 0.1204446        total: 18.8s    remaining: 3.25s
853:    learn: 0.1203162        total: 18.9s    remaining: 3.23s
854:    learn: 0.1201724        total: 18.9s    remaining: 3.2s
855:    learn: 0.1200874        total: 18.9s    remaining: 3.18s
856:    learn: 0.1199364        total: 18.9s    remaining: 3.16s
857:    learn: 0.1197792        total: 19s      remaining: 3.14s
858:    learn: 0.1196664        total: 19s      remaining: 3.12s
859:    learn: 0.1195083        total: 19s      remaining: 3.09s
860:    learn: 0.1193767        total: 19s      remaining: 3.07s
861:    learn: 0.1192322        total: 19s      remaining: 3.05s
862:    learn: 0.1191154        total: 19.1s    remaining: 3.03s
863:    learn: 0.1189832        total: 19.1s    remaining: 3s
864:    learn: 0.1188821        total: 19.1s    remaining: 2.98s
865:    learn: 0.1186969        total: 19.1s    remaining: 2.96s
866:    learn: 0.1185107        total: 19.2s    remaining: 2.94s
867:    learn: 0.1183735        total: 19.2s    remaining: 2.92s
868:    learn: 0.1182816        total: 19.2s    remaining: 2.89s
869:    learn: 0.1181437        total: 19.2s    remaining: 2.87s
870:    learn: 0.1179910        total: 19.2s    remaining: 2.85s
871:    learn: 0.1178273        total: 19.3s    remaining: 2.83s
872:    learn: 0.1176989        total: 19.3s    remaining: 2.81s
873:    learn: 0.1176062        total: 19.3s    remaining: 2.78s
874:    learn: 0.1174757        total: 19.3s    remaining: 2.76s
875:    learn: 0.1173265        total: 19.3s    remaining: 2.74s
876:    learn: 0.1171430        total: 19.4s    remaining: 2.72s
877:    learn: 0.1169755        total: 19.4s    remaining: 2.69s
878:    learn: 0.1167830        total: 19.4s    remaining: 2.67s
879:    learn: 0.1167161        total: 19.5s    remaining: 2.65s
880:    learn: 0.1165704        total: 19.5s    remaining: 2.63s
881:    learn: 0.1164830        total: 19.5s    remaining: 2.61s
882:    learn: 0.1163628        total: 19.5s    remaining: 2.59s
```

```
883:    learn: 0.1162226        total: 19.5s    remaining: 2.56s
884:    learn: 0.1161114        total: 19.6s    remaining: 2.54s
885:    learn: 0.1159780        total: 19.6s    remaining: 2.52s
886:    learn: 0.1158071        total: 19.6s    remaining: 2.5s
887:    learn: 0.1156409        total: 19.6s    remaining: 2.48s
888:    learn: 0.1155100        total: 19.6s    remaining: 2.45s
889:    learn: 0.1154080        total: 19.7s    remaining: 2.43s
890:    learn: 0.1153057        total: 19.7s    remaining: 2.41s
891:    learn: 0.1151398        total: 19.7s    remaining: 2.39s
892:    learn: 0.1149865        total: 19.7s    remaining: 2.36s
893:    learn: 0.1148553        total: 19.8s    remaining: 2.34s
894:    learn: 0.1146859        total: 19.8s    remaining: 2.32s
895:    learn: 0.1145559        total: 19.8s    remaining: 2.3s
896:    learn: 0.1144091        total: 19.8s    remaining: 2.28s
897:    learn: 0.1142486        total: 19.8s    remaining: 2.25s
898:    learn: 0.1140849        total: 19.9s    remaining: 2.23s
899:    learn: 0.1139267        total: 19.9s    remaining: 2.21s
900:    learn: 0.1138118        total: 19.9s    remaining: 2.19s
901:    learn: 0.1137095        total: 19.9s    remaining: 2.17s
902:    learn: 0.1135819        total: 19.9s    remaining: 2.14s
903:    learn: 0.1134398        total: 20s      remaining: 2.12s
904:    learn: 0.1132756        total: 20s      remaining: 2.1s
905:    learn: 0.1131074        total: 20s      remaining: 2.08s
906:    learn: 0.1129999        total: 20s      remaining: 2.05s
907:    learn: 0.1128438        total: 20.1s    remaining: 2.03s
908:    learn: 0.1127009        total: 20.1s    remaining: 2.01s
909:    learn: 0.1125815        total: 20.1s    remaining: 1.99s
910:    learn: 0.1124761        total: 20.1s    remaining: 1.97s
911:    learn: 0.1123315        total: 20.1s    remaining: 1.94s
912:    learn: 0.1122008        total: 20.2s    remaining: 1.92s
913:    learn: 0.1120483        total: 20.2s    remaining: 1.9s
914:    learn: 0.1119160        total: 20.2s    remaining: 1.88s
915:    learn: 0.1117878        total: 20.2s    remaining: 1.85s
916:    learn: 0.1116721        total: 20.2s    remaining: 1.83s
917:    learn: 0.1115020        total: 20.3s    remaining: 1.81s
918:    learn: 0.1113292        total: 20.3s    remaining: 1.79s
919:    learn: 0.1112246        total: 20.3s    remaining: 1.77s
920:    learn: 0.1110526        total: 20.3s    remaining: 1.74s
921:    learn: 0.1108878        total: 20.4s    remaining: 1.72s
922:    learn: 0.1107827        total: 20.4s    remaining: 1.7s
923:    learn: 0.1106450        total: 20.4s    remaining: 1.68s
924:    learn: 0.1105219        total: 20.4s    remaining: 1.66s
925:    learn: 0.1104192        total: 20.4s    remaining: 1.63s
926:    learn: 0.1103573        total: 20.5s    remaining: 1.61s
927:    learn: 0.1102081        total: 20.5s    remaining: 1.59s
```

```
928:    learn: 0.1100669        total: 20.5s    remaining: 1.57s
929:    learn: 0.1099238        total: 20.5s    remaining: 1.54s
930:    learn: 0.1097807        total: 20.5s    remaining: 1.52s
931:    learn: 0.1096706        total: 20.6s    remaining: 1.5s
932:    learn: 0.1095685        total: 20.6s    remaining: 1.48s
933:    learn: 0.1094781        total: 20.6s    remaining: 1.46s
934:    learn: 0.1093507        total: 20.6s    remaining: 1.43s
935:    learn: 0.1092766        total: 20.7s    remaining: 1.41s
936:    learn: 0.1091097        total: 20.7s    remaining: 1.39s
937:    learn: 0.1090008        total: 20.7s    remaining: 1.37s
938:    learn: 0.1088485        total: 20.7s    remaining: 1.35s
939:    learn: 0.1087735        total: 20.7s    remaining: 1.32s
940:    learn: 0.1086277        total: 20.8s    remaining: 1.3s
941:    learn: 0.1085718        total: 20.8s    remaining: 1.28s
942:    learn: 0.1084448        total: 20.8s    remaining: 1.26s
943:    learn: 0.1083298        total: 20.8s    remaining: 1.24s
944:    learn: 0.1081721        total: 20.9s    remaining: 1.21s
945:    learn: 0.1080410        total: 20.9s    remaining: 1.19s
946:    learn: 0.1078786        total: 20.9s    remaining: 1.17s
947:    learn: 0.1077345        total: 20.9s    remaining: 1.15s
948:    learn: 0.1076530        total: 21s      remaining: 1.13s
949:    learn: 0.1075120        total: 21s      remaining: 1.1s
950:    learn: 0.1073757        total: 21s      remaining: 1.08s
951:    learn: 0.1072722        total: 21s      remaining: 1.06s
952:    learn: 0.1071189        total: 21s      remaining: 1.04s
953:    learn: 0.1069833        total: 21.1s    remaining: 1.02s
954:    learn: 0.1068338        total: 21.1s    remaining: 994ms
955:    learn: 0.1067291        total: 21.1s    remaining: 972ms
956:    learn: 0.1066032        total: 21.1s    remaining: 950ms
957:    learn: 0.1064415        total: 21.2s    remaining: 928ms
958:    learn: 0.1063192        total: 21.2s    remaining: 906ms
959:    learn: 0.1062151        total: 21.2s    remaining: 884ms
960:    learn: 0.1060581        total: 21.2s    remaining: 862ms
961:    learn: 0.1059349        total: 21.3s    remaining: 840ms
962:    learn: 0.1057979        total: 21.3s    remaining: 818ms
963:    learn: 0.1056633        total: 21.3s    remaining: 796ms
964:    learn: 0.1055617        total: 21.3s    remaining: 774ms
965:    learn: 0.1054504        total: 21.4s    remaining: 752ms
966:    learn: 0.1052796        total: 21.4s    remaining: 730ms
967:    learn: 0.1051786        total: 21.4s    remaining: 707ms
968:    learn: 0.1050491        total: 21.4s    remaining: 685ms
969:    learn: 0.1049599        total: 21.4s    remaining: 663ms
970:    learn: 0.1048692        total: 21.5s    remaining: 641ms
971:    learn: 0.1047358        total: 21.5s    remaining: 619ms
972:    learn: 0.1045975        total: 21.5s    remaining: 597ms
```

```
973:    learn: 0.1045157        total: 21.5s    remaining: 575ms
974:    learn: 0.1044113        total: 21.6s    remaining: 553ms
975:    learn: 0.1042891        total: 21.6s    remaining: 531ms
976:    learn: 0.1041520        total: 21.6s    remaining: 509ms
977:    learn: 0.1040194        total: 21.6s    remaining: 486ms
978:    learn: 0.1039331        total: 21.6s    remaining: 464ms
979:    learn: 0.1037916        total: 21.7s    remaining: 442ms
980:    learn: 0.1036434        total: 21.7s    remaining: 420ms
981:    learn: 0.1035062        total: 21.7s    remaining: 398ms
982:    learn: 0.1034090        total: 21.7s    remaining: 376ms
983:    learn: 0.1033169        total: 21.8s    remaining: 354ms
984:    learn: 0.1031837        total: 21.8s    remaining: 332ms
985:    learn: 0.1030809        total: 21.8s    remaining: 310ms
986:    learn: 0.1029538        total: 21.8s    remaining: 287ms
987:    learn: 0.1027967        total: 21.8s    remaining: 265ms
988:    learn: 0.1026502        total: 21.9s    remaining: 243ms
989:    learn: 0.1025108        total: 21.9s    remaining: 221ms
990:    learn: 0.1024073        total: 21.9s    remaining: 199ms
991:    learn: 0.1023109        total: 21.9s    remaining: 177ms
992:    learn: 0.1021983        total: 22s      remaining: 155ms
993:    learn: 0.1020597        total: 22s      remaining: 133ms
994:    learn: 0.1019168        total: 22s      remaining: 111ms
995:    learn: 0.1017608        total: 22s      remaining: 88.5ms
996:    learn: 0.1017235        total: 22.1s    remaining: 66.4ms
997:    learn: 0.1016556        total: 22.1s    remaining: 44.2ms
998:    learn: 0.1015189        total: 22.1s    remaining: 22.1ms
999:    learn: 0.1014229        total: 22.1s    remaining: 0us
```

In [89]:

```
evaluate(y_social_labeled_test, y_pred_cb_social)
```

```
Confusion Matrix:
[[4479 2672]
 [ 560 8954]]
Accuracy:  0.806060606060606
Precision:  0.7701703079305006
Recall  0.9411393735547614
F1:  0.8471144749290445
```

BERT

In [90]:

```
#Install simpletransformers
#conda install pytorch cpuonly -c pytorch
```

```
#pip install simpletransformers
```

In [95]:
```
from simpletransformers.classification import ClassificationModel
```

In [ ]:
```

```

In [ ]:
```

```

In [96]:
```
df = pd.DataFrame({'text': X_labeled_train[:, 0],'label':y_agency_labeled_train})
arr = []
for i in range(0, len(X_labeled_test)):
    arr.append(X_labeled_test[i, 0])
model = ClassificationModel('bert', 'bert-base-cased', use_cuda=False, args = {"num_train_epochs": 2,"use_multiprocessing
model.train_model(df)
y_pred_bert_agency = model.predict(arr)
```

```
Some weights of the model checkpoint at bert-base-cased were not used when initializing BertForSequenceClassification:
['cls.predictions.transform.dense.bias', 'cls.predictions.decoder.weight', 'cls.predictions.transform.LayerNorm.bias', 'c
ls.seq_relationship.bias', 'cls.seq_relationship.weight', 'cls.predictions.bias', 'cls.predictions.transform.LayerNorm.we
ight', 'cls.predictions.transform.dense.weight']
- This IS expected if you are initializing BertForSequenceClassification from the checkpoint of a model trained on anothe
r task or with another architecture (e.g. initializing a BertForSequenceClassification model from a BertForPreTraining mo
del).
- This IS NOT expected if you are initializing BertForSequenceClassification from the checkpoint of a model that you expe
ct to be exactly identical (initializing a BertForSequenceClassification model from a BertForSequenceClassification mode
l).
Some weights of BertForSequenceClassification were not initialized from the model checkpoint at bert-base-cased and are n
ewly initialized: ['classifier.weight', 'classifier.bias']
You should probably TRAIN this model on a down-stream task to be able to use it for predictions and inference.
```

In [ ]:
```

```

In [97]:
```
evaluate(y_agency_labeled_test, y_pred_bert_agency[0])
```

```
Confusion Matrix:
[[3899 1000]
 [2063 9703]]
Accuracy:  0.8162016201620163
Precision:  0.9065682518919929
Recall  0.8246642869284379
F1:  0.8636788464106101
```

In [98]:

```
df = pd.DataFrame({'text': X_labeled_train[:, 0],'label':y_social_labeled_train})
arr = []
for i in range(0, len(X_labeled_test)):
    arr.append(X_labeled_test[i, 0])
model = ClassificationModel('bert', 'bert-base-cased', use_cuda=False, args = {"num_train_epochs": 2,"use_multiprocessing
model.train_model(df)
y_pred_bert_social = model.predict(arr)
```

```
Some weights of the model checkpoint at bert-base-cased were not used when initializing BertForSequenceClassification:
['cls.predictions.transform.dense.bias', 'cls.predictions.decoder.weight', 'cls.predictions.transform.LayerNorm.bias', 'c
ls.seq_relationship.bias', 'cls.seq_relationship.weight', 'cls.predictions.bias', 'cls.predictions.transform.LayerNorm.we
ight', 'cls.predictions.transform.dense.weight']
- This IS expected if you are initializing BertForSequenceClassification from the checkpoint of a model trained on anothe
r task or with another architecture (e.g. initializing a BertForSequenceClassification model from a BertForPreTraining mo
del).
- This IS NOT expected if you are initializing BertForSequenceClassification from the checkpoint of a model that you expe
ct to be exactly identical (initializing a BertForSequenceClassification model from a BertForSequenceClassification mode
l).
Some weights of BertForSequenceClassification were not initialized from the model checkpoint at bert-base-cased and are n
ewly initialized: ['classifier.weight', 'classifier.bias']
You should probably TRAIN this model on a down-stream task to be able to use it for predictions and inference.
C:\Users\parit\anaconda3\lib\site-packages\simpletransformers\classification\classification_model.py:585: UserWarning: Da
taframe headers not specified. Falling back to using column 0 as text and column 1 as labels.
  warnings.warn(

C:\Users\parit\anaconda3\lib\site-packages\transformers\optimization.py:306: FutureWarning: This implementation of AdamW
is deprecated and will be removed in a future version. Use the PyTorch implementation torch.optim.AdamW instead, or set `
no_deprecation_warning=True` to disable this warning
  warnings.warn(
```

In [99]:

```
evaluate(y_social_labeled_test, y_pred_bert_social[0])
```

```
Confusion Matrix:
[[6784  367]
 [1090 8424]]
Accuracy:  0.9125712571257125
Precision:  0.9582527585030145
Recall  0.8854319949548034
F1:  0.9204042611308385
```

Using Unlabeled Training Dataset

In [100…

```
train_unlabeled
```

Out[100…

	hmid	moment	age	country	gender	married	parenthood	reflection	duration
0	27673	went successful date someone felt sympathy con...	35.0	1	1	3	0	0	3
1	27675	went gym morning yoga	30.0	1	0	1	1	0	3
2	27678	meditated last night	23.0	0	1	3	0	0	3
3	27679	made new recipe peasant bread came spectacular	30.0	1	1	3	0	0	4
4	27680	got gift elder brother really surprising	23.0	0	1	3	0	0	3
...	...	...	...	...	...	...	...	...	...
72319	128761	spent time daughter	40.0	1	0	3	1	0	4
72320	128762	husband announced getting decent bonus quarter	48.0	1	0	1	1	0	3
72321	128763	pepsi drink	29.0	1	1	3	0	0	0
72322	128764	cuddling girlfriend last night	23.0	1	1	3	0	0	2
72323	128766	great workout last night	35.0	1	1	3	0	0	3

71771 rows × 9 columns

In [101…

```
test_unlabeled
```

Out[101…

	hmid	moment	reflection	age	country	gender	duration	married	parenthood
0	0	I was able to spend the day with my fiance sho...	0	28	1	1	1	3	0

	hmid	moment	reflection	age	country	gender	duration	married	parenthood
1	1	I was able to play with my cat.	0	28	1	1	2	3	0
2	2	I was able to clean my room and gold my laundry.	0	28	1	1	2	3	0
3	3	I spend the day at a party on the beach and I ...	0	24	1	1	3	3	0
4	4	My cat greeting me when I got home from work -...	0	24	1	1	3	3	0
...	...	...	...	...	...	...	...	...	...
17210	21892	My wife and I went for a hike last week and we...	1	34	1	1	3	1	0
17211	21893	I finally hit platinum rank in Overwatch.	1	34	1	1	2	1	0
17212	21897	One of my long-time friends and I finally ackn...	1	34	1	1	1	3	0
17213	21898	I earned a professional certification.	1	34	1	1	3	3	0
17214	21899	I built a new computer.	1	34	1	1	3	3	0

16665 rows × 9 columns

In [102…

```
train_cols = [1, 5, 7, 8, 9, 10, 11]
X_labeled_train = train_labeled.iloc[:, train_cols].values
y_agency_labeled_train = train_labeled.iloc[:, 3].values
y_social_labeled_train = train_labeled.iloc[:, 4].values
train_vectors = vectors(nlp, X_labeled_train)
```

In [103…

```
test_cols = [1, 2, 3, 5, 6, 7, 8]
X_labeled_test = test_labeled.iloc[:, test_cols].values
y_agency_labeled_test = test_labeled.iloc[:, 10].values
y_social_labeled_test = test_labeled.iloc[:, 11].values
test_vectors = vectors(nlp, X_labeled_test)
```

In [104…

```
from sklearn.ensemble import RandomForestClassifier
rf_model_agency = RandomForestClassifier(n_estimators = 200)
rf_model_agency.fit(train_vectors, y_agency_labeled_train)
y_pred_rf_agency = rf_model_agency.predict(test_vectors)
```

In [105…

```
evaluate(y_agency_labeled_test, y_pred_rf_agency)
```

```
Confusion Matrix:
[[  624  4275]
 [  234 11532]]
Accuracy:  0.7294329432943294
Precision:  0.7295501992788005
Recall  0.9801121876593575
F1:  0.8364704602328364
```

In [106…
```
train_cols = [1, 2, 4, 5, 6, 7, 8]
X_unlabeled_train = train_unlabeled.iloc[:, train_cols].values
train_vectors = vectors(nlp, X_unlabeled_train)
```

In [107…
```
y_unlabeled_rf_agency = rf_model_agency.predict(train_vectors)
```

In [108…
```
train_cols_labeled = [1, 5, 7, 8, 9, 10, 11]

train_cols_unlabeled = [1, 2, 4, 5, 6, 7, 8]
```

In [109…
```
combined_df_train_X = pd.concat([train_labeled.iloc[:, train_cols_labeled], train_unlabeled.iloc[:, train_cols_unlabeled]
```

In [110…
```
train_vectors = vectors(nlp, combined_df_train_X.values)
```

In [111…
```
combined_df_train_y = pd.concat([train_labeled.iloc[:, 10], pd.Series(y_unlabeled_rf_agency)], axis=0)
```

In [112…
```
rf_model_agency.fit(train_vectors, combined_df_train_y)
y_pred_rf_agency = rf_model_agency.predict(test_vectors)
```

In [113…
```
evaluate(y_agency_labeled_test, y_pred_rf_agency)
```

```
Confusion Matrix:
[[   98  4801]
 [   22 11744]]
Accuracy:  0.7105910591059106
Precision:  0.7098216983983077
```

```
Recall  0.9981302056773755
F1:  0.8296421885486207
```

In [114…]
```
#Social
train_cols = [1, 5, 7, 8, 9, 10, 11]
X_labeled_train = train_labeled.iloc[:, train_cols].values
y_agency_labeled_train = train_labeled.iloc[:, 3].values
y_social_labeled_train = train_labeled.iloc[:, 4].values
train_vectors = vectors(nlp, X_labeled_train)
rf_model_social = RandomForestClassifier(n_estimators = 200)
rf_model_social.fit(train_vectors, y_social_labeled_train)
y_pred_rf_social = rf_model_social.predict(test_vectors)
```

In [115…]
```
evaluate(y_social_labeled_test, y_pred_rf_social)
```

```
Confusion Matrix:
[[5025 2126]
 [ 730 8784]]
Accuracy:  0.8286228622862286
Precision:  0.8051329055912008
Recall  0.9232709690981711
F1:  0.8601645123384254
```

In [116…]
```
train_cols = [1, 2, 4, 5, 6, 7, 8]
X_unlabeled_train = train_unlabeled.iloc[:, train_cols].values
train_vectors = vectors(nlp, X_unlabeled_train)
y_unlabeled_rf_social = rf_model_social.predict(train_vectors)
```

In [117…]
```
train_cols_labeled = [1, 5, 7, 8, 9, 10, 11]
train_cols_unlabeled = [1, 2, 4, 5, 6, 7, 8]
```

In [118…]
```
combined_df_train_X = pd.concat([train_labeled.iloc[:, train_cols_labeled], train_unlabeled.iloc[:, train_cols_unlabeled]
```

In [119…]
```
train_vectors = vectors(nlp, combined_df_train_X.values)
```

In [120…]
```
combined_df_train_y = pd.concat([train_labeled.iloc[:, 10], pd.Series(y_unlabeled_rf_social)], axis=0)
```

In [121…
```
rf_model_social.fit(train_vectors, combined_df_train_y)
y_pred_rf_social = rf_model_social.predict(test_vectors)
```

In [122…
```
evaluate(y_social_labeled_test, y_pred_rf_social)
```

```
Confusion Matrix:
[[5961 1190]
 [1308 8206]]
Accuracy:  0.8501050105010501
Precision:  0.873350361856109
Recall  0.8625183939457641
F1:  0.8679005817028028
```

In [ ]:

In [ ]: