

LGB_PT

May 5, 2022

1 Hyperparameter tuning for LGB

1.0.1 Import library

```
[ ]: # Pandas and numpy for data manipulation
import pandas as pd
import numpy as np
import seaborn as sns
from sklearn.metrics import roc_auc_score
from timeit import default_timer as timer
import random
import csv
from hyperopt import STATUS_OK
from timeit import default_timer as timer

import matplotlib.pyplot as plt
%matplotlib inline

# Modeling
import lightgbm as lgb

# Evaluation of the model
from sklearn.model_selection import KFold
# MAX_EVALS = 500
MAX_EVALS = 500
N_FOLDS = 10

# bayesian opt
from hyperopt import hp
from hyperopt import tpe
from hyperopt.pyll.stochastic import sample
from hyperopt import Trials
from hyperopt import fmin
```

1.0.2 Read in data and separate into training and testing sets

```
[ ]: data = pd.read_csv('/content/caravan-insurance-challenge.csv')
train = data[data['ORIGIN'] == 'train']
test = data[data['ORIGIN'] == 'test']

# Extract the labels and format properly
train_labels = np.array(train['CARAVAN'].astype(np.int32)).reshape((-1,))
test_labels = np.array(test['CARAVAN'].astype(np.int32)).reshape((-1,))

# Drop the unneeded columns
train = train.drop(columns = ['ORIGIN', 'CARAVAN'])
test = test.drop(columns = ['ORIGIN', 'CARAVAN'])

# Convert to numpy array for splitting in cross validation
features = np.array(train)
test_features = np.array(test)
labels = train_labels[:]

print('Train shape: ', train.shape)
print('Test shape: ', test.shape)
train.head()
```

Train shape: (5822, 85)

Test shape: (4000, 85)

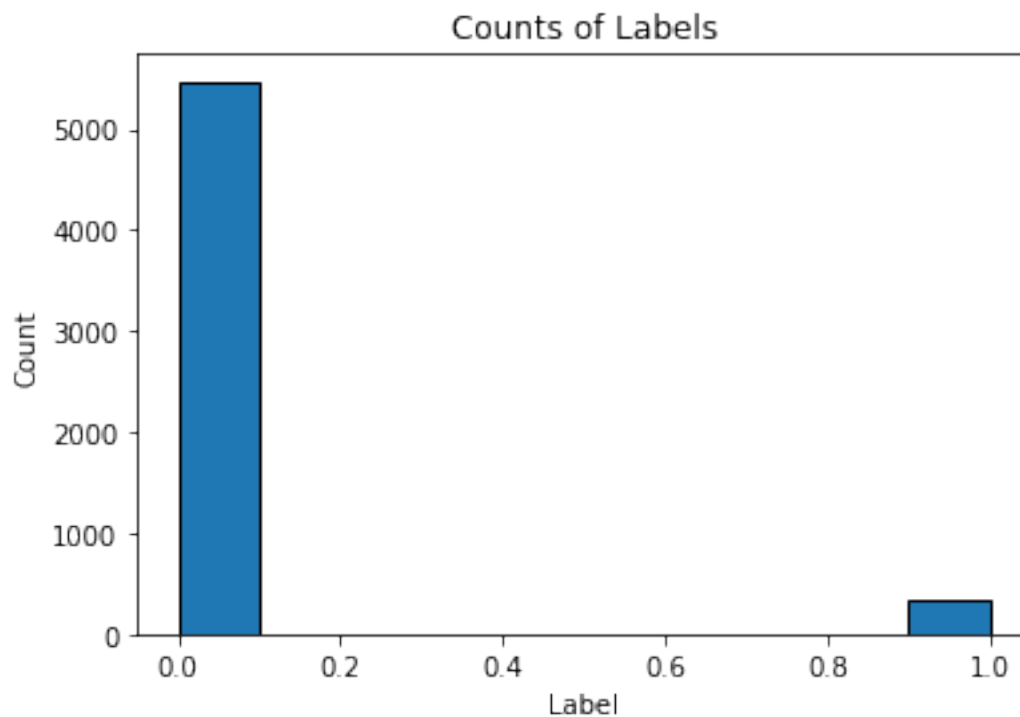
```
[ ]: MOSTYPE  MAANTHUI  MGEMOMV  MGEMLEEF  MOSHOOFD  MGODRK  MGODPR  MGODOV  \
0         33         1         3         2         8         0         5         1
1         37         1         2         2         8         1         4         1
2         37         1         2         2         8         0         4         2
3          9         1         3         3         3         2         3         2
4         40         1         4         2        10         1         4         1

      MGODGE  MRELGE  ...  ALEVEN  APERSONG  AGEZONG  AWAOREG  ABRAND  AZEILPL  \
0          3         7  ...        0         0         0         0         1         0
1          4         6  ...        0         0         0         0         1         0
2          4         3  ...        0         0         0         0         1         0
3          4         5  ...        0         0         0         0         1         0
4          4         7  ...        0         0         0         0         1         0

      APLEZIER  AFIETS  AINBOED  ABYSTAND
0            0         0         0         0
1            0         0         0         0
2            0         0         0         0
3            0         0         0         0
4            0         0         0         0
```

[5 rows x 85 columns]

```
[ ]: plt.hist(labels, edgecolor = 'k');
plt.xlabel('Label'); plt.ylabel('Count'); plt.title('Counts of Labels');
```



1.0.3 Model with default hyperparameters

```
[ ]: model = lgb.LGBMClassifier()
model.get_params()
```

```
[ ]: {'boosting_type': 'gbdt',
      'class_weight': None,
      'colsample_bytree': 1.0,
      'importance_type': 'split',
      'learning_rate': 0.1,
      'max_depth': -1,
      'min_child_samples': 20,
      'min_child_weight': 0.001,
      'min_split_gain': 0.0,
      'n_estimators': 100,
      'n_jobs': -1,
      'num_leaves': 31,
      'objective': None,
      'random_state': None,
      'reg_alpha': 0.0,
```

```
'reg_lambda': 0.0,
'silent': True,
'subsample': 1.0,
'subsample_for_bin': 200000,
'subsample_freq': 0}
```

```
[ ]: start = timer()
model.fit(features, labels)
train_time = timer() - start

predictions = model.predict_proba(test_features)[: , 1]
auc = roc_auc_score(test_labels, predictions)

print('The baseline score on the test set is {:.4f}'.format(auc))
print('The baseline training time is {:.4f} seconds'.format(train_time))
```

The baseline score on the test set is 0.7092.

The baseline training time is 0.2939 seconds

1.0.4 Hyperparameter grid

```
[ ]: param_grid = {
    'class_weight': [None, 'balanced'],
    'boosting_type': ['gbdt', 'goss', 'dart'],
    'num_leaves': list(range(30, 150)),
    'learning_rate': list(np.logspace(np.log(0.005), np.log(0.2), base = np.
→exp(1), num = 1000)),
    'subsample_for_bin': list(range(20000, 300000, 20000)),
    'min_child_samples': list(range(20, 500, 5)),
    'reg_alpha': list(np.linspace(0, 1)),
    'reg_lambda': list(np.linspace(0, 1)),
    'colsample_bytree': list(np.linspace(0.6, 1, 10))
}

# Subsampling (only applicable with 'goss')
subsample_dist = list(np.linspace(0.5, 1, 100))
```

1.0.5 Randomly sample parameters for gbm

```
[ ]: params = {key: random.sample(value, 1)[0] for key, value in param_grid.items()}
params
```

```
[ ]: {'boosting_type': 'goss',
      'class_weight': 'balanced',
      'colsample_bytree': 0.6444444444444444,
      'learning_rate': 0.03953863309933855,
      'min_child_samples': 210,
```

```
'num_leaves': 59,
'reg_alpha': 0.32653061224489793,
'reg_lambda': 0.8775510204081632,
'subsample_for_bin': 40000}
```

1.0.6 Create a lgb dataset

```
[ ]: train_set = lgb.Dataset(features, label = labels)
```

1.0.7 Perform cross validation with 10 folds

```
[ ]: r = lgb.cv(params, train_set, num_boost_round = 100, nfold = 10, metrics = 'auc',
    verbose_eval = False, seed = 50)

# Highest score
r_best = np.max(r['auc-mean'])

# Standard deviation of best score
r_best_std = r['auc-stdv'][np.argmax(r['auc-mean'])]

print('The maximum ROC AUC on the validation set was {:.5f} with std of {:.5f}.'.
    format(r_best, r_best_std))
print('The ideal number of iterations was {}'.format(np.argmax(r['auc-mean']) + 1))
```

The maximum ROC AUC on the validation set was 0.76053 with std of 0.04667.
The ideal number of iterations was 25.

```
[ ]: predictions = model.predict_proba(test_features)[: , 1]
auc = roc_auc_score(test_labels, predictions)
```

1.0.8 Dataframe to hold cv results

```
[ ]: random_results = pd.DataFrame(columns = ['loss', 'params', 'iteration',
    'estimators', 'time'],
    index = list(range(MAX_EVALS)))
```

1.0.9 Objective function for random search

```
[ ]: def random_objective(params, iteration, n_folds = N_FOLDS):
    """Random search objective function. Takes in hyperparameters
    and returns a list of results to be saved."""

    start = timer()

    # Perform n_folds cross validation
```

```

cv_results = lgb.cv(params, train_set, num_boost_round = 100, nfold = 
↪n_folds,
                    metrics = 'auc', seed = 50)

end = timer()
best_score = np.max(cv_results['auc-mean'])

# Loss must be minimized
loss = 1 - best_score

# Boosting rounds that returned the highest cv score
n_estimators = int(np.argmax(cv_results['auc-mean']) + 1)

# Return list of results
return [loss, params, iteration, n_estimators, end - start]

```

1.0.10 Running random search

```

[ ]: random.seed(50)

# Iterate through the specified number of evaluations
for i in range(MAX_EVALS):

    # Randomly sample parameters for gbm
    print("Iteration: ", i+1)
    params = {key: random.sample(value, 1)[0] for key, value in param_grid.
↪items()}

    print(params)

    if params['boosting_type'] == 'goss':
        # Cannot subsample with goss
        params['subsample'] = 1.0
    else:
        # Subsample supported for gdbt and dart
        params['subsample'] = random.sample(subsample_dist, 1)[0]

    results_list = random_objective(params, i)

    # Add results to next row in dataframe
    random_results.loc[i, :] = results_list

```

```

Iteration: 1
{'class_weight': 'balanced', 'boosting_type': 'goss', 'num_leaves': 76,
'learning_rate': 0.055533968216953146, 'subsample_for_bin': 80000,
'min_child_samples': 460, 'reg_alpha': 0.6122448979591836, 'reg_lambda': 1.0,
'colsample_bytree': 0.8222222222222222}

```

```

Iteration: 2
{'class_weight': None, 'boosting_type': 'dart', 'num_leaves': 70,
 'learning_rate': 0.011646863384981408, 'subsample_for_bin': 220000,
 'min_child_samples': 375, 'reg_alpha': 0.1020408163265306, 'reg_lambda':
 0.18367346938775508, 'colsample_bytree': 0.8222222222222222}
Iteration: 3
{'class_weight': 'balanced', 'boosting_type': 'goss', 'num_leaves': 58,
 'learning_rate': 0.010197109660117238, 'subsample_for_bin': 40000,
 'min_child_samples': 230, 'reg_alpha': 0.7755102040816326, 'reg_lambda':
 0.7755102040816326, 'colsample_bytree': 0.8666666666666667}
Iteration: 4
{'class_weight': None, 'boosting_type': 'gbdt', 'num_leaves': 118,
 'learning_rate': 0.048981732603349946, 'subsample_for_bin': 280000,
 'min_child_samples': 230, 'reg_alpha': 0.8979591836734693, 'reg_lambda':
 0.836734693877551, 'colsample_bytree': 0.8666666666666667}
Iteration: 5
{'class_weight': None, 'boosting_type': 'goss', 'num_leaves': 64,
 'learning_rate': 0.10213232309588141, 'subsample_for_bin': 140000,
 'min_child_samples': 465, 'reg_alpha': 0.12244897959183673, 'reg_lambda':
 0.24489795918367346, 'colsample_bytree': 0.9111111111111111}
Iteration: 6
{'class_weight': 'balanced', 'boosting_type': 'dart', 'num_leaves': 104,
 'learning_rate': 0.02846397739454339, 'subsample_for_bin': 60000,
 'min_child_samples': 190, 'reg_alpha': 0.7959183673469387, 'reg_lambda':
 0.26530612244897955, 'colsample_bytree': 0.9555555555555555}
Iteration: 7
{'class_weight': None, 'boosting_type': 'goss', 'num_leaves': 117,
 'learning_rate': 0.05293111954843996, 'subsample_for_bin': 240000,
 'min_child_samples': 95, 'reg_alpha': 0.8163265306122448, 'reg_lambda':
 0.6938775510204082, 'colsample_bytree': 0.9111111111111111}
Iteration: 8
{'class_weight': 'balanced', 'boosting_type': 'dart', 'num_leaves': 134,
 'learning_rate': 0.037270312367259056, 'subsample_for_bin': 280000,
 'min_child_samples': 450, 'reg_alpha': 0.16326530612244897, 'reg_lambda':
 0.6326530612244897, 'colsample_bytree': 1.0}
Iteration: 9
{'class_weight': 'balanced', 'boosting_type': 'gbdt', 'num_leaves': 139,
 'learning_rate': 0.020042299081514503, 'subsample_for_bin': 260000,
 'min_child_samples': 350, 'reg_alpha': 0.18367346938775508, 'reg_lambda': 0.0,
 'colsample_bytree': 0.8222222222222222}
Iteration: 10
{'class_weight': 'balanced', 'boosting_type': 'goss', 'num_leaves': 131,
 'learning_rate': 0.12421023520674607, 'subsample_for_bin': 220000,
 'min_child_samples': 360, 'reg_alpha': 0.2857142857142857, 'reg_lambda':
 0.2040816326530612, 'colsample_bytree': 1.0}
Iteration: 11
{'class_weight': None, 'boosting_type': 'gbdt', 'num_leaves': 62,
 'learning_rate': 0.02071955918890094, 'subsample_for_bin': 260000,

```

```

'min_child_samples': 175, 'reg_alpha': 0.42857142857142855, 'reg_lambda':
0.04081632653061224, 'colsample_bytree': 0.9555555555555555}
Iteration: 12
{'class_weight': None, 'boosting_type': 'dart', 'num_leaves': 60,
'learning_rate': 0.06581535611293016, 'subsample_for_bin': 100000,
'min_child_samples': 355, 'reg_alpha': 0.5306122448979591, 'reg_lambda':
0.5918367346938775, 'colsample_bytree': 1.0}
Iteration: 13
{'class_weight': 'balanced', 'boosting_type': 'goss', 'num_leaves': 41,
'learning_rate': 0.022891772973308803, 'subsample_for_bin': 40000,
'min_child_samples': 250, 'reg_alpha': 0.061224489795918366, 'reg_lambda': 1.0,
'colsample_bytree': 0.6}
Iteration: 14
{'class_weight': None, 'boosting_type': 'goss', 'num_leaves': 115,
'learning_rate': 0.055945612728102, 'subsample_for_bin': 200000,
'min_child_samples': 25, 'reg_alpha': 0.3877551020408163, 'reg_lambda':
0.4081632653061224, 'colsample_bytree': 0.8222222222222222}
Iteration: 15
{'class_weight': 'balanced', 'boosting_type': 'gbdt', 'num_leaves': 68,
'learning_rate': 0.009127822372082045, 'subsample_for_bin': 140000,
'min_child_samples': 145, 'reg_alpha': 0.14285714285714285, 'reg_lambda':
0.8571428571428571, 'colsample_bytree': 0.6444444444444444}
Iteration: 16
{'class_weight': None, 'boosting_type': 'gbdt', 'num_leaves': 36,
'learning_rate': 0.008572448761425775, 'subsample_for_bin': 20000,
'min_child_samples': 215, 'reg_alpha': 0.8775510204081632, 'reg_lambda':
0.9591836734693877, 'colsample_bytree': 0.8222222222222222}
Iteration: 17
{'class_weight': None, 'boosting_type': 'dart', 'num_leaves': 36,
'learning_rate': 0.012401415643146391, 'subsample_for_bin': 200000,
'min_child_samples': 470, 'reg_alpha': 0.3877551020408163, 'reg_lambda':
0.8979591836734693, 'colsample_bytree': 1.0}
Iteration: 18
{'class_weight': None, 'boosting_type': 'goss', 'num_leaves': 81,
'learning_rate': 0.0255734511264479, 'subsample_for_bin': 120000,
'min_child_samples': 365, 'reg_alpha': 0.18367346938775508, 'reg_lambda':
0.2857142857142857, 'colsample_bytree': 0.6}
Iteration: 19
{'class_weight': 'balanced', 'boosting_type': 'dart', 'num_leaves': 72,
'learning_rate': 0.15330849225623966, 'subsample_for_bin': 140000,
'min_child_samples': 225, 'reg_alpha': 0.04081632653061224, 'reg_lambda':
0.18367346938775508, 'colsample_bytree': 0.9555555555555555}
Iteration: 20
{'class_weight': 'balanced', 'boosting_type': 'gbdt', 'num_leaves': 133,
'learning_rate': 0.007673526341891829, 'subsample_for_bin': 120000,
'min_child_samples': 260, 'reg_alpha': 0.9183673469387754, 'reg_lambda':
0.32653061224489793, 'colsample_bytree': 0.9555555555555555}
Iteration: 21

```



```

{'class_weight': None, 'boosting_type': 'gbdt', 'num_leaves': 101,
'learning_rate': 0.006450936939768325, 'subsample_for_bin': 20000,
'min_child_samples': 85, 'reg_alpha': 0.3877551020408163, 'reg_lambda':
0.8163265306122448, 'colsample_bytree': 0.9111111111111111}
Iteration: 22
{'class_weight': 'balanced', 'boosting_type': 'goss', 'num_leaves': 130,
'learning_rate': 0.061583063540367876, 'subsample_for_bin': 200000,
'min_child_samples': 175, 'reg_alpha': 0.32653061224489793, 'reg_lambda':
0.2857142857142857, 'colsample_bytree': 1.0}
Iteration: 23
{'class_weight': None, 'boosting_type': 'gbdt', 'num_leaves': 68,
'learning_rate': 0.012726146225595376, 'subsample_for_bin': 20000,
'min_child_samples': 375, 'reg_alpha': 0.6326530612244897, 'reg_lambda':
0.22448979591836732, 'colsample_bytree': 0.7333333333333333}
Iteration: 24
{'class_weight': 'balanced', 'boosting_type': 'dart', 'num_leaves': 78,
'learning_rate': 0.09008212992267725, 'subsample_for_bin': 20000,
'min_child_samples': 485, 'reg_alpha': 0.36734693877551017, 'reg_lambda':
0.7142857142857142, 'colsample_bytree': 0.6444444444444444}
Iteration: 25
{'class_weight': 'balanced', 'boosting_type': 'gbdt', 'num_leaves': 92,
'learning_rate': 0.021899563889224465, 'subsample_for_bin': 260000,
'min_child_samples': 365, 'reg_alpha': 0.061224489795918366, 'reg_lambda':
0.673469387755102, 'colsample_bytree': 0.7777777777777778}
Iteration: 26
{'class_weight': None, 'boosting_type': 'gbdt', 'num_leaves': 51,
'learning_rate': 0.17253747952889908, 'subsample_for_bin': 260000,
'min_child_samples': 230, 'reg_alpha': 0.6530612244897959, 'reg_lambda':
0.24489795918367346, 'colsample_bytree': 0.6}
Iteration: 27
{'class_weight': None, 'boosting_type': 'goss', 'num_leaves': 66,
'learning_rate': 0.07298436232037893, 'subsample_for_bin': 220000,
'min_child_samples': 315, 'reg_alpha': 0.8163265306122448, 'reg_lambda':
0.8163265306122448, 'colsample_bytree': 0.9555555555555555}
Iteration: 28
{'class_weight': None, 'boosting_type': 'gbdt', 'num_leaves': 144,
'learning_rate': 0.005774480071545175, 'subsample_for_bin': 120000,
'min_child_samples': 35, 'reg_alpha': 0.24489795918367346, 'reg_lambda':
0.1020408163265306, 'colsample_bytree': 0.7333333333333333}
Iteration: 29
{'class_weight': None, 'boosting_type': 'dart', 'num_leaves': 134,
'learning_rate': 0.02634017457899043, 'subsample_for_bin': 40000,
'min_child_samples': 180, 'reg_alpha': 0.9387755102040816, 'reg_lambda':
0.6326530612244897, 'colsample_bytree': 0.7333333333333333}
Iteration: 30
{'class_weight': 'balanced', 'boosting_type': 'goss', 'num_leaves': 109,
'learning_rate': 0.006194161098119677, 'subsample_for_bin': 40000,
'min_child_samples': 70, 'reg_alpha': 0.9795918367346939, 'reg_lambda':

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0.4693877551020408, 'colsample_bytree': 0.8666666666666667}
Iteration: 31
{'class_weight': None, 'boosting_type': 'gbdt', 'num_leaves': 78,
 'learning_rate': 0.030196332879124828, 'subsample_for_bin': 200000,
 'min_child_samples': 220, 'reg_alpha': 0.5510204081632653, 'reg_lambda': 1.0,
 'colsample_bytree': 0.6444444444444444}
Iteration: 32
{'class_weight': 'balanced', 'boosting_type': 'goss', 'num_leaves': 61,
 'learning_rate': 0.027943272602300912, 'subsample_for_bin': 220000,
 'min_child_samples': 460, 'reg_alpha': 0.7142857142857142, 'reg_lambda':
 0.673469387755102, 'colsample_bytree': 0.6444444444444444}
Iteration: 33
{'class_weight': None, 'boosting_type': 'gbdt', 'num_leaves': 115,
 'learning_rate': 0.008993992591122319, 'subsample_for_bin': 180000,
 'min_child_samples': 25, 'reg_alpha': 0.6122448979591836, 'reg_lambda':
 0.36734693877551017, 'colsample_bytree': 0.7777777777777778}
Iteration: 34
{'class_weight': 'balanced', 'boosting_type': 'dart', 'num_leaves': 101,
 'learning_rate': 0.18783119153687952, 'subsample_for_bin': 200000,
 'min_child_samples': 260, 'reg_alpha': 0.673469387755102, 'reg_lambda':
 0.18367346938775508, 'colsample_bytree': 1.0}
Iteration: 35
{'class_weight': None, 'boosting_type': 'dart', 'num_leaves': 57,
 'learning_rate': 0.022143509726932693, 'subsample_for_bin': 140000,
 'min_child_samples': 195, 'reg_alpha': 0.42857142857142855, 'reg_lambda':
 0.8775510204081632, 'colsample_bytree': 0.8222222222222222}
Iteration: 36
{'class_weight': 'balanced', 'boosting_type': 'goss', 'num_leaves': 69,
 'learning_rate': 0.1656697242034905, 'subsample_for_bin': 160000,
 'min_child_samples': 115, 'reg_alpha': 0.12244897959183673, 'reg_lambda':
 0.08163265306122448, 'colsample_bytree': 0.9555555555555555}
Iteration: 37
{'class_weight': 'balanced', 'boosting_type': 'dart', 'num_leaves': 143,
 'learning_rate': 0.05532928317911197, 'subsample_for_bin': 140000,
 'min_child_samples': 280, 'reg_alpha': 0.6122448979591836, 'reg_lambda':
 0.6938775510204082, 'colsample_bytree': 0.6}
Iteration: 38
{'class_weight': None, 'boosting_type': 'gbdt', 'num_leaves': 110,
 'learning_rate': 0.043845419886860144, 'subsample_for_bin': 260000,
 'min_child_samples': 215, 'reg_alpha': 0.5918367346938775, 'reg_lambda':
 0.836734693877551, 'colsample_bytree': 0.8222222222222222}
Iteration: 39
{'class_weight': 'balanced', 'boosting_type': 'gbdt', 'num_leaves': 50,
 'learning_rate': 0.012632507993991704, 'subsample_for_bin': 180000,
 'min_child_samples': 245, 'reg_alpha': 0.0, 'reg_lambda': 1.0,
 'colsample_bytree': 0.8222222222222222}
Iteration: 40
{'class_weight': None, 'boosting_type': 'dart', 'num_leaves': 81,

```

```

'learning_rate': 0.07974762271777591, 'subsample_for_bin': 220000,
'min_child_samples': 290, 'reg_alpha': 0.42857142857142855, 'reg_lambda':
0.673469387755102, 'colsample_bytree': 1.0}
Iteration: 41
{'class_weight': 'balanced', 'boosting_type': 'goss', 'num_leaves': 87,
'learning_rate': 0.16505910488604397, 'subsample_for_bin': 220000,
'min_child_samples': 430, 'reg_alpha': 0.24489795918367346, 'reg_lambda':
0.22448979591836732, 'colsample_bytree': 1.0}
Iteration: 42
{'class_weight': 'balanced', 'boosting_type': 'dart', 'num_leaves': 138,
'learning_rate': 0.021980579091407017, 'subsample_for_bin': 260000,
'min_child_samples': 310, 'reg_alpha': 0.9795918367346939, 'reg_lambda':
0.8979591836734693, 'colsample_bytree': 0.8222222222222222}
Iteration: 43
{'class_weight': 'balanced', 'boosting_type': 'dart', 'num_leaves': 140,
'learning_rate': 0.025013090700207016, 'subsample_for_bin': 220000,
'min_child_samples': 55, 'reg_alpha': 0.5306122448979591, 'reg_lambda':
0.42857142857142855, 'colsample_bytree': 0.7333333333333333}
Iteration: 44
{'class_weight': None, 'boosting_type': 'dart', 'num_leaves': 74,
'learning_rate': 0.051390373088866674, 'subsample_for_bin': 220000,
'min_child_samples': 495, 'reg_alpha': 0.8571428571428571, 'reg_lambda':
0.5918367346938775, 'colsample_bytree': 0.6}
Iteration: 45
{'class_weight': 'balanced', 'boosting_type': 'gbdt', 'num_leaves': 64,
'learning_rate': 0.023232400445675372, 'subsample_for_bin': 160000,
'min_child_samples': 185, 'reg_alpha': 0.24489795918367346, 'reg_lambda':
0.02040816326530612, 'colsample_bytree': 0.7777777777777778}
Iteration: 46
{'class_weight': None, 'boosting_type': 'dart', 'num_leaves': 73,
'learning_rate': 0.11159664496056187, 'subsample_for_bin': 40000,
'min_child_samples': 480, 'reg_alpha': 0.4693877551020408, 'reg_lambda': 1.0,
'colsample_bytree': 0.8222222222222222}
Iteration: 47
{'class_weight': 'balanced', 'boosting_type': 'gbdt', 'num_leaves': 31,
'learning_rate': 0.02614636513157514, 'subsample_for_bin': 40000,
'min_child_samples': 390, 'reg_alpha': 0.36734693877551017, 'reg_lambda':
0.5102040816326531, 'colsample_bytree': 0.6444444444444444}
Iteration: 48
{'class_weight': None, 'boosting_type': 'goss', 'num_leaves': 117,
'learning_rate': 0.024284996692974452, 'subsample_for_bin': 60000,
'min_child_samples': 365, 'reg_alpha': 0.673469387755102, 'reg_lambda':
0.16326530612244897, 'colsample_bytree': 0.7333333333333333}
Iteration: 49
{'class_weight': 'balanced', 'boosting_type': 'gbdt', 'num_leaves': 120,
'learning_rate': 0.16875687224624136, 'subsample_for_bin': 20000,
'min_child_samples': 180, 'reg_alpha': 0.5510204081632653, 'reg_lambda':
0.9795918367346939, 'colsample_bytree': 0.8666666666666667}

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Iteration: 50
{'class_weight': 'balanced', 'boosting_type': 'dart', 'num_leaves': 59,
'learning_rate': 0.005544630207207856, 'subsample_for_bin': 60000,
'min_child_samples': 475, 'reg_alpha': 0.9795918367346939, 'reg_lambda':
0.2857142857142857, 'colsample_bytree': 0.7777777777777778}
Iteration: 51
{'class_weight': 'balanced', 'boosting_type': 'goss', 'num_leaves': 123,
'learning_rate': 0.05913178504865036, 'subsample_for_bin': 80000,
'min_child_samples': 395, 'reg_alpha': 0.5918367346938775, 'reg_lambda':
0.7959183673469387, 'colsample_bytree': 0.9111111111111111}
Iteration: 52
{'class_weight': 'balanced', 'boosting_type': 'gbdt', 'num_leaves': 109,
'learning_rate': 0.02867496609994534, 'subsample_for_bin': 260000,
'min_child_samples': 465, 'reg_alpha': 0.8775510204081632, 'reg_lambda':
0.3469387755102041, 'colsample_bytree': 0.8666666666666667}
Iteration: 53
{'class_weight': 'balanced', 'boosting_type': 'dart', 'num_leaves': 60,
'learning_rate': 0.08123366803215583, 'subsample_for_bin': 280000,
'min_child_samples': 135, 'reg_alpha': 0.6530612244897959, 'reg_lambda':
0.6122448979591836, 'colsample_bytree': 0.9555555555555555}
Iteration: 54
{'class_weight': 'balanced', 'boosting_type': 'dart', 'num_leaves': 101,
'learning_rate': 0.011561166452715621, 'subsample_for_bin': 40000,
'min_child_samples': 110, 'reg_alpha': 0.7142857142857142, 'reg_lambda':
0.4693877551020408, 'colsample_bytree': 0.9555555555555555}
Iteration: 55
{'class_weight': 'balanced', 'boosting_type': 'gbdt', 'num_leaves': 145,
'learning_rate': 0.1455844269527345, 'subsample_for_bin': 240000,
'min_child_samples': 270, 'reg_alpha': 0.673469387755102, 'reg_lambda':
0.5102040816326531, 'colsample_bytree': 0.7333333333333333}
Iteration: 56
{'class_weight': None, 'boosting_type': 'goss', 'num_leaves': 130,
'learning_rate': 0.007874457328332661, 'subsample_for_bin': 120000,
'min_child_samples': 335, 'reg_alpha': 0.2040816326530612, 'reg_lambda':
0.2040816326530612, 'colsample_bytree': 0.6}
Iteration: 57
{'class_weight': None, 'boosting_type': 'gbdt', 'num_leaves': 33,
'learning_rate': 0.08004264091132256, 'subsample_for_bin': 240000,
'min_child_samples': 70, 'reg_alpha': 0.6938775510204082, 'reg_lambda':
0.5714285714285714, 'colsample_bytree': 0.8222222222222222}
Iteration: 58
{'class_weight': 'balanced', 'boosting_type': 'gbdt', 'num_leaves': 135,
'learning_rate': 0.005112013431877946, 'subsample_for_bin': 180000,
'min_child_samples': 225, 'reg_alpha': 0.9183673469387754, 'reg_lambda':
0.7959183673469387, 'colsample_bytree': 0.8222222222222222}
Iteration: 59
{'class_weight': None, 'boosting_type': 'dart', 'num_leaves': 109,
'learning_rate': 0.07191428439547362, 'subsample_for_bin': 160000,

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'min_child_samples': 295, 'reg_alpha': 0.9795918367346939, 'reg_lambda':
0.7142857142857142, 'colsample_bytree': 0.6}
Iteration: 60
{'class_weight': None, 'boosting_type': 'goss', 'num_leaves': 105,
'learning_rate': 0.02473753188230597, 'subsample_for_bin': 160000,
'min_child_samples': 480, 'reg_alpha': 0.4897959183673469, 'reg_lambda':
0.22448979591836732, 'colsample_bytree': 0.8666666666666667}
Iteration: 61
{'class_weight': None, 'boosting_type': 'goss', 'num_leaves': 73,
'learning_rate': 0.10100717376671212, 'subsample_for_bin': 40000,
'min_child_samples': 485, 'reg_alpha': 0.36734693877551017, 'reg_lambda':
0.8571428571428571, 'colsample_bytree': 0.8666666666666667}
Iteration: 62
{'class_weight': 'balanced', 'boosting_type': 'dart', 'num_leaves': 97,
'learning_rate': 0.007422701832211806, 'subsample_for_bin': 160000,
'min_child_samples': 470, 'reg_alpha': 0.14285714285714285, 'reg_lambda':
0.8775510204081632, 'colsample_bytree': 0.7333333333333333}
Iteration: 63
{'class_weight': 'balanced', 'boosting_type': 'gbdt', 'num_leaves': 107,
'learning_rate': 0.02733098511444611, 'subsample_for_bin': 20000,
'min_child_samples': 400, 'reg_alpha': 1.0, 'reg_lambda': 0.9795918367346939,
'colsample_bytree': 0.8222222222222222}
Iteration: 64
{'class_weight': None, 'boosting_type': 'gbdt', 'num_leaves': 100,
'learning_rate': 0.07407036290619914, 'subsample_for_bin': 260000,
'min_child_samples': 285, 'reg_alpha': 0.4693877551020408, 'reg_lambda':
0.6326530612244897, 'colsample_bytree': 0.8222222222222222}
Iteration: 65
{'class_weight': 'balanced', 'boosting_type': 'dart', 'num_leaves': 80,
'learning_rate': 0.02614636513157514, 'subsample_for_bin': 120000,
'min_child_samples': 125, 'reg_alpha': 0.6122448979591836, 'reg_lambda':
0.673469387755102, 'colsample_bytree': 0.6888888888888889}
Iteration: 66
{'class_weight': None, 'boosting_type': 'gbdt', 'num_leaves': 60,
'learning_rate': 0.10636616732547971, 'subsample_for_bin': 40000,
'min_child_samples': 200, 'reg_alpha': 0.1020408163265306, 'reg_lambda':
0.8979591836734693, 'colsample_bytree': 0.9111111111111111}
Iteration: 67
{'class_weight': 'balanced', 'boosting_type': 'dart', 'num_leaves': 133,
'learning_rate': 0.032994544109792474, 'subsample_for_bin': 180000,
'min_child_samples': 110, 'reg_alpha': 0.6938775510204082, 'reg_lambda':
0.7551020408163265, 'colsample_bytree': 0.8666666666666667}
Iteration: 68
{'class_weight': None, 'boosting_type': 'dart', 'num_leaves': 43,
'learning_rate': 0.02206189400106402, 'subsample_for_bin': 240000,
'min_child_samples': 385, 'reg_alpha': 0.7551020408163265, 'reg_lambda':
0.22448979591836732, 'colsample_bytree': 0.6}
Iteration: 69

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{'class_weight': 'balanced', 'boosting_type': 'goss', 'num_leaves': 114,
'learning_rate': 0.03740819008514941, 'subsample_for_bin': 240000,
'min_child_samples': 235, 'reg_alpha': 0.3877551020408163, 'reg_lambda': 1.0,
'colsample_bytree': 0.7777777777777778}
Iteration: 70
{'class_weight': None, 'boosting_type': 'goss', 'num_leaves': 98,
'learning_rate': 0.018753468046486473, 'subsample_for_bin': 280000,
'min_child_samples': 310, 'reg_alpha': 0.9591836734693877, 'reg_lambda':
0.6122448979591836, 'colsample_bytree': 0.6}
Iteration: 71
{'class_weight': 'balanced', 'boosting_type': 'goss', 'num_leaves': 93,
'learning_rate': 0.042100178118260397, 'subsample_for_bin': 160000,
'min_child_samples': 65, 'reg_alpha': 0.3469387755102041, 'reg_lambda':
0.6326530612244897, 'colsample_bytree': 1.0}
Iteration: 72
{'class_weight': None, 'boosting_type': 'goss', 'num_leaves': 135,
'learning_rate': 0.011996050644130365, 'subsample_for_bin': 200000,
'min_child_samples': 305, 'reg_alpha': 0.16326530612244897, 'reg_lambda':
0.3877551020408163, 'colsample_bytree': 1.0}
Iteration: 73
{'class_weight': None, 'boosting_type': 'goss', 'num_leaves': 32,
'learning_rate': 0.020567105897255245, 'subsample_for_bin': 120000,
'min_child_samples': 425, 'reg_alpha': 0.22448979591836732, 'reg_lambda': 0.0,
'colsample_bytree': 0.8666666666666667}
Iteration: 74
{'class_weight': None, 'boosting_type': 'dart', 'num_leaves': 44,
'learning_rate': 0.02473753188230597, 'subsample_for_bin': 60000,
'min_child_samples': 385, 'reg_alpha': 1.0, 'reg_lambda': 0.061224489795918366,
'colsample_bytree': 1.0}
Iteration: 75
{'class_weight': None, 'boosting_type': 'goss', 'num_leaves': 88,
'learning_rate': 0.16025447891850195, 'subsample_for_bin': 200000,
'min_child_samples': 205, 'reg_alpha': 0.1020408163265306, 'reg_lambda':
0.7959183673469387, 'colsample_bytree': 0.8666666666666667}
Iteration: 76
{'class_weight': None, 'boosting_type': 'dart', 'num_leaves': 61,
'learning_rate': 0.028887518755219454, 'subsample_for_bin': 180000,
'min_child_samples': 470, 'reg_alpha': 0.7959183673469387, 'reg_lambda':
0.12244897959183673, 'colsample_bytree': 0.9555555555555555}
Iteration: 77
{'class_weight': None, 'boosting_type': 'goss', 'num_leaves': 136,
'learning_rate': 0.1764027825708195, 'subsample_for_bin': 280000,
'min_child_samples': 355, 'reg_alpha': 0.836734693877551, 'reg_lambda':
0.18367346938775508, 'colsample_bytree': 0.6444444444444444}
Iteration: 78
{'class_weight': None, 'boosting_type': 'dart', 'num_leaves': 41,
'learning_rate': 0.16938117107675146, 'subsample_for_bin': 120000,
'min_child_samples': 150, 'reg_alpha': 0.3877551020408163, 'reg_lambda':

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0.36734693877551017, 'colsample_bytree': 0.9111111111111111}
Iteration: 79
{'class_weight': None, 'boosting_type': 'gbdt', 'num_leaves': 96,
 'learning_rate': 0.030645651529774956, 'subsample_for_bin': 240000,
 'min_child_samples': 470, 'reg_alpha': 0.9795918367346939, 'reg_lambda':
 0.6530612244897959, 'colsample_bytree': 1.0}
Iteration: 80
{'class_weight': None, 'boosting_type': 'dart', 'num_leaves': 71,
 'learning_rate': 0.03782489118082559, 'subsample_for_bin': 200000,
 'min_child_samples': 100, 'reg_alpha': 0.2857142857142857, 'reg_lambda':
 0.3469387755102041, 'colsample_bytree': 0.6444444444444444}
Iteration: 81
{'class_weight': None, 'boosting_type': 'goss', 'num_leaves': 123,
 'learning_rate': 0.013401339215436023, 'subsample_for_bin': 180000,
 'min_child_samples': 225, 'reg_alpha': 0.2857142857142857, 'reg_lambda':
 0.061224489795918366, 'colsample_bytree': 0.8666666666666667}
Iteration: 82
{'class_weight': 'balanced', 'boosting_type': 'gbdt', 'num_leaves': 104,
 'learning_rate': 0.04148291614861856, 'subsample_for_bin': 20000,
 'min_child_samples': 480, 'reg_alpha': 0.18367346938775508, 'reg_lambda':
 0.5510204081632653, 'colsample_bytree': 0.9555555555555555}
Iteration: 83
{'class_weight': None, 'boosting_type': 'goss', 'num_leaves': 40,
 'learning_rate': 0.03487362448885011, 'subsample_for_bin': 100000,
 'min_child_samples': 45, 'reg_alpha': 0.7346938775510203, 'reg_lambda':
 0.9795918367346939, 'colsample_bytree': 0.6}
Iteration: 84
{'class_weight': 'balanced', 'boosting_type': 'dart', 'num_leaves': 128,
 'learning_rate': 0.014269556728872437, 'subsample_for_bin': 240000,
 'min_child_samples': 350, 'reg_alpha': 0.04081632653061224, 'reg_lambda':
 0.9183673469387754, 'colsample_bytree': 0.6}
Iteration: 85
{'class_weight': None, 'boosting_type': 'dart', 'num_leaves': 130,
 'learning_rate': 0.01093822113634156, 'subsample_for_bin': 60000,
 'min_child_samples': 365, 'reg_alpha': 0.4897959183673469, 'reg_lambda':
 0.04081632653061224, 'colsample_bytree': 0.8666666666666667}
Iteration: 86
{'class_weight': 'balanced', 'boosting_type': 'dart', 'num_leaves': 49,
 'learning_rate': 0.011820167638891784, 'subsample_for_bin': 80000,
 'min_child_samples': 395, 'reg_alpha': 0.4693877551020408, 'reg_lambda':
 0.22448979591836732, 'colsample_bytree': 1.0}
Iteration: 87
{'class_weight': 'balanced', 'boosting_type': 'dart', 'num_leaves': 144,
 'learning_rate': 0.17381641040122672, 'subsample_for_bin': 80000,
 'min_child_samples': 55, 'reg_alpha': 0.1020408163265306, 'reg_lambda':
 0.836734693877551, 'colsample_bytree': 0.9555555555555555}
Iteration: 88
{'class_weight': None, 'boosting_type': 'goss', 'num_leaves': 111,

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'learning_rate': 0.012867906601167418, 'subsample_for_bin': 180000,
'min_child_samples': 380, 'reg_alpha': 0.9387755102040816, 'reg_lambda':
0.4081632653061224, 'colsample_bytree': 0.9555555555555555}
Iteration: 89
{'class_weight': 'balanced', 'boosting_type': 'gbdt', 'num_leaves': 78,
'learning_rate': 0.08153418369872095, 'subsample_for_bin': 140000,
'min_child_samples': 170, 'reg_alpha': 1.0, 'reg_lambda': 0.673469387755102,
'colsample_bytree': 0.6}
Iteration: 90
{'class_weight': None, 'boosting_type': 'goss', 'num_leaves': 83,
'learning_rate': 0.09879392446119441, 'subsample_for_bin': 280000,
'min_child_samples': 115, 'reg_alpha': 0.24489795918367346, 'reg_lambda':
0.3877551020408163, 'colsample_bytree': 0.8222222222222222}
Iteration: 91
{'class_weight': None, 'boosting_type': 'goss', 'num_leaves': 107,
'learning_rate': 0.04971057627082245, 'subsample_for_bin': 140000,
'min_child_samples': 360, 'reg_alpha': 0.5306122448979591, 'reg_lambda':
0.5510204081632653, 'colsample_bytree': 1.0}
Iteration: 92
{'class_weight': 'balanced', 'boosting_type': 'goss', 'num_leaves': 71,
'learning_rate': 0.03810526748634296, 'subsample_for_bin': 260000,
'min_child_samples': 305, 'reg_alpha': 0.4081632653061224, 'reg_lambda':
0.4897959183673469, 'colsample_bytree': 0.8666666666666667}
Iteration: 93
{'class_weight': 'balanced', 'boosting_type': 'gbdt', 'num_leaves': 52,
'learning_rate': 0.006693595023309685, 'subsample_for_bin': 60000,
'min_child_samples': 290, 'reg_alpha': 0.4081632653061224, 'reg_lambda':
0.7959183673469387, 'colsample_bytree': 0.9111111111111111}
Iteration: 94
{'class_weight': 'balanced', 'boosting_type': 'goss', 'num_leaves': 147,
'learning_rate': 0.035654887361053864, 'subsample_for_bin': 160000,
'min_child_samples': 60, 'reg_alpha': 0.08163265306122448, 'reg_lambda':
0.9387755102040816, 'colsample_bytree': 0.7333333333333333}
Iteration: 95
{'class_weight': 'balanced', 'boosting_type': 'gbdt', 'num_leaves': 136,
'learning_rate': 0.00726005705102873, 'subsample_for_bin': 180000,
'min_child_samples': 230, 'reg_alpha': 0.673469387755102, 'reg_lambda':
0.4693877551020408, 'colsample_bytree': 0.8666666666666667}
Iteration: 96
{'class_weight': None, 'boosting_type': 'dart', 'num_leaves': 86,
'learning_rate': 0.009506211670468586, 'subsample_for_bin': 200000,
'min_child_samples': 390, 'reg_alpha': 0.5102040816326531, 'reg_lambda':
0.5918367346938775, 'colsample_bytree': 0.8666666666666667}
Iteration: 97
{'class_weight': None, 'boosting_type': 'dart', 'num_leaves': 45,
'learning_rate': 0.008540852748112464, 'subsample_for_bin': 260000,
'min_child_samples': 290, 'reg_alpha': 0.5714285714285714, 'reg_lambda':
0.1020408163265306, 'colsample_bytree': 0.9555555555555555}

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Iteration: 98
{'class_weight': None, 'boosting_type': 'gbdt', 'num_leaves': 83,
 'learning_rate': 0.024920898379346815, 'subsample_for_bin': 160000,
 'min_child_samples': 65, 'reg_alpha': 0.7551020408163265, 'reg_lambda':
 0.9591836734693877, 'colsample_bytree': 0.6888888888888889}
Iteration: 99
{'class_weight': None, 'boosting_type': 'goss', 'num_leaves': 117,
 'learning_rate': 0.02846397739454339, 'subsample_for_bin': 260000,
 'min_child_samples': 30, 'reg_alpha': 0.44897959183673464, 'reg_lambda':
 0.2857142857142857, 'colsample_bytree': 0.8666666666666667}
Iteration: 100
{'class_weight': 'balanced', 'boosting_type': 'gbdt', 'num_leaves': 91,
 'learning_rate': 0.014060340162908316, 'subsample_for_bin': 180000,
 'min_child_samples': 150, 'reg_alpha': 0.3061224489795918, 'reg_lambda':
 0.8979591836734693, 'colsample_bytree': 0.6444444444444444}
Iteration: 101
{'class_weight': 'balanced', 'boosting_type': 'dart', 'num_leaves': 72,
 'learning_rate': 0.1477507098101902, 'subsample_for_bin': 120000,
 'min_child_samples': 320, 'reg_alpha': 0.5918367346938775, 'reg_lambda':
 0.4693877551020408, 'colsample_bytree': 0.9555555555555555}
Iteration: 102
{'class_weight': None, 'boosting_type': 'dart', 'num_leaves': 101,
 'learning_rate': 0.014481886418058792, 'subsample_for_bin': 220000,
 'min_child_samples': 115, 'reg_alpha': 0.061224489795918366, 'reg_lambda':
 0.8775510204081632, 'colsample_bytree': 0.8666666666666667}
Iteration: 103
{'class_weight': 'balanced', 'boosting_type': 'goss', 'num_leaves': 41,
 'learning_rate': 0.032390959551047066, 'subsample_for_bin': 200000,
 'min_child_samples': 215, 'reg_alpha': 0.36734693877551017, 'reg_lambda':
 0.44897959183673464, 'colsample_bytree': 0.9555555555555555}
Iteration: 104
{'class_weight': None, 'boosting_type': 'gbdt', 'num_leaves': 49,
 'learning_rate': 0.06930722759417562, 'subsample_for_bin': 120000,
 'min_child_samples': 395, 'reg_alpha': 0.5510204081632653, 'reg_lambda':
 0.4693877551020408, 'colsample_bytree': 0.9555555555555555}
Iteration: 105
{'class_weight': None, 'boosting_type': 'gbdt', 'num_leaves': 83,
 'learning_rate': 0.11494244934547872, 'subsample_for_bin': 160000,
 'min_child_samples': 350, 'reg_alpha': 0.32653061224489793, 'reg_lambda':
 0.061224489795918366, 'colsample_bytree': 0.6444444444444444}
Iteration: 106
{'class_weight': None, 'boosting_type': 'dart', 'num_leaves': 106,
 'learning_rate': 0.12104078694567788, 'subsample_for_bin': 60000,
 'min_child_samples': 85, 'reg_alpha': 0.7551020408163265, 'reg_lambda':
 0.6938775510204082, 'colsample_bytree': 0.6}
Iteration: 107
{'class_weight': 'balanced', 'boosting_type': 'goss', 'num_leaves': 98,
 'learning_rate': 0.005037062407420691, 'subsample_for_bin': 260000,

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'min_child_samples': 105, 'reg_alpha': 0.2857142857142857, 'reg_lambda':
0.4693877551020408, 'colsample_bytree': 0.7333333333333333}
Iteration: 108
{'class_weight': None, 'boosting_type': 'dart', 'num_leaves': 57,
'learning_rate': 0.06557277631737372, 'subsample_for_bin': 200000,
'min_child_samples': 370, 'reg_alpha': 0.7959183673469387, 'reg_lambda':
0.32653061224489793, 'colsample_bytree': 0.8666666666666667}
Iteration: 109
{'class_weight': None, 'boosting_type': 'goss', 'num_leaves': 96,
'learning_rate': 0.06557277631737372, 'subsample_for_bin': 40000,
'min_child_samples': 50, 'reg_alpha': 0.0, 'reg_lambda': 0.4081632653061224,
'colsample_bytree': 1.0}
Iteration: 110
{'class_weight': None, 'boosting_type': 'dart', 'num_leaves': 144,
'learning_rate': 0.006971074647836605, 'subsample_for_bin': 180000,
'min_child_samples': 70, 'reg_alpha': 0.6326530612244897, 'reg_lambda':
0.7142857142857142, 'colsample_bytree': 0.7777777777777778}
Iteration: 111
{'class_weight': None, 'boosting_type': 'dart', 'num_leaves': 54,
'learning_rate': 0.028254541131562887, 'subsample_for_bin': 120000,
'min_child_samples': 115, 'reg_alpha': 0.16326530612244897, 'reg_lambda':
0.8163265306122448, 'colsample_bytree': 0.7333333333333333}
Iteration: 112
{'class_weight': None, 'boosting_type': 'goss', 'num_leaves': 141,
'learning_rate': 0.16203960182341529, 'subsample_for_bin': 100000,
'min_child_samples': 250, 'reg_alpha': 0.5714285714285714, 'reg_lambda':
0.8979591836734693, 'colsample_bytree': 0.7777777777777778}
Iteration: 113
{'class_weight': 'balanced', 'boosting_type': 'goss', 'num_leaves': 64,
'learning_rate': 0.1466635688219004, 'subsample_for_bin': 180000,
'min_child_samples': 490, 'reg_alpha': 0.7959183673469387, 'reg_lambda':
0.2040816326530612, 'colsample_bytree': 0.7777777777777778}
Iteration: 114
{'class_weight': None, 'boosting_type': 'dart', 'num_leaves': 91,
'learning_rate': 0.06226905583226853, 'subsample_for_bin': 60000,
'min_child_samples': 185, 'reg_alpha': 0.44897959183673464, 'reg_lambda':
0.04081632653061224, 'colsample_bytree': 0.6444444444444444}
Iteration: 115
{'class_weight': None, 'boosting_type': 'dart', 'num_leaves': 97,
'learning_rate': 0.14292118324159045, 'subsample_for_bin': 160000,
'min_child_samples': 225, 'reg_alpha': 0.22448979591836732, 'reg_lambda':
0.3061224489795918, 'colsample_bytree': 0.6888888888888889}
Iteration: 116
{'class_weight': 'balanced', 'boosting_type': 'goss', 'num_leaves': 78,
'learning_rate': 0.008732190793608503, 'subsample_for_bin': 60000,
'min_child_samples': 375, 'reg_alpha': 0.6122448979591836, 'reg_lambda':
0.6326530612244897, 'colsample_bytree': 0.8666666666666667}
Iteration: 117

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{'class_weight': 'balanced', 'boosting_type': 'gbdt', 'num_leaves': 119,
'learning_rate': 0.014643204512415313, 'subsample_for_bin': 280000,
'min_child_samples': 350, 'reg_alpha': 0.7755102040816326, 'reg_lambda':
0.673469387755102, 'colsample_bytree': 0.8222222222222222}
Iteration: 118
{'class_weight': None, 'boosting_type': 'gbdt', 'num_leaves': 111,
'learning_rate': 0.07685658953929919, 'subsample_for_bin': 140000,
'min_child_samples': 45, 'reg_alpha': 0.9183673469387754, 'reg_lambda':
0.3469387755102041, 'colsample_bytree': 0.6888888888888889}
Iteration: 119
{'class_weight': None, 'boosting_type': 'gbdt', 'num_leaves': 54,
'learning_rate': 0.04133001995671539, 'subsample_for_bin': 200000,
'min_child_samples': 70, 'reg_alpha': 0.08163265306122448, 'reg_lambda':
0.7346938775510203, 'colsample_bytree': 0.8222222222222222}
Iteration: 120
{'class_weight': None, 'boosting_type': 'goss', 'num_leaves': 104,
'learning_rate': 0.007395343513435183, 'subsample_for_bin': 180000,
'min_child_samples': 110, 'reg_alpha': 0.6530612244897959, 'reg_lambda':
0.22448979591836732, 'colsample_bytree': 0.9555555555555555}
Iteration: 121
{'class_weight': 'balanced', 'boosting_type': 'gbdt', 'num_leaves': 80,
'learning_rate': 0.06581535611293016, 'subsample_for_bin': 20000,
'min_child_samples': 435, 'reg_alpha': 0.7551020408163265, 'reg_lambda':
0.8979591836734693, 'colsample_bytree': 0.7333333333333333}
Iteration: 122
{'class_weight': None, 'boosting_type': 'goss', 'num_leaves': 97,
'learning_rate': 0.1499492267569419, 'subsample_for_bin': 220000,
'min_child_samples': 225, 'reg_alpha': 0.24489795918367346, 'reg_lambda':
0.18367346938775508, 'colsample_bytree': 1.0}
Iteration: 123
{'class_weight': 'balanced', 'boosting_type': 'goss', 'num_leaves': 85,
'learning_rate': 0.005991692591322071, 'subsample_for_bin': 60000,
'min_child_samples': 330, 'reg_alpha': 0.42857142857142855, 'reg_lambda':
0.7142857142857142, 'colsample_bytree': 0.9111111111111111}
Iteration: 124
{'class_weight': 'balanced', 'boosting_type': 'goss', 'num_leaves': 103,
'learning_rate': 0.014112354956756064, 'subsample_for_bin': 240000,
'min_child_samples': 40, 'reg_alpha': 0.18367346938775508, 'reg_lambda':
0.3469387755102041, 'colsample_bytree': 0.8666666666666667}
Iteration: 125
{'class_weight': None, 'boosting_type': 'goss', 'num_leaves': 32,
'learning_rate': 0.015026636248522334, 'subsample_for_bin': 100000,
'min_child_samples': 115, 'reg_alpha': 0.5306122448979591, 'reg_lambda':
0.5510204081632653, 'colsample_bytree': 0.9555555555555555}
Iteration: 126
{'class_weight': 'balanced', 'boosting_type': 'dart', 'num_leaves': 149,
'learning_rate': 0.005074399539250138, 'subsample_for_bin': 280000,
'min_child_samples': 65, 'reg_alpha': 0.8571428571428571, 'reg_lambda':

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0.7551020408163265, 'colsample_bytree': 0.8666666666666667}
Iteration: 127
{'class_weight': 'balanced', 'boosting_type': 'dart', 'num_leaves': 145,
 'learning_rate': 0.005753196707328522, 'subsample_for_bin': 220000,
 'min_child_samples': 365, 'reg_alpha': 0.6122448979591836, 'reg_lambda':
 0.8979591836734693, 'colsample_bytree': 0.9111111111111111}
Iteration: 128
{'class_weight': None, 'boosting_type': 'goss', 'num_leaves': 51,
 'learning_rate': 0.010197109660117238, 'subsample_for_bin': 40000,
 'min_child_samples': 315, 'reg_alpha': 0.061224489795918366, 'reg_lambda':
 0.9591836734693877, 'colsample_bytree': 0.7333333333333333}
Iteration: 129
{'class_weight': None, 'boosting_type': 'gbdt', 'num_leaves': 139,
 'learning_rate': 0.04880119755222093, 'subsample_for_bin': 260000,
 'min_child_samples': 430, 'reg_alpha': 0.5306122448979591, 'reg_lambda':
 0.24489795918367346, 'colsample_bytree': 0.6888888888888889}
Iteration: 130
{'class_weight': 'balanced', 'boosting_type': 'goss', 'num_leaves': 140,
 'learning_rate': 0.03215262878550817, 'subsample_for_bin': 280000,
 'min_child_samples': 495, 'reg_alpha': 0.42857142857142855, 'reg_lambda':
 0.08163265306122448, 'colsample_bytree': 0.6}
Iteration: 131
{'class_weight': None, 'boosting_type': 'goss', 'num_leaves': 138,
 'learning_rate': 0.053126932824615544, 'subsample_for_bin': 140000,
 'min_child_samples': 450, 'reg_alpha': 0.673469387755102, 'reg_lambda':
 0.673469387755102, 'colsample_bytree': 0.6444444444444444}
Iteration: 132
{'class_weight': 'balanced', 'boosting_type': 'dart', 'num_leaves': 91,
 'learning_rate': 0.010897905447059984, 'subsample_for_bin': 180000,
 'min_child_samples': 155, 'reg_alpha': 0.9387755102040816, 'reg_lambda': 1.0,
 'colsample_bytree': 0.9555555555555555}
Iteration: 133
{'class_weight': None, 'boosting_type': 'gbdt', 'num_leaves': 109,
 'learning_rate': 0.02340461018381101, 'subsample_for_bin': 260000,
 'min_child_samples': 495, 'reg_alpha': 0.04081632653061224, 'reg_lambda':
 0.9795918367346939, 'colsample_bytree': 1.0}
Iteration: 134
{'class_weight': 'balanced', 'boosting_type': 'goss', 'num_leaves': 147,
 'learning_rate': 0.011863895143053077, 'subsample_for_bin': 240000,
 'min_child_samples': 365, 'reg_alpha': 0.5306122448979591, 'reg_lambda':
 0.02040816326530612, 'colsample_bytree': 0.9555555555555555}
Iteration: 135
{'class_weight': None, 'boosting_type': 'dart', 'num_leaves': 103,
 'learning_rate': 0.07244734769700005, 'subsample_for_bin': 80000,
 'min_child_samples': 355, 'reg_alpha': 0.5510204081632653, 'reg_lambda':
 0.02040816326530612, 'colsample_bytree': 0.6}
Iteration: 136
{'class_weight': None, 'boosting_type': 'dart', 'num_leaves': 50,

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'learning_rate': 0.014112354956756064, 'subsample_for_bin': 220000,
'min_child_samples': 205, 'reg_alpha': 0.9387755102040816, 'reg_lambda':
0.836734693877551, 'colsample_bytree': 0.7777777777777778}
Iteration: 137
{'class_weight': 'balanced', 'boosting_type': 'dart', 'num_leaves': 74,
'learning_rate': 0.11622282790624151, 'subsample_for_bin': 80000,
'min_child_samples': 360, 'reg_alpha': 0.12244897959183673, 'reg_lambda':
0.5510204081632653, 'colsample_bytree': 0.9111111111111111}
Iteration: 138
{'class_weight': 'balanced', 'boosting_type': 'gbdt', 'num_leaves': 66,
'learning_rate': 0.005363392912759854, 'subsample_for_bin': 120000,
'min_child_samples': 440, 'reg_alpha': 0.3061224489795918, 'reg_lambda':
0.7346938775510203, 'colsample_bytree': 0.9555555555555555}
Iteration: 139
{'class_weight': 'balanced', 'boosting_type': 'dart', 'num_leaves': 56,
'learning_rate': 0.01475174699473203, 'subsample_for_bin': 220000,
'min_child_samples': 210, 'reg_alpha': 0.5510204081632653, 'reg_lambda':
0.5306122448979591, 'colsample_bytree': 0.8222222222222222}
Iteration: 140
{'class_weight': 'balanced', 'boosting_type': 'goss', 'num_leaves': 72,
'learning_rate': 0.005284756227090885, 'subsample_for_bin': 240000,
'min_child_samples': 80, 'reg_alpha': 0.6122448979591836, 'reg_lambda':
0.6938775510204082, 'colsample_bytree': 1.0}
Iteration: 141
{'class_weight': None, 'boosting_type': 'dart', 'num_leaves': 88,
'learning_rate': 0.061583063540367876, 'subsample_for_bin': 40000,
'min_child_samples': 355, 'reg_alpha': 0.4897959183673469, 'reg_lambda':
0.8979591836734693, 'colsample_bytree': 0.6444444444444444}
Iteration: 142
{'class_weight': 'balanced', 'boosting_type': 'dart', 'num_leaves': 101,
'learning_rate': 0.018962368575084928, 'subsample_for_bin': 160000,
'min_child_samples': 215, 'reg_alpha': 0.836734693877551, 'reg_lambda':
0.16326530612244897, 'colsample_bytree': 0.6444444444444444}
Iteration: 143
{'class_weight': None, 'boosting_type': 'goss', 'num_leaves': 71,
'learning_rate': 0.02331834634070841, 'subsample_for_bin': 140000,
'min_child_samples': 80, 'reg_alpha': 0.2040816326530612, 'reg_lambda':
0.6326530612244897, 'colsample_bytree': 0.6888888888888889}
Iteration: 144
{'class_weight': None, 'boosting_type': 'dart', 'num_leaves': 54,
'learning_rate': 0.014916071147326697, 'subsample_for_bin': 140000,
'min_child_samples': 325, 'reg_alpha': 0.7755102040816326, 'reg_lambda':
0.4897959183673469, 'colsample_bytree': 0.8666666666666667}
Iteration: 145
{'class_weight': 'balanced', 'boosting_type': 'dart', 'num_leaves': 43,
'learning_rate': 0.022143509726932693, 'subsample_for_bin': 180000,
'min_child_samples': 60, 'reg_alpha': 0.4693877551020408, 'reg_lambda':
0.4693877551020408, 'colsample_bytree': 0.8222222222222222}

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Iteration: 146
{'class_weight': 'balanced', 'boosting_type': 'gbdt', 'num_leaves': 138,
 'learning_rate': 0.08397867859761513, 'subsample_for_bin': 200000,
 'min_child_samples': 110, 'reg_alpha': 0.14285714285714285, 'reg_lambda':
 0.8571428571428571, 'colsample_bytree': 0.6444444444444444}
Iteration: 147
{'class_weight': None, 'boosting_type': 'gbdt', 'num_leaves': 41,
 'learning_rate': 0.006945380919765311, 'subsample_for_bin': 120000,
 'min_child_samples': 255, 'reg_alpha': 0.5918367346938775, 'reg_lambda':
 0.5102040816326531, 'colsample_bytree': 0.6444444444444444}
Iteration: 148
{'class_weight': None, 'boosting_type': 'dart', 'num_leaves': 138,
 'learning_rate': 0.014916071147326697, 'subsample_for_bin': 240000,
 'min_child_samples': 400, 'reg_alpha': 0.02040816326530612, 'reg_lambda':
 0.5102040816326531, 'colsample_bytree': 0.9555555555555555}
Iteration: 149
{'class_weight': 'balanced', 'boosting_type': 'goss', 'num_leaves': 68,
 'learning_rate': 0.012264794404456493, 'subsample_for_bin': 80000,
 'min_child_samples': 100, 'reg_alpha': 0.2040816326530612, 'reg_lambda':
 0.1020408163265306, 'colsample_bytree': 0.6444444444444444}
Iteration: 150
{'class_weight': 'balanced', 'boosting_type': 'gbdt', 'num_leaves': 98,
 'learning_rate': 0.03323911555708387, 'subsample_for_bin': 140000,
 'min_child_samples': 150, 'reg_alpha': 0.4081632653061224, 'reg_lambda':
 0.3877551020408163, 'colsample_bytree': 0.8222222222222222}
Iteration: 151
{'class_weight': 'balanced', 'boosting_type': 'goss', 'num_leaves': 138,
 'learning_rate': 0.08305352042021888, 'subsample_for_bin': 280000,
 'min_child_samples': 385, 'reg_alpha': 0.6326530612244897, 'reg_lambda':
 0.4693877551020408, 'colsample_bytree': 0.7777777777777778}
Iteration: 152
{'class_weight': None, 'boosting_type': 'dart', 'num_leaves': 129,
 'learning_rate': 0.05371872972971951, 'subsample_for_bin': 40000,
 'min_child_samples': 205, 'reg_alpha': 0.3061224489795918, 'reg_lambda':
 0.42857142857142855, 'colsample_bytree': 0.6444444444444444}
Iteration: 153
{'class_weight': None, 'boosting_type': 'goss', 'num_leaves': 106,
 'learning_rate': 0.009683353769868812, 'subsample_for_bin': 180000,
 'min_child_samples': 480, 'reg_alpha': 0.8571428571428571, 'reg_lambda':
 0.7959183673469387, 'colsample_bytree': 0.6888888888888889}
Iteration: 154
{'class_weight': None, 'boosting_type': 'goss', 'num_leaves': 69,
 'learning_rate': 0.12059465930791366, 'subsample_for_bin': 100000,
 'min_child_samples': 95, 'reg_alpha': 0.44897959183673464, 'reg_lambda':
 0.7346938775510203, 'colsample_bytree': 0.6888888888888889}
Iteration: 155
{'class_weight': 'balanced', 'boosting_type': 'gbdt', 'num_leaves': 56,
 'learning_rate': 0.036185428799389435, 'subsample_for_bin': 240000,

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'min_child_samples': 425, 'reg_alpha': 0.08163265306122448, 'reg_lambda':
0.3469387755102041, 'colsample_bytree': 0.6}
Iteration: 156
{'class_weight': None, 'boosting_type': 'dart', 'num_leaves': 90,
'learning_rate': 0.005304306643546163, 'subsample_for_bin': 140000,
'min_child_samples': 355, 'reg_alpha': 0.3469387755102041, 'reg_lambda':
0.7142857142857142, 'colsample_bytree': 0.6888888888888889}
Iteration: 157
{'class_weight': 'balanced', 'boosting_type': 'gbdt', 'num_leaves': 94,
'learning_rate': 0.02473753188230597, 'subsample_for_bin': 120000,
'min_child_samples': 160, 'reg_alpha': 0.8775510204081632, 'reg_lambda':
0.4897959183673469, 'colsample_bytree': 1.0}
Iteration: 158
{'class_weight': 'balanced', 'boosting_type': 'goss', 'num_leaves': 88,
'learning_rate': 0.0648503883108266, 'subsample_for_bin': 100000,
'min_child_samples': 435, 'reg_alpha': 0.22448979591836732, 'reg_lambda':
0.6326530612244897, 'colsample_bytree': 0.6444444444444444}
Iteration: 159
{'class_weight': None, 'boosting_type': 'goss', 'num_leaves': 75,
'learning_rate': 0.03215262878550817, 'subsample_for_bin': 220000,
'min_child_samples': 440, 'reg_alpha': 0.3469387755102041, 'reg_lambda':
0.16326530612244897, 'colsample_bytree': 0.6888888888888889}
Iteration: 160
{'class_weight': None, 'boosting_type': 'gbdt', 'num_leaves': 52,
'learning_rate': 0.08681644729140979, 'subsample_for_bin': 60000,
'min_child_samples': 30, 'reg_alpha': 0.08163265306122448, 'reg_lambda':
0.6122448979591836, 'colsample_bytree': 0.7777777777777778}
Iteration: 161
{'class_weight': 'balanced', 'boosting_type': 'goss', 'num_leaves': 52,
'learning_rate': 0.006546926286978412, 'subsample_for_bin': 160000,
'min_child_samples': 495, 'reg_alpha': 0.9795918367346939, 'reg_lambda':
0.9183673469387754, 'colsample_bytree': 0.6444444444444444}
Iteration: 162
{'class_weight': None, 'boosting_type': 'gbdt', 'num_leaves': 146,
'learning_rate': 0.04880119755222093, 'subsample_for_bin': 200000,
'min_child_samples': 70, 'reg_alpha': 0.08163265306122448, 'reg_lambda':
0.9795918367346939, 'colsample_bytree': 0.7333333333333333}
Iteration: 163
{'class_weight': None, 'boosting_type': 'goss', 'num_leaves': 63,
'learning_rate': 0.007759004062869183, 'subsample_for_bin': 180000,
'min_child_samples': 400, 'reg_alpha': 0.36734693877551017, 'reg_lambda':
0.8163265306122448, 'colsample_bytree': 0.7777777777777778}
Iteration: 164
{'class_weight': 'balanced', 'boosting_type': 'dart', 'num_leaves': 105,
'learning_rate': 0.010122079930054748, 'subsample_for_bin': 240000,
'min_child_samples': 310, 'reg_alpha': 0.3877551020408163, 'reg_lambda':
0.7959183673469387, 'colsample_bytree': 0.6}
Iteration: 165

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{'class_weight': 'balanced', 'boosting_type': 'gbdt', 'num_leaves': 51,
'learning_rate': 0.07685658953929919, 'subsample_for_bin': 100000,
'min_child_samples': 485, 'reg_alpha': 0.3877551020408163, 'reg_lambda':
0.6326530612244897, 'colsample_bytree': 0.8666666666666667}
Iteration: 166
{'class_weight': 'balanced', 'boosting_type': 'goss', 'num_leaves': 107,
'learning_rate': 0.018753468046486473, 'subsample_for_bin': 100000,
'min_child_samples': 110, 'reg_alpha': 1.0, 'reg_lambda': 0.42857142857142855,
'colsample_bytree': 0.6888888888888889}
Iteration: 167
{'class_weight': 'balanced', 'boosting_type': 'goss', 'num_leaves': 53,
'learning_rate': 0.005055696505862444, 'subsample_for_bin': 40000,
'min_child_samples': 470, 'reg_alpha': 0.6122448979591836, 'reg_lambda':
0.5510204081632653, 'colsample_bytree': 0.7777777777777778}
Iteration: 168
{'class_weight': 'balanced', 'boosting_type': 'goss', 'num_leaves': 35,
'learning_rate': 0.06319561364496086, 'subsample_for_bin': 20000,
'min_child_samples': 265, 'reg_alpha': 0.8979591836734693, 'reg_lambda':
0.5918367346938775, 'colsample_bytree': 0.6}
Iteration: 169
{'class_weight': 'balanced', 'boosting_type': 'dart', 'num_leaves': 138,
'learning_rate': 0.008261677945375495, 'subsample_for_bin': 20000,
'min_child_samples': 90, 'reg_alpha': 0.7755102040816326, 'reg_lambda':
0.36734693877551017, 'colsample_bytree': 0.7333333333333333}
Iteration: 170
{'class_weight': 'balanced', 'boosting_type': 'gbdt', 'num_leaves': 70,
'learning_rate': 0.009541378930619003, 'subsample_for_bin': 240000,
'min_child_samples': 490, 'reg_alpha': 0.32653061224489793, 'reg_lambda':
0.16326530612244897, 'colsample_bytree': 0.7777777777777778}
Iteration: 171
{'class_weight': None, 'boosting_type': 'dart', 'num_leaves': 32,
'learning_rate': 0.08649646245384768, 'subsample_for_bin': 200000,
'min_child_samples': 40, 'reg_alpha': 0.5714285714285714, 'reg_lambda':
0.9795918367346939, 'colsample_bytree': 0.9111111111111111}
Iteration: 172
{'class_weight': None, 'boosting_type': 'goss', 'num_leaves': 144,
'learning_rate': 0.03215262878550817, 'subsample_for_bin': 260000,
'min_child_samples': 245, 'reg_alpha': 0.12244897959183673, 'reg_lambda':
0.24489795918367346, 'colsample_bytree': 0.7333333333333333}
Iteration: 173
{'class_weight': None, 'boosting_type': 'gbdt', 'num_leaves': 146,
'learning_rate': 0.07916084442421274, 'subsample_for_bin': 180000,
'min_child_samples': 110, 'reg_alpha': 0.24489795918367346, 'reg_lambda':
0.6530612244897959, 'colsample_bytree': 0.7777777777777778}
Iteration: 174
{'class_weight': 'balanced', 'boosting_type': 'gbdt', 'num_leaves': 126,
'learning_rate': 0.09521241941169564, 'subsample_for_bin': 280000,
'min_child_samples': 100, 'reg_alpha': 0.9591836734693877, 'reg_lambda':

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0.08163265306122448, 'colsample_bytree': 0.7777777777777778}
Iteration: 175
{'class_weight': 'balanced', 'boosting_type': 'goss', 'num_leaves': 38,
'learning_rate': 0.027840280325796125, 'subsample_for_bin': 120000,
'min_child_samples': 375, 'reg_alpha': 0.7551020408163265, 'reg_lambda':
0.4693877551020408, 'colsample_bytree': 0.9555555555555555}
Iteration: 176
{'class_weight': 'balanced', 'boosting_type': 'goss', 'num_leaves': 140,
'learning_rate': 0.015250231211196221, 'subsample_for_bin': 180000,
'min_child_samples': 110, 'reg_alpha': 0.4897959183673469, 'reg_lambda': 1.0,
'colsample_bytree': 0.6888888888888889}
Iteration: 177
{'class_weight': None, 'boosting_type': 'goss', 'num_leaves': 63,
'learning_rate': 0.013854191076355483, 'subsample_for_bin': 200000,
'min_child_samples': 355, 'reg_alpha': 0.8163265306122448, 'reg_lambda':
0.673469387755102, 'colsample_bytree': 0.8666666666666667}
Iteration: 178
{'class_weight': None, 'boosting_type': 'goss', 'num_leaves': 30,
'learning_rate': 0.09952623259700825, 'subsample_for_bin': 140000,
'min_child_samples': 75, 'reg_alpha': 0.16326530612244897, 'reg_lambda':
0.26530612244897955, 'colsample_bytree': 0.6}
Iteration: 179
{'class_weight': None, 'boosting_type': 'gbdt', 'num_leaves': 120,
'learning_rate': 0.028359065923651342, 'subsample_for_bin': 220000,
'min_child_samples': 130, 'reg_alpha': 0.4081632653061224, 'reg_lambda':
0.3877551020408163, 'colsample_bytree': 0.8666666666666667}
Iteration: 180
{'class_weight': 'balanced', 'boosting_type': 'goss', 'num_leaves': 101,
'learning_rate': 0.053323470492027424, 'subsample_for_bin': 100000,
'min_child_samples': 430, 'reg_alpha': 0.6938775510204082, 'reg_lambda':
0.7346938775510203, 'colsample_bytree': 0.9111111111111111}
Iteration: 181
{'class_weight': 'balanced', 'boosting_type': 'goss', 'num_leaves': 117,
'learning_rate': 0.14720613573058514, 'subsample_for_bin': 20000,
'min_child_samples': 480, 'reg_alpha': 0.5102040816326531, 'reg_lambda':
0.7959183673469387, 'colsample_bytree': 0.6888888888888889}
Iteration: 182
{'class_weight': None, 'boosting_type': 'gbdt', 'num_leaves': 53,
'learning_rate': 0.09451185205828212, 'subsample_for_bin': 160000,
'min_child_samples': 265, 'reg_alpha': 0.6122448979591836, 'reg_lambda':
0.42857142857142855, 'colsample_bytree': 0.7333333333333333}
Iteration: 183
{'class_weight': None, 'boosting_type': 'gbdt', 'num_leaves': 72,
'learning_rate': 0.006868866546589226, 'subsample_for_bin': 280000,
'min_child_samples': 320, 'reg_alpha': 0.7551020408163265, 'reg_lambda':
0.18367346938775508, 'colsample_bytree': 0.9111111111111111}
Iteration: 184
{'class_weight': 'balanced', 'boosting_type': 'gbdt', 'num_leaves': 80,

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'learning_rate': 0.07138514334220704, 'subsample_for_bin': 220000,
'min_child_samples': 340, 'reg_alpha': 0.6938775510204082, 'reg_lambda':
0.7346938775510203, 'colsample_bytree': 0.7777777777777778}
Iteration: 185
{'class_weight': None, 'boosting_type': 'goss', 'num_leaves': 129,
'learning_rate': 0.025858321500565308, 'subsample_for_bin': 240000,
'min_child_samples': 440, 'reg_alpha': 0.5918367346938775, 'reg_lambda':
0.673469387755102, 'colsample_bytree': 0.6888888888888889}
Iteration: 186
{'class_weight': 'balanced', 'boosting_type': 'dart', 'num_leaves': 81,
'learning_rate': 0.11970733093385101, 'subsample_for_bin': 180000,
'min_child_samples': 425, 'reg_alpha': 0.9591836734693877, 'reg_lambda':
0.8775510204081632, 'colsample_bytree': 0.6444444444444444}
Iteration: 187
{'class_weight': 'balanced', 'boosting_type': 'gbdt', 'num_leaves': 85,
'learning_rate': 0.014481886418058792, 'subsample_for_bin': 260000,
'min_child_samples': 485, 'reg_alpha': 0.44897959183673464, 'reg_lambda':
0.44897959183673464, 'colsample_bytree': 0.9555555555555555}
Iteration: 188
{'class_weight': 'balanced', 'boosting_type': 'dart', 'num_leaves': 75,
'learning_rate': 0.0255734511264479, 'subsample_for_bin': 240000,
'min_child_samples': 340, 'reg_alpha': 0.5102040816326531, 'reg_lambda':
0.1020408163265306, 'colsample_bytree': 0.8222222222222222}
Iteration: 189
{'class_weight': None, 'boosting_type': 'gbdt', 'num_leaves': 49,
'learning_rate': 0.15790486901843698, 'subsample_for_bin': 260000,
'min_child_samples': 340, 'reg_alpha': 0.2040816326530612, 'reg_lambda':
0.3877551020408163, 'colsample_bytree': 0.8666666666666667}
Iteration: 190
{'class_weight': 'balanced', 'boosting_type': 'gbdt', 'num_leaves': 87,
'learning_rate': 0.008200889007454273, 'subsample_for_bin': 100000,
'min_child_samples': 355, 'reg_alpha': 0.3877551020408163, 'reg_lambda':
0.9591836734693877, 'colsample_bytree': 0.8222222222222222}
Iteration: 191
{'class_weight': None, 'boosting_type': 'gbdt', 'num_leaves': 81,
'learning_rate': 0.05234799941715502, 'subsample_for_bin': 80000,
'min_child_samples': 165, 'reg_alpha': 0.5306122448979591, 'reg_lambda':
0.14285714285714285, 'colsample_bytree': 0.9555555555555555}
Iteration: 192
{'class_weight': 'balanced', 'boosting_type': 'gbdt', 'num_leaves': 89,
'learning_rate': 0.04862132791047936, 'subsample_for_bin': 160000,
'min_child_samples': 410, 'reg_alpha': 0.3877551020408163, 'reg_lambda':
0.9795918367346939, 'colsample_bytree': 0.6888888888888889}
Iteration: 193
{'class_weight': 'balanced', 'boosting_type': 'dart', 'num_leaves': 133,
'learning_rate': 0.01868434721035691, 'subsample_for_bin': 240000,
'min_child_samples': 345, 'reg_alpha': 0.2857142857142857, 'reg_lambda':
0.8163265306122448, 'colsample_bytree': 0.7777777777777778}

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Iteration: 194
{'class_weight': None, 'boosting_type': 'dart', 'num_leaves': 80,
'learning_rate': 0.042100178118260397, 'subsample_for_bin': 280000,
'min_child_samples': 135, 'reg_alpha': 1.0, 'reg_lambda': 0.673469387755102,
'colsample_bytree': 1.0}
Iteration: 195
{'class_weight': 'balanced', 'boosting_type': 'goss', 'num_leaves': 54,
'learning_rate': 0.00799162852774722, 'subsample_for_bin': 40000,
'min_child_samples': 115, 'reg_alpha': 0.8979591836734693, 'reg_lambda':
0.1020408163265306, 'colsample_bytree': 1.0}
Iteration: 196
{'class_weight': None, 'boosting_type': 'gbdt', 'num_leaves': 106,
'learning_rate': 0.05848035476425735, 'subsample_for_bin': 200000,
'min_child_samples': 40, 'reg_alpha': 0.6326530612244897, 'reg_lambda':
0.3469387755102041, 'colsample_bytree': 0.7333333333333333}
Iteration: 197
{'class_weight': 'balanced', 'boosting_type': 'dart', 'num_leaves': 118,
'learning_rate': 0.01416456217402655, 'subsample_for_bin': 40000,
'min_child_samples': 290, 'reg_alpha': 0.9795918367346939, 'reg_lambda':
0.08163265306122448, 'colsample_bytree': 0.7777777777777778}
Iteration: 198
{'class_weight': 'balanced', 'boosting_type': 'dart', 'num_leaves': 97,
'learning_rate': 0.019530883658574666, 'subsample_for_bin': 80000,
'min_child_samples': 410, 'reg_alpha': 0.7959183673469387, 'reg_lambda':
0.6530612244897959, 'colsample_bytree': 0.7777777777777778}
Iteration: 199
{'class_weight': None, 'boosting_type': 'gbdt', 'num_leaves': 149,
'learning_rate': 0.030645651529774956, 'subsample_for_bin': 60000,
'min_child_samples': 350, 'reg_alpha': 0.673469387755102, 'reg_lambda':
0.9387755102040816, 'colsample_bytree': 0.7777777777777778}
Iteration: 200
{'class_weight': 'balanced', 'boosting_type': 'dart', 'num_leaves': 110,
'learning_rate': 0.036859720835735944, 'subsample_for_bin': 220000,
'min_child_samples': 195, 'reg_alpha': 0.3061224489795918, 'reg_lambda':
0.6122448979591836, 'colsample_bytree': 0.7777777777777778}
Iteration: 201
{'class_weight': 'balanced', 'boosting_type': 'goss', 'num_leaves': 125,
'learning_rate': 0.008446761725321852, 'subsample_for_bin': 200000,
'min_child_samples': 160, 'reg_alpha': 0.5714285714285714, 'reg_lambda':
0.6530612244897959, 'colsample_bytree': 0.9555555555555555}
Iteration: 202
{'class_weight': 'balanced', 'boosting_type': 'gbdt', 'num_leaves': 54,
'learning_rate': 0.04989447547573647, 'subsample_for_bin': 160000,
'min_child_samples': 395, 'reg_alpha': 0.2040816326530612, 'reg_lambda':
0.6122448979591836, 'colsample_bytree': 0.8666666666666667}
Iteration: 203
{'class_weight': 'balanced', 'boosting_type': 'gbdt', 'num_leaves': 69,
'learning_rate': 0.02173842819275145, 'subsample_for_bin': 20000,

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'min_child_samples': 330, 'reg_alpha': 0.5714285714285714, 'reg_lambda':
0.4897959183673469, 'colsample_bytree': 0.7777777777777778}
Iteration: 204
{'class_weight': 'balanced', 'boosting_type': 'gbdt', 'num_leaves': 79,
'learning_rate': 0.026535420635346134, 'subsample_for_bin': 40000,
'min_child_samples': 310, 'reg_alpha': 0.26530612244897955, 'reg_lambda':
0.4693877551020408, 'colsample_bytree': 0.9111111111111111}
Iteration: 205
{'class_weight': 'balanced', 'boosting_type': 'goss', 'num_leaves': 80,
'learning_rate': 0.12559385042541965, 'subsample_for_bin': 280000,
'min_child_samples': 480, 'reg_alpha': 0.061224489795918366, 'reg_lambda':
0.8571428571428571, 'colsample_bytree': 1.0}
Iteration: 206
{'class_weight': None, 'boosting_type': 'gbdt', 'num_leaves': 130,
'learning_rate': 0.006971074647836605, 'subsample_for_bin': 240000,
'min_child_samples': 405, 'reg_alpha': 0.7346938775510203, 'reg_lambda':
0.44897959183673464, 'colsample_bytree': 0.9111111111111111}
Iteration: 207
{'class_weight': None, 'boosting_type': 'goss', 'num_leaves': 38,
'learning_rate': 0.0371329428339413, 'subsample_for_bin': 120000,
'min_child_samples': 315, 'reg_alpha': 0.673469387755102, 'reg_lambda':
0.8775510204081632, 'colsample_bytree': 0.6}
Iteration: 208
{'class_weight': None, 'boosting_type': 'goss', 'num_leaves': 67,
'learning_rate': 0.04272662488912983, 'subsample_for_bin': 200000,
'min_child_samples': 300, 'reg_alpha': 0.32653061224489793, 'reg_lambda':
0.836734693877551, 'colsample_bytree': 0.9111111111111111}
Iteration: 209
{'class_weight': None, 'boosting_type': 'dart', 'num_leaves': 32,
'learning_rate': 0.1864491407334594, 'subsample_for_bin': 100000,
'min_child_samples': 30, 'reg_alpha': 0.9183673469387754, 'reg_lambda':
0.36734693877551017, 'colsample_bytree': 0.6444444444444444}
Iteration: 210
{'class_weight': 'balanced', 'boosting_type': 'dart', 'num_leaves': 86,
'learning_rate': 0.02206189400106402, 'subsample_for_bin': 120000,
'min_child_samples': 325, 'reg_alpha': 0.8571428571428571, 'reg_lambda':
0.3877551020408163, 'colsample_bytree': 0.8222222222222222}
Iteration: 211
{'class_weight': 'balanced', 'boosting_type': 'gbdt', 'num_leaves': 142,
'learning_rate': 0.005226536265540098, 'subsample_for_bin': 260000,
'min_child_samples': 195, 'reg_alpha': 0.3469387755102041, 'reg_lambda':
0.36734693877551017, 'colsample_bytree': 0.6}
Iteration: 212
{'class_weight': 'balanced', 'boosting_type': 'gbdt', 'num_leaves': 102,
'learning_rate': 0.033983761038311154, 'subsample_for_bin': 160000,
'min_child_samples': 410, 'reg_alpha': 0.836734693877551, 'reg_lambda':
0.8775510204081632, 'colsample_bytree': 0.7777777777777778}
Iteration: 213

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{'class_weight': None, 'boosting_type': 'gbdt', 'num_leaves': 136,
'learning_rate': 0.020415774347916988, 'subsample_for_bin': 60000,
'min_child_samples': 415, 'reg_alpha': 0.1020408163265306, 'reg_lambda':
0.3061224489795918, 'colsample_bytree': 0.6}
Iteration: 214
{'class_weight': None, 'boosting_type': 'gbdt', 'num_leaves': 82,
'learning_rate': 0.008667939849965027, 'subsample_for_bin': 240000,
'min_child_samples': 220, 'reg_alpha': 0.0, 'reg_lambda': 0.04081632653061224,
'colsample_bytree': 0.8666666666666667}
Iteration: 215
{'class_weight': None, 'boosting_type': 'goss', 'num_leaves': 131,
'learning_rate': 0.05741054640417811, 'subsample_for_bin': 100000,
'min_child_samples': 185, 'reg_alpha': 0.3061224489795918, 'reg_lambda':
0.4693877551020408, 'colsample_bytree': 0.9111111111111111}
Iteration: 216
{'class_weight': 'balanced', 'boosting_type': 'dart', 'num_leaves': 48,
'learning_rate': 0.005585729675955174, 'subsample_for_bin': 240000,
'min_child_samples': 65, 'reg_alpha': 0.9795918367346939, 'reg_lambda':
0.32653061224489793, 'colsample_bytree': 0.6888888888888889}
Iteration: 217
{'class_weight': None, 'boosting_type': 'goss', 'num_leaves': 143,
'learning_rate': 0.1284074900672029, 'subsample_for_bin': 120000,
'min_child_samples': 185, 'reg_alpha': 0.14285714285714285, 'reg_lambda':
0.5510204081632653, 'colsample_bytree': 0.8666666666666667}
Iteration: 218
{'class_weight': 'balanced', 'boosting_type': 'gbdt', 'num_leaves': 123,
'learning_rate': 0.022143509726932693, 'subsample_for_bin': 180000,
'min_child_samples': 485, 'reg_alpha': 0.5918367346938775, 'reg_lambda':
0.6530612244897959, 'colsample_bytree': 0.6888888888888889}
Iteration: 219
{'class_weight': 'balanced', 'boosting_type': 'dart', 'num_leaves': 126,
'learning_rate': 0.025013090700207016, 'subsample_for_bin': 240000,
'min_child_samples': 20, 'reg_alpha': 0.9591836734693877, 'reg_lambda':
0.5918367346938775, 'colsample_bytree': 0.7777777777777778}
Iteration: 220
{'class_weight': 'balanced', 'boosting_type': 'dart', 'num_leaves': 70,
'learning_rate': 0.030987022671792253, 'subsample_for_bin': 160000,
'min_child_samples': 120, 'reg_alpha': 0.14285714285714285, 'reg_lambda':
0.6938775510204082, 'colsample_bytree': 0.8222222222222222}
Iteration: 221
{'class_weight': None, 'boosting_type': 'gbdt', 'num_leaves': 69,
'learning_rate': 0.020415774347916988, 'subsample_for_bin': 20000,
'min_child_samples': 220, 'reg_alpha': 0.8163265306122448, 'reg_lambda':
0.6326530612244897, 'colsample_bytree': 0.7777777777777778}
Iteration: 222
{'class_weight': None, 'boosting_type': 'goss', 'num_leaves': 55,
'learning_rate': 0.1095551555712299, 'subsample_for_bin': 260000,
'min_child_samples': 375, 'reg_alpha': 0.6122448979591836, 'reg_lambda':

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0.9183673469387754, 'colsample_bytree': 0.6444444444444444}
Iteration: 223
{'class_weight': 'balanced', 'boosting_type': 'dart', 'num_leaves': 47,
'learning_rate': 0.01709975946676697, 'subsample_for_bin': 140000,
'min_child_samples': 240, 'reg_alpha': 0.3877551020408163, 'reg_lambda':
0.9183673469387754, 'colsample_bytree': 0.6444444444444444}
Iteration: 224
{'class_weight': 'balanced', 'boosting_type': 'gbdt', 'num_leaves': 36,
'learning_rate': 0.015306647885571812, 'subsample_for_bin': 100000,
'min_child_samples': 25, 'reg_alpha': 0.12244897959183673, 'reg_lambda':
0.02040816326530612, 'colsample_bytree': 0.6444444444444444}
Iteration: 225
{'class_weight': None, 'boosting_type': 'dart', 'num_leaves': 65,
'learning_rate': 0.09591817970764478, 'subsample_for_bin': 280000,
'min_child_samples': 465, 'reg_alpha': 0.1020408163265306, 'reg_lambda':
0.16326530612244897, 'colsample_bytree': 0.6888888888888889}
Iteration: 226
{'class_weight': 'balanced', 'boosting_type': 'dart', 'num_leaves': 96,
'learning_rate': 0.15330849225623966, 'subsample_for_bin': 260000,
'min_child_samples': 420, 'reg_alpha': 0.6326530612244897, 'reg_lambda':
0.9387755102040816, 'colsample_bytree': 0.9555555555555555}
Iteration: 227
{'class_weight': 'balanced', 'boosting_type': 'goss', 'num_leaves': 147,
'learning_rate': 0.043845419886860144, 'subsample_for_bin': 120000,
'min_child_samples': 20, 'reg_alpha': 0.7346938775510203, 'reg_lambda':
0.7755102040816326, 'colsample_bytree': 0.7777777777777778}
Iteration: 228
{'class_weight': 'balanced', 'boosting_type': 'gbdt', 'num_leaves': 104,
'learning_rate': 0.01605934097818438, 'subsample_for_bin': 280000,
'min_child_samples': 425, 'reg_alpha': 0.8775510204081632, 'reg_lambda':
0.6122448979591836, 'colsample_bytree': 0.6444444444444444}
Iteration: 229
{'class_weight': 'balanced', 'boosting_type': 'gbdt', 'num_leaves': 135,
'learning_rate': 0.052155057104807535, 'subsample_for_bin': 80000,
'min_child_samples': 470, 'reg_alpha': 0.7959183673469387, 'reg_lambda':
0.24489795918367346, 'colsample_bytree': 0.8666666666666667}
Iteration: 230
{'class_weight': None, 'boosting_type': 'dart', 'num_leaves': 117,
'learning_rate': 0.11494244934547872, 'subsample_for_bin': 140000,
'min_child_samples': 445, 'reg_alpha': 0.4897959183673469, 'reg_lambda':
0.8571428571428571, 'colsample_bytree': 0.8666666666666667}
Iteration: 231
{'class_weight': None, 'boosting_type': 'gbdt', 'num_leaves': 130,
'learning_rate': 0.007874457328332661, 'subsample_for_bin': 80000,
'min_child_samples': 420, 'reg_alpha': 0.6122448979591836, 'reg_lambda':
0.2857142857142857, 'colsample_bytree': 0.7777777777777778}
Iteration: 232
{'class_weight': None, 'boosting_type': 'gbdt', 'num_leaves': 74,

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'learning_rate': 0.12935930820975056, 'subsample_for_bin': 240000,
'min_child_samples': 165, 'reg_alpha': 1.0, 'reg_lambda': 0.12244897959183673,
'colsample_bytree': 1.0}
Iteration: 233
{'class_weight': None, 'boosting_type': 'goss', 'num_leaves': 143,
'learning_rate': 0.005443199705065208, 'subsample_for_bin': 220000,
'min_child_samples': 175, 'reg_alpha': 0.04081632653061224, 'reg_lambda':
0.6530612244897959, 'colsample_bytree': 0.6888888888888889}
Iteration: 234
{'class_weight': 'balanced', 'boosting_type': 'goss', 'num_leaves': 52,
'learning_rate': 0.13176983516071486, 'subsample_for_bin': 220000,
'min_child_samples': 365, 'reg_alpha': 0.5714285714285714, 'reg_lambda':
0.8775510204081632, 'colsample_bytree': 0.6444444444444444}
Iteration: 235
{'class_weight': 'balanced', 'boosting_type': 'gbdt', 'num_leaves': 140,
'learning_rate': 0.020116443522038775, 'subsample_for_bin': 100000,
'min_child_samples': 300, 'reg_alpha': 0.42857142857142855, 'reg_lambda':
0.36734693877551017, 'colsample_bytree': 0.8666666666666667}
Iteration: 236
{'class_weight': 'balanced', 'boosting_type': 'goss', 'num_leaves': 64,
'learning_rate': 0.008021192742094972, 'subsample_for_bin': 260000,
'min_child_samples': 110, 'reg_alpha': 0.836734693877551, 'reg_lambda':
0.9591836734693877, 'colsample_bytree': 0.6444444444444444}
Iteration: 237
{'class_weight': None, 'boosting_type': 'gbdt', 'num_leaves': 40,
'learning_rate': 0.006332926946560723, 'subsample_for_bin': 100000,
'min_child_samples': 75, 'reg_alpha': 0.5102040816326531, 'reg_lambda':
0.5918367346938775, 'colsample_bytree': 0.6444444444444444}
Iteration: 238
{'class_weight': 'balanced', 'boosting_type': 'goss', 'num_leaves': 68,
'learning_rate': 0.11325719275394726, 'subsample_for_bin': 20000,
'min_child_samples': 380, 'reg_alpha': 0.2857142857142857, 'reg_lambda':
0.5102040816326531, 'colsample_bytree': 0.6444444444444444}
Iteration: 239
{'class_weight': None, 'boosting_type': 'gbdt', 'num_leaves': 104,
'learning_rate': 0.18371547144769346, 'subsample_for_bin': 220000,
'min_child_samples': 170, 'reg_alpha': 0.5306122448979591, 'reg_lambda':
0.673469387755102, 'colsample_bytree': 0.6444444444444444}
Iteration: 240
{'class_weight': None, 'boosting_type': 'dart', 'num_leaves': 34,
'learning_rate': 0.17317576433031381, 'subsample_for_bin': 40000,
'min_child_samples': 290, 'reg_alpha': 0.16326530612244897, 'reg_lambda':
0.2857142857142857, 'colsample_bytree': 0.8666666666666667}
Iteration: 241
{'class_weight': None, 'boosting_type': 'dart', 'num_leaves': 111,
'learning_rate': 0.010464120576814964, 'subsample_for_bin': 200000,
'min_child_samples': 45, 'reg_alpha': 0.8775510204081632, 'reg_lambda':
0.2857142857142857, 'colsample_bytree': 0.6888888888888889}

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Iteration: 242
{'class_weight': 'balanced', 'boosting_type': 'gbdt', 'num_leaves': 70,
 'learning_rate': 0.11200948536232092, 'subsample_for_bin': 60000,
 'min_child_samples': 30, 'reg_alpha': 0.24489795918367346, 'reg_lambda':
 0.08163265306122448, 'colsample_bytree': 0.7333333333333333}
Iteration: 243
{'class_weight': None, 'boosting_type': 'gbdt', 'num_leaves': 117,
 'learning_rate': 0.11118532619062516, 'subsample_for_bin': 160000,
 'min_child_samples': 95, 'reg_alpha': 0.3877551020408163, 'reg_lambda':
 0.6530612244897959, 'colsample_bytree': 0.7777777777777778}
Iteration: 244
{'class_weight': None, 'boosting_type': 'goss', 'num_leaves': 145,
 'learning_rate': 0.032390959551047066, 'subsample_for_bin': 240000,
 'min_child_samples': 200, 'reg_alpha': 0.673469387755102, 'reg_lambda':
 0.22448979591836732, 'colsample_bytree': 0.9111111111111111}
Iteration: 245
{'class_weight': 'balanced', 'boosting_type': 'dart', 'num_leaves': 131,
 'learning_rate': 0.1103672311333934, 'subsample_for_bin': 240000,
 'min_child_samples': 335, 'reg_alpha': 0.7142857142857142, 'reg_lambda':
 0.7142857142857142, 'colsample_bytree': 1.0}
Iteration: 246
{'class_weight': 'balanced', 'boosting_type': 'goss', 'num_leaves': 118,
 'learning_rate': 0.008140547350944652, 'subsample_for_bin': 40000,
 'min_child_samples': 295, 'reg_alpha': 0.26530612244897955, 'reg_lambda':
 0.7551020408163265, 'colsample_bytree': 0.6888888888888889}
Iteration: 247
{'class_weight': 'balanced', 'boosting_type': 'dart', 'num_leaves': 92,
 'learning_rate': 0.027432093305280215, 'subsample_for_bin': 80000,
 'min_child_samples': 45, 'reg_alpha': 0.36734693877551017, 'reg_lambda':
 0.7755102040816326, 'colsample_bytree': 0.9111111111111111}
Iteration: 248
{'class_weight': 'balanced', 'boosting_type': 'goss', 'num_leaves': 83,
 'learning_rate': 0.010272695546664568, 'subsample_for_bin': 100000,
 'min_child_samples': 155, 'reg_alpha': 0.42857142857142855, 'reg_lambda':
 0.7959183673469387, 'colsample_bytree': 0.8666666666666667}
Iteration: 249
{'class_weight': None, 'boosting_type': 'goss', 'num_leaves': 32,
 'learning_rate': 0.013253702234594397, 'subsample_for_bin': 100000,
 'min_child_samples': 150, 'reg_alpha': 1.0, 'reg_lambda': 0.16326530612244897,
 'colsample_bytree': 0.8222222222222222}
Iteration: 250
{'class_weight': 'balanced', 'boosting_type': 'gbdt', 'num_leaves': 148,
 'learning_rate': 0.026049995829899114, 'subsample_for_bin': 20000,
 'min_child_samples': 365, 'reg_alpha': 0.3877551020408163, 'reg_lambda':
 0.6122448979591836, 'colsample_bytree': 0.7777777777777778}
Iteration: 251
{'class_weight': None, 'boosting_type': 'goss', 'num_leaves': 128,
 'learning_rate': 0.005991692591322071, 'subsample_for_bin': 60000,

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'min_child_samples': 260, 'reg_alpha': 0.7142857142857142, 'reg_lambda':
0.9183673469387754, 'colsample_bytree': 1.0}
Iteration: 252
{'class_weight': 'balanced', 'boosting_type': 'dart', 'num_leaves': 38,
'learning_rate': 0.02975360202281891, 'subsample_for_bin': 160000,
'min_child_samples': 475, 'reg_alpha': 0.9183673469387754, 'reg_lambda':
0.4693877551020408, 'colsample_bytree': 0.9111111111111111}
Iteration: 253
{'class_weight': 'balanced', 'boosting_type': 'gbdt', 'num_leaves': 144,
'learning_rate': 0.10636616732547971, 'subsample_for_bin': 100000,
'min_child_samples': 225, 'reg_alpha': 0.08163265306122448, 'reg_lambda':
0.22448979591836732, 'colsample_bytree': 0.7333333333333333}
Iteration: 254
{'class_weight': 'balanced', 'boosting_type': 'goss', 'num_leaves': 107,
'learning_rate': 0.13323765904001916, 'subsample_for_bin': 280000,
'min_child_samples': 270, 'reg_alpha': 0.6122448979591836, 'reg_lambda': 1.0,
'colsample_bytree': 0.7333333333333333}
Iteration: 255
{'class_weight': None, 'boosting_type': 'goss', 'num_leaves': 72,
'learning_rate': 0.061583063540367876, 'subsample_for_bin': 80000,
'min_child_samples': 425, 'reg_alpha': 0.9183673469387754, 'reg_lambda':
0.44897959183673464, 'colsample_bytree': 1.0}
Iteration: 256
{'class_weight': None, 'boosting_type': 'goss', 'num_leaves': 98,
'learning_rate': 0.029863672437724486, 'subsample_for_bin': 20000,
'min_child_samples': 255, 'reg_alpha': 0.5714285714285714, 'reg_lambda':
0.8163265306122448, 'colsample_bytree': 0.6444444444444444}
Iteration: 257
{'class_weight': 'balanced', 'boosting_type': 'dart', 'num_leaves': 141,
'learning_rate': 0.06461136515776175, 'subsample_for_bin': 20000,
'min_child_samples': 475, 'reg_alpha': 0.9591836734693877, 'reg_lambda':
0.673469387755102, 'colsample_bytree': 0.6}
Iteration: 258
{'class_weight': 'balanced', 'boosting_type': 'dart', 'num_leaves': 30,
'learning_rate': 0.013500676394233089, 'subsample_for_bin': 120000,
'min_child_samples': 450, 'reg_alpha': 0.7959183673469387, 'reg_lambda':
0.02040816326530612, 'colsample_bytree': 1.0}
Iteration: 259
{'class_weight': 'balanced', 'boosting_type': 'goss', 'num_leaves': 116,
'learning_rate': 0.06068014852203403, 'subsample_for_bin': 120000,
'min_child_samples': 295, 'reg_alpha': 0.673469387755102, 'reg_lambda':
0.9591836734693877, 'colsample_bytree': 0.6444444444444444}
Iteration: 260
{'class_weight': None, 'boosting_type': 'gbdt', 'num_leaves': 78,
'learning_rate': 0.021899563889224465, 'subsample_for_bin': 20000,
'min_child_samples': 475, 'reg_alpha': 0.1020408163265306, 'reg_lambda':
0.7142857142857142, 'colsample_bytree': 0.8222222222222222}
Iteration: 261

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{'class_weight': 'balanced', 'boosting_type': 'dart', 'num_leaves': 66,
'learning_rate': 0.0502643173513611, 'subsample_for_bin': 140000,
'min_child_samples': 395, 'reg_alpha': 0.8571428571428571, 'reg_lambda':
0.9387755102040816, 'colsample_bytree': 0.8222222222222222}
Iteration: 262
{'class_weight': None, 'boosting_type': 'gbdt', 'num_leaves': 67,
'learning_rate': 0.08460116899778225, 'subsample_for_bin': 120000,
'min_child_samples': 225, 'reg_alpha': 0.22448979591836732, 'reg_lambda':
0.673469387755102, 'colsample_bytree': 0.7777777777777778}
Iteration: 263
{'class_weight': 'balanced', 'boosting_type': 'goss', 'num_leaves': 132,
'learning_rate': 0.030987022671792253, 'subsample_for_bin': 200000,
'min_child_samples': 315, 'reg_alpha': 0.5918367346938775, 'reg_lambda':
0.42857142857142855, 'colsample_bytree': 0.8666666666666667}
Iteration: 264
{'class_weight': 'balanced', 'boosting_type': 'dart', 'num_leaves': 43,
'learning_rate': 0.07325436052214492, 'subsample_for_bin': 80000,
'min_child_samples': 275, 'reg_alpha': 0.04081632653061224, 'reg_lambda':
0.6938775510204082, 'colsample_bytree': 0.9555555555555555}
Iteration: 265
{'class_weight': None, 'boosting_type': 'dart', 'num_leaves': 37,
'learning_rate': 0.10755101209788154, 'subsample_for_bin': 280000,
'min_child_samples': 290, 'reg_alpha': 0.3469387755102041, 'reg_lambda': 1.0,
'colsample_bytree': 0.7777777777777778}
Iteration: 266
{'class_weight': 'balanced', 'boosting_type': 'gbdt', 'num_leaves': 136,
'learning_rate': 0.06461136515776175, 'subsample_for_bin': 120000,
'min_child_samples': 150, 'reg_alpha': 0.0, 'reg_lambda': 0.9591836734693877,
'colsample_bytree': 0.6}
Iteration: 267
{'class_weight': None, 'boosting_type': 'goss', 'num_leaves': 84,
'learning_rate': 0.013651064494620752, 'subsample_for_bin': 60000,
'min_child_samples': 220, 'reg_alpha': 0.4693877551020408, 'reg_lambda':
0.7142857142857142, 'colsample_bytree': 0.6444444444444444}
Iteration: 268
{'class_weight': None, 'boosting_type': 'gbdt', 'num_leaves': 72,
'learning_rate': 0.05826481004429197, 'subsample_for_bin': 160000,
'min_child_samples': 85, 'reg_alpha': 0.2040816326530612, 'reg_lambda':
0.14285714285714285, 'colsample_bytree': 1.0}
Iteration: 269
{'class_weight': 'balanced', 'boosting_type': 'goss', 'num_leaves': 121,
'learning_rate': 0.051012245761693865, 'subsample_for_bin': 20000,
'min_child_samples': 245, 'reg_alpha': 0.4897959183673469, 'reg_lambda':
0.9795918367346939, 'colsample_bytree': 1.0}
Iteration: 270
{'class_weight': None, 'boosting_type': 'goss', 'num_leaves': 90,
'learning_rate': 0.012773225305100642, 'subsample_for_bin': 40000,
'min_child_samples': 390, 'reg_alpha': 0.44897959183673464, 'reg_lambda':

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0.7959183673469387, 'colsample_bytree': 0.6888888888888889}
Iteration: 271
{'class_weight': 'balanced', 'boosting_type': 'dart', 'num_leaves': 43,
 'learning_rate': 0.008635991879143561, 'subsample_for_bin': 40000,
 'min_child_samples': 195, 'reg_alpha': 0.9795918367346939, 'reg_lambda':
 0.04081632653061224, 'colsample_bytree': 0.6888888888888889}
Iteration: 272
{'class_weight': None, 'boosting_type': 'gbdt', 'num_leaves': 82,
 'learning_rate': 0.05891383931113318, 'subsample_for_bin': 80000,
 'min_child_samples': 185, 'reg_alpha': 0.9795918367346939, 'reg_lambda':
 0.3469387755102041, 'colsample_bytree': 0.7777777777777778}
Iteration: 273
{'class_weight': 'balanced', 'boosting_type': 'goss', 'num_leaves': 125,
 'learning_rate': 0.012401415643146391, 'subsample_for_bin': 220000,
 'min_child_samples': 60, 'reg_alpha': 0.04081632653061224, 'reg_lambda':
 0.836734693877551, 'colsample_bytree': 1.0}
Iteration: 274
{'class_weight': 'balanced', 'boosting_type': 'gbdt', 'num_leaves': 127,
 'learning_rate': 0.005838803744176648, 'subsample_for_bin': 80000,
 'min_child_samples': 340, 'reg_alpha': 0.08163265306122448, 'reg_lambda':
 0.6326530612244897, 'colsample_bytree': 0.9555555555555555}
Iteration: 275
{'class_weight': None, 'boosting_type': 'gbdt', 'num_leaves': 112,
 'learning_rate': 0.008829461296754142, 'subsample_for_bin': 180000,
 'min_child_samples': 485, 'reg_alpha': 0.6530612244897959, 'reg_lambda':
 0.24489795918367346, 'colsample_bytree': 1.0}
Iteration: 276
{'class_weight': None, 'boosting_type': 'goss', 'num_leaves': 128,
 'learning_rate': 0.014481886418058792, 'subsample_for_bin': 60000,
 'min_child_samples': 155, 'reg_alpha': 0.9795918367346939, 'reg_lambda':
 0.673469387755102, 'colsample_bytree': 0.8222222222222222}
Iteration: 277
{'class_weight': None, 'boosting_type': 'goss', 'num_leaves': 47,
 'learning_rate': 0.008292241179990454, 'subsample_for_bin': 260000,
 'min_child_samples': 135, 'reg_alpha': 0.18367346938775508, 'reg_lambda':
 0.5306122448979591, 'colsample_bytree': 1.0}
Iteration: 278
{'class_weight': 'balanced', 'boosting_type': 'dart', 'num_leaves': 35,
 'learning_rate': 0.016419113357517282, 'subsample_for_bin': 260000,
 'min_child_samples': 440, 'reg_alpha': 0.42857142857142855, 'reg_lambda':
 0.061224489795918366, 'colsample_bytree': 1.0}
Iteration: 279
{'class_weight': None, 'boosting_type': 'goss', 'num_leaves': 113,
 'learning_rate': 0.054922173584349414, 'subsample_for_bin': 40000,
 'min_child_samples': 215, 'reg_alpha': 0.5918367346938775, 'reg_lambda':
 0.2857142857142857, 'colsample_bytree': 0.6444444444444444}
Iteration: 280
{'class_weight': None, 'boosting_type': 'dart', 'num_leaves': 78,

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'learning_rate': 0.02049130042208341, 'subsample_for_bin': 80000,
'min_child_samples': 55, 'reg_alpha': 0.836734693877551, 'reg_lambda': 1.0,
'colsample_bytree': 1.0}
Iteration: 281
{'class_weight': None, 'boosting_type': 'gbdt', 'num_leaves': 146,
'learning_rate': 0.030308041131661214, 'subsample_for_bin': 160000,
'min_child_samples': 120, 'reg_alpha': 0.2040816326530612, 'reg_lambda':
0.12244897959183673, 'colsample_bytree': 0.7333333333333333}
Iteration: 282
{'class_weight': None, 'boosting_type': 'dart', 'num_leaves': 142,
'learning_rate': 0.010159525531994104, 'subsample_for_bin': 140000,
'min_child_samples': 75, 'reg_alpha': 0.2857142857142857, 'reg_lambda':
0.02040816326530612, 'colsample_bytree': 0.9555555555555555}
Iteration: 283
{'class_weight': None, 'boosting_type': 'dart', 'num_leaves': 43,
'learning_rate': 0.0271298853416841, 'subsample_for_bin': 60000,
'min_child_samples': 230, 'reg_alpha': 0.4693877551020408, 'reg_lambda':
0.32653061224489793, 'colsample_bytree': 0.7777777777777778}
Iteration: 284
{'class_weight': 'balanced', 'boosting_type': 'dart', 'num_leaves': 143,
'learning_rate': 0.04952735487476894, 'subsample_for_bin': 280000,
'min_child_samples': 150, 'reg_alpha': 0.5714285714285714, 'reg_lambda':
0.5918367346938775, 'colsample_bytree': 0.9111111111111111}
Iteration: 285
{'class_weight': 'balanced', 'boosting_type': 'dart', 'num_leaves': 72,
'learning_rate': 0.10636616732547971, 'subsample_for_bin': 280000,
'min_child_samples': 280, 'reg_alpha': 0.5918367346938775, 'reg_lambda':
0.9795918367346939, 'colsample_bytree': 0.6444444444444444}
Iteration: 286
{'class_weight': 'balanced', 'boosting_type': 'gbdt', 'num_leaves': 57,
'learning_rate': 0.13274657662401146, 'subsample_for_bin': 280000,
'min_child_samples': 90, 'reg_alpha': 0.9183673469387754, 'reg_lambda':
0.9387755102040816, 'colsample_bytree': 1.0}
Iteration: 287
{'class_weight': None, 'boosting_type': 'gbdt', 'num_leaves': 109,
'learning_rate': 0.09627301922688382, 'subsample_for_bin': 140000,
'min_child_samples': 180, 'reg_alpha': 0.16326530612244897, 'reg_lambda':
0.22448979591836732, 'colsample_bytree': 0.7777777777777778}
Iteration: 288
{'class_weight': None, 'boosting_type': 'gbdt', 'num_leaves': 47,
'learning_rate': 0.006971074647836605, 'subsample_for_bin': 160000,
'min_child_samples': 65, 'reg_alpha': 0.8163265306122448, 'reg_lambda':
0.18367346938775508, 'colsample_bytree': 0.7333333333333333}
Iteration: 289
{'class_weight': None, 'boosting_type': 'gbdt', 'num_leaves': 97,
'learning_rate': 0.036996079612148326, 'subsample_for_bin': 120000,
'min_child_samples': 475, 'reg_alpha': 0.4081632653061224, 'reg_lambda':
0.7551020408163265, 'colsample_bytree': 0.7333333333333333}

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Iteration: 290
{'class_weight': None, 'boosting_type': 'goss', 'num_leaves': 149,
 'learning_rate': 0.13031818168665613, 'subsample_for_bin': 280000,
 'min_child_samples': 375, 'reg_alpha': 0.3061224489795918, 'reg_lambda':
 0.6938775510204082, 'colsample_bytree': 0.8222222222222222}
Iteration: 291
{'class_weight': 'balanced', 'boosting_type': 'goss', 'num_leaves': 66,
 'learning_rate': 0.008894909515131234, 'subsample_for_bin': 160000,
 'min_child_samples': 160, 'reg_alpha': 0.9183673469387754, 'reg_lambda':
 0.673469387755102, 'colsample_bytree': 0.6888888888888889}
Iteration: 292
{'class_weight': 'balanced', 'boosting_type': 'gbdt', 'num_leaves': 116,
 'learning_rate': 0.18783119153687952, 'subsample_for_bin': 240000,
 'min_child_samples': 350, 'reg_alpha': 0.12244897959183673, 'reg_lambda':
 0.061224489795918366, 'colsample_bytree': 0.9555555555555555}
Iteration: 293
{'class_weight': 'balanced', 'boosting_type': 'dart', 'num_leaves': 64,
 'learning_rate': 0.0600116605611819, 'subsample_for_bin': 240000,
 'min_child_samples': 255, 'reg_alpha': 0.7959183673469387, 'reg_lambda':
 0.8163265306122448, 'colsample_bytree': 0.6444444444444444}
Iteration: 294
{'class_weight': 'balanced', 'boosting_type': 'goss', 'num_leaves': 97,
 'learning_rate': 0.13824951937907706, 'subsample_for_bin': 220000,
 'min_child_samples': 430, 'reg_alpha': 0.22448979591836732, 'reg_lambda':
 0.9795918367346939, 'colsample_bytree': 1.0}
Iteration: 295
{'class_weight': 'balanced', 'boosting_type': 'goss', 'num_leaves': 33,
 'learning_rate': 0.01854686888813489, 'subsample_for_bin': 200000,
 'min_child_samples': 290, 'reg_alpha': 0.5306122448979591, 'reg_lambda':
 0.26530612244897955, 'colsample_bytree': 0.7333333333333333}
Iteration: 296
{'class_weight': 'balanced', 'boosting_type': 'dart', 'num_leaves': 144,
 'learning_rate': 0.014916071147326697, 'subsample_for_bin': 60000,
 'min_child_samples': 25, 'reg_alpha': 0.04081632653061224, 'reg_lambda':
 0.3877551020408163, 'colsample_bytree': 0.7333333333333333}
Iteration: 297
{'class_weight': None, 'boosting_type': 'dart', 'num_leaves': 135,
 'learning_rate': 0.034235665037768974, 'subsample_for_bin': 260000,
 'min_child_samples': 355, 'reg_alpha': 0.04081632653061224, 'reg_lambda':
 0.836734693877551, 'colsample_bytree': 0.6444444444444444}
Iteration: 298
{'class_weight': 'balanced', 'boosting_type': 'gbdt', 'num_leaves': 81,
 'learning_rate': 0.08745997259947594, 'subsample_for_bin': 20000,
 'min_child_samples': 110, 'reg_alpha': 0.061224489795918366, 'reg_lambda':
 0.836734693877551, 'colsample_bytree': 0.7777777777777778}
Iteration: 299
{'class_weight': 'balanced', 'boosting_type': 'goss', 'num_leaves': 117,
 'learning_rate': 0.043845419886860144, 'subsample_for_bin': 120000,

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'min_child_samples': 200, 'reg_alpha': 0.7142857142857142, 'reg_lambda':
0.7755102040816326, 'colsample_bytree': 0.8666666666666667}
Iteration: 300
{'class_weight': 'balanced', 'boosting_type': 'gbdt', 'num_leaves': 144,
'learning_rate': 0.07600989245515277, 'subsample_for_bin': 140000,
'min_child_samples': 20, 'reg_alpha': 0.3877551020408163, 'reg_lambda':
0.5918367346938775, 'colsample_bytree': 0.8666666666666667}
Iteration: 301
{'class_weight': None, 'boosting_type': 'goss', 'num_leaves': 45,
'learning_rate': 0.008261677945375495, 'subsample_for_bin': 180000,
'min_child_samples': 380, 'reg_alpha': 0.9591836734693877, 'reg_lambda':
0.9795918367346939, 'colsample_bytree': 0.8222222222222222}
Iteration: 302
{'class_weight': 'balanced', 'boosting_type': 'goss', 'num_leaves': 102,
'learning_rate': 0.10213232309588141, 'subsample_for_bin': 40000,
'min_child_samples': 255, 'reg_alpha': 0.2040816326530612, 'reg_lambda':
0.8979591836734693, 'colsample_bytree': 0.6}
Iteration: 303
{'class_weight': 'balanced', 'boosting_type': 'gbdt', 'num_leaves': 33,
'learning_rate': 0.08975010855334152, 'subsample_for_bin': 180000,
'min_child_samples': 280, 'reg_alpha': 0.4897959183673469, 'reg_lambda':
0.061224489795918366, 'colsample_bytree': 0.9111111111111111}
Iteration: 304
{'class_weight': 'balanced', 'boosting_type': 'goss', 'num_leaves': 133,
'learning_rate': 0.01729023883744441, 'subsample_for_bin': 20000,
'min_child_samples': 330, 'reg_alpha': 0.5306122448979591, 'reg_lambda':
0.836734693877551, 'colsample_bytree': 0.6444444444444444}
Iteration: 305
{'class_weight': 'balanced', 'boosting_type': 'dart', 'num_leaves': 79,
'learning_rate': 0.010698544988293692, 'subsample_for_bin': 20000,
'min_child_samples': 350, 'reg_alpha': 0.6530612244897959, 'reg_lambda':
0.6530612244897959, 'colsample_bytree': 0.9555555555555555}
Iteration: 306
{'class_weight': 'balanced', 'boosting_type': 'dart', 'num_leaves': 41,
'learning_rate': 0.008604161660966584, 'subsample_for_bin': 120000,
'min_child_samples': 270, 'reg_alpha': 0.2857142857142857, 'reg_lambda':
0.673469387755102, 'colsample_bytree': 0.8666666666666667}
Iteration: 307
{'class_weight': None, 'boosting_type': 'goss', 'num_leaves': 48,
'learning_rate': 0.0884342155747991, 'subsample_for_bin': 240000,
'min_child_samples': 160, 'reg_alpha': 0.8775510204081632, 'reg_lambda': 1.0,
'colsample_bytree': 0.7333333333333333}
Iteration: 308
{'class_weight': None, 'boosting_type': 'goss', 'num_leaves': 147,
'learning_rate': 0.03852973353713157, 'subsample_for_bin': 40000,
'min_child_samples': 125, 'reg_alpha': 0.8979591836734693, 'reg_lambda':
0.5714285714285714, 'colsample_bytree': 1.0}
Iteration: 309

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{'class_weight': None, 'boosting_type': 'gbdt', 'num_leaves': 90,
'learning_rate': 0.04549470675187697, 'subsample_for_bin': 140000,
'min_child_samples': 195, 'reg_alpha': 0.14285714285714285, 'reg_lambda':
0.02040816326530612, 'colsample_bytree': 0.7777777777777778}
Iteration: 310
{'class_weight': None, 'boosting_type': 'gbdt', 'num_leaves': 77,
'learning_rate': 0.022390172950796913, 'subsample_for_bin': 180000,
'min_child_samples': 125, 'reg_alpha': 0.8163265306122448, 'reg_lambda':
0.5510204081632653, 'colsample_bytree': 0.9111111111111111}
Iteration: 311
{'class_weight': None, 'boosting_type': 'goss', 'num_leaves': 81,
'learning_rate': 0.04336239313022275, 'subsample_for_bin': 220000,
'min_child_samples': 490, 'reg_alpha': 0.8775510204081632, 'reg_lambda':
0.7959183673469387, 'colsample_bytree': 0.8666666666666667}
Iteration: 312
{'class_weight': 'balanced', 'boosting_type': 'goss', 'num_leaves': 92,
'learning_rate': 0.016358596399215775, 'subsample_for_bin': 160000,
'min_child_samples': 195, 'reg_alpha': 0.7142857142857142, 'reg_lambda':
0.7142857142857142, 'colsample_bytree': 0.7333333333333333}
Iteration: 313
{'class_weight': None, 'boosting_type': 'dart', 'num_leaves': 139,
'learning_rate': 0.1362225405289103, 'subsample_for_bin': 240000,
'min_child_samples': 230, 'reg_alpha': 1.0, 'reg_lambda': 0.6938775510204082,
'colsample_bytree': 0.6}
Iteration: 314
{'class_weight': 'balanced', 'boosting_type': 'dart', 'num_leaves': 123,
'learning_rate': 0.005753196707328522, 'subsample_for_bin': 60000,
'min_child_samples': 205, 'reg_alpha': 0.7551020408163265, 'reg_lambda':
0.24489795918367346, 'colsample_bytree': 0.9111111111111111}
Iteration: 315
{'class_weight': 'balanced', 'boosting_type': 'goss', 'num_leaves': 44,
'learning_rate': 0.006194161098119677, 'subsample_for_bin': 160000,
'min_child_samples': 355, 'reg_alpha': 0.16326530612244897, 'reg_lambda':
0.3469387755102041, 'colsample_bytree': 1.0}
Iteration: 316
{'class_weight': None, 'boosting_type': 'dart', 'num_leaves': 51,
'learning_rate': 0.17381641040122672, 'subsample_for_bin': 100000,
'min_child_samples': 420, 'reg_alpha': 0.14285714285714285, 'reg_lambda':
0.4693877551020408, 'colsample_bytree': 0.6444444444444444}
Iteration: 317
{'class_weight': None, 'boosting_type': 'gbdt', 'num_leaves': 138,
'learning_rate': 0.014806319577609457, 'subsample_for_bin': 140000,
'min_child_samples': 410, 'reg_alpha': 0.8163265306122448, 'reg_lambda':
0.16326530612244897, 'colsample_bytree': 0.7777777777777778}
Iteration: 318
{'class_weight': 'balanced', 'boosting_type': 'gbdt', 'num_leaves': 76,
'learning_rate': 0.14451322534564692, 'subsample_for_bin': 140000,
'min_child_samples': 160, 'reg_alpha': 0.12244897959183673, 'reg_lambda':

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0.6530612244897959, 'colsample_bytree': 0.9555555555555555}
Iteration: 319
{'class_weight': 'balanced', 'boosting_type': 'dart', 'num_leaves': 148,
'learning_rate': 0.005668844818808548, 'subsample_for_bin': 280000,
'min_child_samples': 250, 'reg_alpha': 0.7551020408163265, 'reg_lambda':
0.4081632653061224, 'colsample_bytree': 0.6888888888888889}
Iteration: 320
{'class_weight': 'balanced', 'boosting_type': 'dart', 'num_leaves': 142,
'learning_rate': 0.08366915310252615, 'subsample_for_bin': 120000,
'min_child_samples': 425, 'reg_alpha': 0.2857142857142857, 'reg_lambda':
0.44897959183673464, 'colsample_bytree': 0.7333333333333333}
Iteration: 321
{'class_weight': None, 'boosting_type': 'goss', 'num_leaves': 97,
'learning_rate': 0.042884687678484024, 'subsample_for_bin': 260000,
'min_child_samples': 375, 'reg_alpha': 0.673469387755102, 'reg_lambda':
0.02040816326530612, 'colsample_bytree': 0.7333333333333333}
Iteration: 322
{'class_weight': 'balanced', 'boosting_type': 'gbdt', 'num_leaves': 129,
'learning_rate': 0.026831006677541923, 'subsample_for_bin': 240000,
'min_child_samples': 205, 'reg_alpha': 0.0, 'reg_lambda': 0.8163265306122448,
'colsample_bytree': 0.9555555555555555}
Iteration: 323
{'class_weight': 'balanced', 'boosting_type': 'dart', 'num_leaves': 90,
'learning_rate': 0.09989441973977974, 'subsample_for_bin': 20000,
'min_child_samples': 35, 'reg_alpha': 0.24489795918367346, 'reg_lambda':
0.04081632653061224, 'colsample_bytree': 0.6888888888888889}
Iteration: 324
{'class_weight': None, 'boosting_type': 'gbdt', 'num_leaves': 110,
'learning_rate': 0.10026396895331954, 'subsample_for_bin': 160000,
'min_child_samples': 200, 'reg_alpha': 0.6530612244897959, 'reg_lambda':
0.9387755102040816, 'colsample_bytree': 0.6444444444444444}
Iteration: 325
{'class_weight': None, 'boosting_type': 'gbdt', 'num_leaves': 40,
'learning_rate': 0.09591817970764478, 'subsample_for_bin': 280000,
'min_child_samples': 375, 'reg_alpha': 0.061224489795918366, 'reg_lambda':
0.2040816326530612, 'colsample_bytree': 0.6}
Iteration: 326
{'class_weight': None, 'boosting_type': 'dart', 'num_leaves': 127,
'learning_rate': 0.009647663224128009, 'subsample_for_bin': 140000,
'min_child_samples': 240, 'reg_alpha': 0.7755102040816326, 'reg_lambda':
0.2040816326530612, 'colsample_bytree': 0.9555555555555555}
Iteration: 327
{'class_weight': 'balanced', 'boosting_type': 'dart', 'num_leaves': 68,
'learning_rate': 0.024920898379346815, 'subsample_for_bin': 220000,
'min_child_samples': 190, 'reg_alpha': 0.3469387755102041, 'reg_lambda':
0.7959183673469387, 'colsample_bytree': 1.0}
Iteration: 328
{'class_weight': None, 'boosting_type': 'gbdt', 'num_leaves': 54,

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'learning_rate': 0.030085036356717453, 'subsample_for_bin': 220000,
'min_child_samples': 385, 'reg_alpha': 0.2857142857142857, 'reg_lambda':
0.5918367346938775, 'colsample_bytree': 0.7777777777777778}
Iteration: 329
{'class_weight': 'balanced', 'boosting_type': 'dart', 'num_leaves': 133,
'learning_rate': 0.02149894496984163, 'subsample_for_bin': 240000,
'min_child_samples': 480, 'reg_alpha': 0.5918367346938775, 'reg_lambda':
0.8979591836734693, 'colsample_bytree': 0.8222222222222222}
Iteration: 330
{'class_weight': 'balanced', 'boosting_type': 'dart', 'num_leaves': 125,
'learning_rate': 0.06854369869098051, 'subsample_for_bin': 260000,
'min_child_samples': 80, 'reg_alpha': 0.1020408163265306, 'reg_lambda': 0.0,
'colsample_bytree': 0.9111111111111111}
Iteration: 331
{'class_weight': 'balanced', 'boosting_type': 'goss', 'num_leaves': 118,
'learning_rate': 0.05891383931113318, 'subsample_for_bin': 60000,
'min_child_samples': 425, 'reg_alpha': 0.2040816326530612, 'reg_lambda':
0.5714285714285714, 'colsample_bytree': 0.6444444444444444}
Iteration: 332
{'class_weight': None, 'boosting_type': 'goss', 'num_leaves': 88,
'learning_rate': 0.008200889007454273, 'subsample_for_bin': 80000,
'min_child_samples': 375, 'reg_alpha': 0.7346938775510203, 'reg_lambda': 0.0,
'colsample_bytree': 0.6888888888888889}
Iteration: 333
{'class_weight': 'balanced', 'boosting_type': 'goss', 'num_leaves': 132,
'learning_rate': 0.008080649684776451, 'subsample_for_bin': 60000,
'min_child_samples': 105, 'reg_alpha': 1.0, 'reg_lambda': 0.1020408163265306,
'colsample_bytree': 0.6444444444444444}
Iteration: 334
{'class_weight': None, 'boosting_type': 'dart', 'num_leaves': 87,
'learning_rate': 0.010047602264310566, 'subsample_for_bin': 160000,
'min_child_samples': 295, 'reg_alpha': 0.061224489795918366, 'reg_lambda':
0.08163265306122448, 'colsample_bytree': 0.6444444444444444}
Iteration: 335
{'class_weight': None, 'boosting_type': 'goss', 'num_leaves': 149,
'learning_rate': 0.03867227035514037, 'subsample_for_bin': 220000,
'min_child_samples': 65, 'reg_alpha': 0.6326530612244897, 'reg_lambda':
0.4693877551020408, 'colsample_bytree': 0.7777777777777778}
Iteration: 336
{'class_weight': 'balanced', 'boosting_type': 'dart', 'num_leaves': 39,
'learning_rate': 0.02576301385940817, 'subsample_for_bin': 20000,
'min_child_samples': 385, 'reg_alpha': 0.32653061224489793, 'reg_lambda':
0.9591836734693877, 'colsample_bytree': 0.6}
Iteration: 337
{'class_weight': 'balanced', 'boosting_type': 'goss', 'num_leaves': 116,
'learning_rate': 0.020796209084091227, 'subsample_for_bin': 140000,
'min_child_samples': 455, 'reg_alpha': 0.04081632653061224, 'reg_lambda':
0.3469387755102041, 'colsample_bytree': 1.0}

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Iteration: 338
{'class_weight': None, 'boosting_type': 'dart', 'num_leaves': 72,
 'learning_rate': 0.015082225756147042, 'subsample_for_bin': 120000,
 'min_child_samples': 300, 'reg_alpha': 0.061224489795918366, 'reg_lambda':
 0.5714285714285714, 'colsample_bytree': 0.6444444444444444}
Iteration: 339
{'class_weight': 'balanced', 'boosting_type': 'gbdt', 'num_leaves': 147,
 'learning_rate': 0.06045649588392399, 'subsample_for_bin': 180000,
 'min_child_samples': 480, 'reg_alpha': 0.12244897959183673, 'reg_lambda':
 0.18367346938775508, 'colsample_bytree': 1.0}
Iteration: 340
{'class_weight': 'balanced', 'boosting_type': 'gbdt', 'num_leaves': 67,
 'learning_rate': 0.005245871303187837, 'subsample_for_bin': 140000,
 'min_child_samples': 495, 'reg_alpha': 0.9591836734693877, 'reg_lambda':
 0.26530612244897955, 'colsample_bytree': 0.6888888888888889}
Iteration: 341
{'class_weight': None, 'boosting_type': 'dart', 'num_leaves': 122,
 'learning_rate': 0.025858321500565308, 'subsample_for_bin': 160000,
 'min_child_samples': 20, 'reg_alpha': 0.7959183673469387, 'reg_lambda':
 0.8775510204081632, 'colsample_bytree': 0.8666666666666667}
Iteration: 342
{'class_weight': 'balanced', 'boosting_type': 'gbdt', 'num_leaves': 68,
 'learning_rate': 0.06930722759417562, 'subsample_for_bin': 200000,
 'min_child_samples': 180, 'reg_alpha': 0.7346938775510203, 'reg_lambda':
 0.04081632653061224, 'colsample_bytree': 0.8222222222222222}
Iteration: 343
{'class_weight': None, 'boosting_type': 'gbdt', 'num_leaves': 118,
 'learning_rate': 0.009195482186405599, 'subsample_for_bin': 160000,
 'min_child_samples': 240, 'reg_alpha': 0.04081632653061224, 'reg_lambda':
 0.22448979591836732, 'colsample_bytree': 1.0}
Iteration: 344
{'class_weight': 'balanced', 'boosting_type': 'dart', 'num_leaves': 93,
 'learning_rate': 0.005838803744176648, 'subsample_for_bin': 280000,
 'min_child_samples': 260, 'reg_alpha': 0.26530612244897955, 'reg_lambda':
 0.5714285714285714, 'colsample_bytree': 0.6}
Iteration: 345
{'class_weight': 'balanced', 'boosting_type': 'dart', 'num_leaves': 117,
 'learning_rate': 0.028254541131562887, 'subsample_for_bin': 220000,
 'min_child_samples': 365, 'reg_alpha': 0.673469387755102, 'reg_lambda':
 0.5918367346938775, 'colsample_bytree': 0.8222222222222222}
Iteration: 346
{'class_weight': None, 'boosting_type': 'dart', 'num_leaves': 87,
 'learning_rate': 0.09734543338283685, 'subsample_for_bin': 60000,
 'min_child_samples': 105, 'reg_alpha': 0.7346938775510203, 'reg_lambda':
 0.24489795918367346, 'colsample_bytree': 0.7333333333333333}
Iteration: 347
{'class_weight': None, 'boosting_type': 'goss', 'num_leaves': 117,
 'learning_rate': 0.02206189400106402, 'subsample_for_bin': 220000,

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'min_child_samples': 255, 'reg_alpha': 0.14285714285714285, 'reg_lambda':
0.3061224489795918, 'colsample_bytree': 0.6888888888888889}
Iteration: 348
{'class_weight': None, 'boosting_type': 'goss', 'num_leaves': 113,
'learning_rate': 0.05120096036007925, 'subsample_for_bin': 240000,
'min_child_samples': 420, 'reg_alpha': 0.9183673469387754, 'reg_lambda':
0.18367346938775508, 'colsample_bytree': 0.6}
Iteration: 349
{'class_weight': 'balanced', 'boosting_type': 'dart', 'num_leaves': 43,
'learning_rate': 0.009263643527850038, 'subsample_for_bin': 100000,
'min_child_samples': 220, 'reg_alpha': 0.673469387755102, 'reg_lambda':
0.6938775510204082, 'colsample_bytree': 0.7333333333333333}
Iteration: 350
{'class_weight': 'balanced', 'boosting_type': 'dart', 'num_leaves': 81,
'learning_rate': 0.00540314896341784, 'subsample_for_bin': 180000,
'min_child_samples': 145, 'reg_alpha': 0.8571428571428571, 'reg_lambda':
0.5510204081632653, 'colsample_bytree': 0.8666666666666667}
Iteration: 351
{'class_weight': 'balanced', 'boosting_type': 'gbdt', 'num_leaves': 44,
'learning_rate': 0.015941177296637712, 'subsample_for_bin': 120000,
'min_child_samples': 370, 'reg_alpha': 0.8571428571428571, 'reg_lambda':
0.5918367346938775, 'colsample_bytree': 0.7333333333333333}
Iteration: 352
{'class_weight': None, 'boosting_type': 'dart', 'num_leaves': 136,
'learning_rate': 0.185077258978149, 'subsample_for_bin': 200000,
'min_child_samples': 395, 'reg_alpha': 0.12244897959183673, 'reg_lambda':
0.26530612244897955, 'colsample_bytree': 0.9555555555555555}
Iteration: 353
{'class_weight': 'balanced', 'boosting_type': 'dart', 'num_leaves': 140,
'learning_rate': 0.018410402123280545, 'subsample_for_bin': 180000,
'min_child_samples': 320, 'reg_alpha': 0.26530612244897955, 'reg_lambda':
0.44897959183673464, 'colsample_bytree': 0.8222222222222222}
Iteration: 354
{'class_weight': 'balanced', 'boosting_type': 'dart', 'num_leaves': 137,
'learning_rate': 0.01827493947281459, 'subsample_for_bin': 60000,
'min_child_samples': 445, 'reg_alpha': 0.26530612244897955, 'reg_lambda':
0.7755102040816326, 'colsample_bytree': 0.8222222222222222}
Iteration: 355
{'class_weight': 'balanced', 'boosting_type': 'dart', 'num_leaves': 65,
'learning_rate': 0.014216962526570596, 'subsample_for_bin': 160000,
'min_child_samples': 220, 'reg_alpha': 0.14285714285714285, 'reg_lambda': 1.0,
'colsample_bytree': 0.8222222222222222}
Iteration: 356
{'class_weight': None, 'boosting_type': 'goss', 'num_leaves': 74,
'learning_rate': 0.007533150951473343, 'subsample_for_bin': 120000,
'min_child_samples': 395, 'reg_alpha': 0.5510204081632653, 'reg_lambda':
0.2857142857142857, 'colsample_bytree': 0.6888888888888889}
Iteration: 357

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{'class_weight': None, 'boosting_type': 'gbdt', 'num_leaves': 66,
 'learning_rate': 0.04826357505403305, 'subsample_for_bin': 180000,
 'min_child_samples': 100, 'reg_alpha': 0.7755102040816326, 'reg_lambda':
 0.12244897959183673, 'colsample_bytree': 1.0}
Iteration: 358
{'class_weight': 'balanced', 'boosting_type': 'goss', 'num_leaves': 138,
 'learning_rate': 0.13472183345158328, 'subsample_for_bin': 120000,
 'min_child_samples': 115, 'reg_alpha': 0.02040816326530612, 'reg_lambda':
 0.6938775510204082, 'colsample_bytree': 0.6}
Iteration: 359
{'class_weight': None, 'boosting_type': 'goss', 'num_leaves': 48,
 'learning_rate': 0.005544630207207856, 'subsample_for_bin': 60000,
 'min_child_samples': 480, 'reg_alpha': 0.4693877551020408, 'reg_lambda':
 0.18367346938775508, 'colsample_bytree': 0.9555555555555555}
Iteration: 360
{'class_weight': 'balanced', 'boosting_type': 'gbdt', 'num_leaves': 86,
 'learning_rate': 0.11283975359861685, 'subsample_for_bin': 160000,
 'min_child_samples': 400, 'reg_alpha': 0.26530612244897955, 'reg_lambda':
 0.5510204081632653, 'colsample_bytree': 0.8666666666666667}
Iteration: 361
{'class_weight': 'balanced', 'boosting_type': 'goss', 'num_leaves': 81,
 'learning_rate': 0.09176075208743704, 'subsample_for_bin': 60000,
 'min_child_samples': 85, 'reg_alpha': 0.8979591836734693, 'reg_lambda':
 0.9591836734693877, 'colsample_bytree': 0.6}
Iteration: 362
{'class_weight': 'balanced', 'boosting_type': 'dart', 'num_leaves': 134,
 'learning_rate': 0.04651391039898864, 'subsample_for_bin': 20000,
 'min_child_samples': 310, 'reg_alpha': 0.6122448979591836, 'reg_lambda':
 0.02040816326530612, 'colsample_bytree': 1.0}
Iteration: 363
{'class_weight': 'balanced', 'boosting_type': 'gbdt', 'num_leaves': 90,
 'learning_rate': 0.006217075765108202, 'subsample_for_bin': 200000,
 'min_child_samples': 405, 'reg_alpha': 0.7346938775510203, 'reg_lambda':
 0.7755102040816326, 'colsample_bytree': 0.7777777777777778}
Iteration: 364
{'class_weight': None, 'boosting_type': 'goss', 'num_leaves': 139,
 'learning_rate': 0.07138514334220704, 'subsample_for_bin': 40000,
 'min_child_samples': 270, 'reg_alpha': 0.4081632653061224, 'reg_lambda':
 0.8571428571428571, 'colsample_bytree': 0.8666666666666667}
Iteration: 365
{'class_weight': None, 'boosting_type': 'dart', 'num_leaves': 96,
 'learning_rate': 0.13176983516071486, 'subsample_for_bin': 60000,
 'min_child_samples': 380, 'reg_alpha': 0.1020408163265306, 'reg_lambda':
 0.4897959183673469, 'colsample_bytree': 0.7777777777777778}
Iteration: 366
{'class_weight': 'balanced', 'boosting_type': 'gbdt', 'num_leaves': 98,
 'learning_rate': 0.013752252757425896, 'subsample_for_bin': 200000,
 'min_child_samples': 410, 'reg_alpha': 0.5714285714285714, 'reg_lambda':

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0.8571428571428571, 'colsample_bytree': 0.6888888888888889}
Iteration: 367
{'class_weight': 'balanced', 'boosting_type': 'dart', 'num_leaves': 56,
 'learning_rate': 0.19706765150537875, 'subsample_for_bin': 220000,
 'min_child_samples': 355, 'reg_alpha': 0.7959183673469387, 'reg_lambda':
 0.4693877551020408, 'colsample_bytree': 0.8222222222222222}
Iteration: 368
{'class_weight': 'balanced', 'boosting_type': 'goss', 'num_leaves': 116,
 'learning_rate': 0.04133001995671539, 'subsample_for_bin': 160000,
 'min_child_samples': 150, 'reg_alpha': 0.7142857142857142, 'reg_lambda':
 0.9387755102040816, 'colsample_bytree': 0.8222222222222222}
Iteration: 369
{'class_weight': None, 'boosting_type': 'dart', 'num_leaves': 112,
 'learning_rate': 0.10715460457131845, 'subsample_for_bin': 20000,
 'min_child_samples': 295, 'reg_alpha': 0.4693877551020408, 'reg_lambda':
 0.4693877551020408, 'colsample_bytree': 0.8222222222222222}
Iteration: 370
{'class_weight': None, 'boosting_type': 'gbdt', 'num_leaves': 79,
 'learning_rate': 0.011820167638891784, 'subsample_for_bin': 60000,
 'min_child_samples': 260, 'reg_alpha': 0.5714285714285714, 'reg_lambda':
 0.836734693877551, 'colsample_bytree': 0.6}
Iteration: 371
{'class_weight': 'balanced', 'boosting_type': 'dart', 'num_leaves': 135,
 'learning_rate': 0.009127822372082045, 'subsample_for_bin': 240000,
 'min_child_samples': 35, 'reg_alpha': 0.5510204081632653, 'reg_lambda':
 0.5306122448979591, 'colsample_bytree': 0.6888888888888889}
Iteration: 372
{'class_weight': 'balanced', 'boosting_type': 'goss', 'num_leaves': 95,
 'learning_rate': 0.06068014852203403, 'subsample_for_bin': 40000,
 'min_child_samples': 190, 'reg_alpha': 0.9183673469387754, 'reg_lambda':
 0.3061224489795918, 'colsample_bytree': 1.0}
Iteration: 373
{'class_weight': None, 'boosting_type': 'goss', 'num_leaves': 63,
 'learning_rate': 0.0653310906134197, 'subsample_for_bin': 60000,
 'min_child_samples': 445, 'reg_alpha': 0.7959183673469387, 'reg_lambda':
 0.16326530612244897, 'colsample_bytree': 0.9111111111111111}
Iteration: 374
{'class_weight': None, 'boosting_type': 'goss', 'num_leaves': 138,
 'learning_rate': 0.020116443522038775, 'subsample_for_bin': 120000,
 'min_child_samples': 405, 'reg_alpha': 0.5102040816326531, 'reg_lambda':
 0.7959183673469387, 'colsample_bytree': 0.7333333333333333}
Iteration: 375
{'class_weight': None, 'boosting_type': 'gbdt', 'num_leaves': 139,
 'learning_rate': 0.19926284742685216, 'subsample_for_bin': 100000,
 'min_child_samples': 260, 'reg_alpha': 0.673469387755102, 'reg_lambda': 0.0,
 'colsample_bytree': 0.6444444444444444}
Iteration: 376
{'class_weight': None, 'boosting_type': 'gbdt', 'num_leaves': 47,

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'learning_rate': 0.039979065841380605, 'subsample_for_bin': 20000,
'min_child_samples': 450, 'reg_alpha': 0.6326530612244897, 'reg_lambda': 1.0,
'colsample_bytree': 0.8222222222222222}
Iteration: 377
{'class_weight': None, 'boosting_type': 'gbdt', 'num_leaves': 104,
'learning_rate': 0.01177660130394154, 'subsample_for_bin': 80000,
'min_child_samples': 290, 'reg_alpha': 0.1020408163265306, 'reg_lambda':
0.6122448979591836, 'colsample_bytree': 0.8666666666666667}
Iteration: 378
{'class_weight': 'balanced', 'boosting_type': 'gbdt', 'num_leaves': 53,
'learning_rate': 0.17190154729390325, 'subsample_for_bin': 20000,
'min_child_samples': 490, 'reg_alpha': 0.6122448979591836, 'reg_lambda':
0.2040816326530612, 'colsample_bytree': 0.6444444444444444}
Iteration: 379
{'class_weight': None, 'boosting_type': 'gbdt', 'num_leaves': 133,
'learning_rate': 0.005226536265540098, 'subsample_for_bin': 80000,
'min_child_samples': 295, 'reg_alpha': 0.3061224489795918, 'reg_lambda':
0.7551020408163265, 'colsample_bytree': 0.6}
Iteration: 380
{'class_weight': 'balanced', 'boosting_type': 'goss', 'num_leaves': 59,
'learning_rate': 0.015026636248522334, 'subsample_for_bin': 200000,
'min_child_samples': 65, 'reg_alpha': 0.7346938775510203, 'reg_lambda':
0.7959183673469387, 'colsample_bytree': 0.6888888888888889}
Iteration: 381
{'class_weight': None, 'boosting_type': 'gbdt', 'num_leaves': 77,
'learning_rate': 0.008572448761425775, 'subsample_for_bin': 40000,
'min_child_samples': 350, 'reg_alpha': 0.2040816326530612, 'reg_lambda':
0.061224489795918366, 'colsample_bytree': 0.8666666666666667}
Iteration: 382
{'class_weight': None, 'boosting_type': 'dart', 'num_leaves': 39,
'learning_rate': 0.005018496989847007, 'subsample_for_bin': 40000,
'min_child_samples': 280, 'reg_alpha': 0.02040816326530612, 'reg_lambda':
0.836734693877551, 'colsample_bytree': 0.6444444444444444}
Iteration: 383
{'class_weight': None, 'boosting_type': 'dart', 'num_leaves': 130,
'learning_rate': 0.033116604059273545, 'subsample_for_bin': 80000,
'min_child_samples': 405, 'reg_alpha': 0.5510204081632653, 'reg_lambda':
0.1020408163265306, 'colsample_bytree': 1.0}
Iteration: 384
{'class_weight': 'balanced', 'boosting_type': 'goss', 'num_leaves': 50,
'learning_rate': 0.09989441973977974, 'subsample_for_bin': 100000,
'min_child_samples': 210, 'reg_alpha': 1.0, 'reg_lambda': 0.9795918367346939,
'colsample_bytree': 0.7333333333333333}
Iteration: 385
{'class_weight': None, 'boosting_type': 'dart', 'num_leaves': 100,
'learning_rate': 0.02280739932655284, 'subsample_for_bin': 180000,
'min_child_samples': 90, 'reg_alpha': 0.42857142857142855, 'reg_lambda':
0.3877551020408163, 'colsample_bytree': 0.7777777777777778}

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Iteration: 386
{'class_weight': 'balanced', 'boosting_type': 'gbdt', 'num_leaves': 39,
 'learning_rate': 0.18371547144769346, 'subsample_for_bin': 140000,
 'min_child_samples': 45, 'reg_alpha': 0.4081632653061224, 'reg_lambda':
 0.4081632653061224, 'colsample_bytree': 0.6}
Iteration: 387
{'class_weight': 'balanced', 'boosting_type': 'dart', 'num_leaves': 135,
 'learning_rate': 0.006263159724102542, 'subsample_for_bin': 260000,
 'min_child_samples': 305, 'reg_alpha': 0.18367346938775508, 'reg_lambda':
 0.3469387755102041, 'colsample_bytree': 0.6}
Iteration: 388
{'class_weight': 'balanced', 'boosting_type': 'gbdt', 'num_leaves': 70,
 'learning_rate': 0.015941177296637712, 'subsample_for_bin': 160000,
 'min_child_samples': 410, 'reg_alpha': 0.7346938775510203, 'reg_lambda':
 0.4693877551020408, 'colsample_bytree': 0.6888888888888889}
Iteration: 389
{'class_weight': None, 'boosting_type': 'dart', 'num_leaves': 122,
 'learning_rate': 0.017940627495625486, 'subsample_for_bin': 180000,
 'min_child_samples': 405, 'reg_alpha': 0.7551020408163265, 'reg_lambda':
 0.5306122448979591, 'colsample_bytree': 0.8222222222222222}
Iteration: 390
{'class_weight': 'balanced', 'boosting_type': 'dart', 'num_leaves': 112,
 'learning_rate': 0.005795842171396196, 'subsample_for_bin': 220000,
 'min_child_samples': 455, 'reg_alpha': 0.04081632653061224, 'reg_lambda':
 0.36734693877551017, 'colsample_bytree': 0.9111111111111111}
Iteration: 391
{'class_weight': None, 'boosting_type': 'gbdt', 'num_leaves': 93,
 'learning_rate': 0.08649646245384768, 'subsample_for_bin': 180000,
 'min_child_samples': 60, 'reg_alpha': 0.3469387755102041, 'reg_lambda':
 0.02040816326530612, 'colsample_bytree': 0.9555555555555555}
Iteration: 392
{'class_weight': 'balanced', 'boosting_type': 'goss', 'num_leaves': 85,
 'learning_rate': 0.031332196449772066, 'subsample_for_bin': 60000,
 'min_child_samples': 365, 'reg_alpha': 0.42857142857142855, 'reg_lambda':
 0.673469387755102, 'colsample_bytree': 0.8222222222222222}
Iteration: 393
{'class_weight': None, 'boosting_type': 'goss', 'num_leaves': 143,
 'learning_rate': 0.19706765150537875, 'subsample_for_bin': 60000,
 'min_child_samples': 45, 'reg_alpha': 0.8571428571428571, 'reg_lambda':
 0.061224489795918366, 'colsample_bytree': 0.9555555555555555}
Iteration: 394
{'class_weight': 'balanced', 'boosting_type': 'goss', 'num_leaves': 119,
 'learning_rate': 0.031798416645683614, 'subsample_for_bin': 160000,
 'min_child_samples': 415, 'reg_alpha': 0.8979591836734693, 'reg_lambda':
 0.14285714285714285, 'colsample_bytree': 0.8222222222222222}
Iteration: 395
{'class_weight': 'balanced', 'boosting_type': 'goss', 'num_leaves': 38,
 'learning_rate': 0.1510607226238384, 'subsample_for_bin': 80000,

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'min_child_samples': 470, 'reg_alpha': 0.04081632653061224, 'reg_lambda':
0.5714285714285714, 'colsample_bytree': 0.6444444444444444}
Iteration: 396
{'class_weight': None, 'boosting_type': 'goss', 'num_leaves': 30,
'learning_rate': 0.027432093305280215, 'subsample_for_bin': 80000,
'min_child_samples': 180, 'reg_alpha': 0.04081632653061224, 'reg_lambda':
0.3877551020408163, 'colsample_bytree': 0.9111111111111111}
Iteration: 397
{'class_weight': 'balanced', 'boosting_type': 'gbdt', 'num_leaves': 128,
'learning_rate': 0.02920930552675974, 'subsample_for_bin': 260000,
'min_child_samples': 230, 'reg_alpha': 0.7346938775510203, 'reg_lambda':
0.3469387755102041, 'colsample_bytree': 1.0}
Iteration: 398
{'class_weight': 'balanced', 'boosting_type': 'dart', 'num_leaves': 141,
'learning_rate': 0.03526209229500769, 'subsample_for_bin': 140000,
'min_child_samples': 380, 'reg_alpha': 0.44897959183673464, 'reg_lambda':
0.9183673469387754, 'colsample_bytree': 1.0}
Iteration: 399
{'class_weight': 'balanced', 'boosting_type': 'goss', 'num_leaves': 67,
'learning_rate': 0.02126210003400329, 'subsample_for_bin': 280000,
'min_child_samples': 25, 'reg_alpha': 0.7755102040816326, 'reg_lambda':
0.44897959183673464, 'colsample_bytree': 0.7777777777777778}
Iteration: 400
{'class_weight': None, 'boosting_type': 'gbdt', 'num_leaves': 51,
'learning_rate': 0.007932826597476558, 'subsample_for_bin': 100000,
'min_child_samples': 380, 'reg_alpha': 0.9387755102040816, 'reg_lambda':
0.24489795918367346, 'colsample_bytree': 0.6}
Iteration: 401
{'class_weight': 'balanced', 'boosting_type': 'gbdt', 'num_leaves': 85,
'learning_rate': 0.02126210003400329, 'subsample_for_bin': 200000,
'min_child_samples': 240, 'reg_alpha': 0.673469387755102, 'reg_lambda':
0.5714285714285714, 'colsample_bytree': 0.9555555555555555}
Iteration: 402
{'class_weight': None, 'boosting_type': 'goss', 'num_leaves': 87,
'learning_rate': 0.00764524354345161, 'subsample_for_bin': 260000,
'min_child_samples': 105, 'reg_alpha': 0.7142857142857142, 'reg_lambda':
0.8163265306122448, 'colsample_bytree': 0.8222222222222222}
Iteration: 403
{'class_weight': 'balanced', 'boosting_type': 'gbdt', 'num_leaves': 117,
'learning_rate': 0.02331834634070841, 'subsample_for_bin': 160000,
'min_child_samples': 250, 'reg_alpha': 0.7551020408163265, 'reg_lambda':
0.5918367346938775, 'colsample_bytree': 0.7777777777777778}
Iteration: 404
{'class_weight': 'balanced', 'boosting_type': 'gbdt', 'num_leaves': 141,
'learning_rate': 0.12421023520674607, 'subsample_for_bin': 40000,
'min_child_samples': 230, 'reg_alpha': 0.04081632653061224, 'reg_lambda':
0.44897959183673464, 'colsample_bytree': 0.6444444444444444}
Iteration: 405

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{'class_weight': 'balanced', 'boosting_type': 'goss', 'num_leaves': 36,
 'learning_rate': 0.10915136124707514, 'subsample_for_bin': 220000,
 'min_child_samples': 130, 'reg_alpha': 0.5102040816326531, 'reg_lambda':
 0.7959183673469387, 'colsample_bytree': 0.6444444444444444}
Iteration: 406
{'class_weight': 'balanced', 'boosting_type': 'gbdt', 'num_leaves': 47,
 'learning_rate': 0.008384610951889282, 'subsample_for_bin': 140000,
 'min_child_samples': 100, 'reg_alpha': 0.02040816326530612, 'reg_lambda':
 0.4693877551020408, 'colsample_bytree': 0.8666666666666667}
Iteration: 407
{'class_weight': None, 'boosting_type': 'dart', 'num_leaves': 104,
 'learning_rate': 0.00929791343190622, 'subsample_for_bin': 200000,
 'min_child_samples': 290, 'reg_alpha': 0.6530612244897959, 'reg_lambda':
 0.7346938775510203, 'colsample_bytree': 0.6}
Iteration: 408
{'class_weight': None, 'boosting_type': 'gbdt', 'num_leaves': 110,
 'learning_rate': 0.013059379865615542, 'subsample_for_bin': 140000,
 'min_child_samples': 395, 'reg_alpha': 0.7959183673469387, 'reg_lambda':
 0.08163265306122448, 'colsample_bytree': 0.8222222222222222}
Iteration: 409
{'class_weight': None, 'boosting_type': 'goss', 'num_leaves': 89,
 'learning_rate': 0.057836101016393276, 'subsample_for_bin': 200000,
 'min_child_samples': 315, 'reg_alpha': 0.12244897959183673, 'reg_lambda':
 0.7755102040816326, 'colsample_bytree': 0.7333333333333333}
Iteration: 410
{'class_weight': 'balanced', 'boosting_type': 'dart', 'num_leaves': 103,
 'learning_rate': 0.055945612728102, 'subsample_for_bin': 80000,
 'min_child_samples': 145, 'reg_alpha': 0.3469387755102041, 'reg_lambda':
 0.08163265306122448, 'colsample_bytree': 0.7777777777777778}
Iteration: 411
{'class_weight': 'balanced', 'boosting_type': 'gbdt', 'num_leaves': 53,
 'learning_rate': 0.15387564138118423, 'subsample_for_bin': 120000,
 'min_child_samples': 55, 'reg_alpha': 0.16326530612244897, 'reg_lambda':
 0.7551020408163265, 'colsample_bytree': 0.7777777777777778}
Iteration: 412
{'class_weight': None, 'boosting_type': 'gbdt', 'num_leaves': 114,
 'learning_rate': 0.16203960182341529, 'subsample_for_bin': 140000,
 'min_child_samples': 445, 'reg_alpha': 0.02040816326530612, 'reg_lambda':
 0.3877551020408163, 'colsample_bytree': 0.6888888888888889}
Iteration: 413
{'class_weight': 'balanced', 'boosting_type': 'goss', 'num_leaves': 115,
 'learning_rate': 0.034235665037768974, 'subsample_for_bin': 20000,
 'min_child_samples': 90, 'reg_alpha': 0.8979591836734693, 'reg_lambda':
 0.836734693877551, 'colsample_bytree': 0.8666666666666667}
Iteration: 414
{'class_weight': 'balanced', 'boosting_type': 'gbdt', 'num_leaves': 66,
 'learning_rate': 0.006571145972790277, 'subsample_for_bin': 160000,
 'min_child_samples': 375, 'reg_alpha': 0.0, 'reg_lambda': 0.32653061224489793,

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'colsample_bytree': 0.7333333333333333}
Iteration: 415
{'class_weight': None, 'boosting_type': 'goss', 'num_leaves': 30,
 'learning_rate': 0.035919178553436674, 'subsample_for_bin': 160000,
 'min_child_samples': 375, 'reg_alpha': 0.24489795918367346, 'reg_lambda':
 0.16326530612244897, 'colsample_bytree': 0.9555555555555555}
Iteration: 416
{'class_weight': 'balanced', 'boosting_type': 'goss', 'num_leaves': 89,
 'learning_rate': 0.01827493947281459, 'subsample_for_bin': 160000,
 'min_child_samples': 255, 'reg_alpha': 0.32653061224489793, 'reg_lambda':
 0.2857142857142857, 'colsample_bytree': 0.8222222222222222}
Iteration: 417
{'class_weight': 'balanced', 'boosting_type': 'dart', 'num_leaves': 68,
 'learning_rate': 0.03824623403550541, 'subsample_for_bin': 180000,
 'min_child_samples': 160, 'reg_alpha': 0.04081632653061224, 'reg_lambda':
 0.061224489795918366, 'colsample_bytree': 0.6}
Iteration: 418
{'class_weight': None, 'boosting_type': 'goss', 'num_leaves': 87,
 'learning_rate': 0.020415774347916988, 'subsample_for_bin': 220000,
 'min_child_samples': 40, 'reg_alpha': 0.4693877551020408, 'reg_lambda':
 0.2857142857142857, 'colsample_bytree': 0.8666666666666667}
Iteration: 419
{'class_weight': None, 'boosting_type': 'goss', 'num_leaves': 118,
 'learning_rate': 0.009900286907439045, 'subsample_for_bin': 60000,
 'min_child_samples': 20, 'reg_alpha': 0.36734693877551017, 'reg_lambda':
 0.5714285714285714, 'colsample_bytree': 0.9555555555555555}
Iteration: 420
{'class_weight': None, 'boosting_type': 'gbdt', 'num_leaves': 114,
 'learning_rate': 0.011307840449539407, 'subsample_for_bin': 260000,
 'min_child_samples': 280, 'reg_alpha': 0.14285714285714285, 'reg_lambda':
 0.3877551020408163, 'colsample_bytree': 0.6888888888888889}
Iteration: 421
{'class_weight': None, 'boosting_type': 'goss', 'num_leaves': 135,
 'learning_rate': 0.14720613573058514, 'subsample_for_bin': 120000,
 'min_child_samples': 150, 'reg_alpha': 0.4081632653061224, 'reg_lambda':
 0.9183673469387754, 'colsample_bytree': 0.9555555555555555}
Iteration: 422
{'class_weight': 'balanced', 'boosting_type': 'dart', 'num_leaves': 57,
 'learning_rate': 0.11451879873398406, 'subsample_for_bin': 200000,
 'min_child_samples': 270, 'reg_alpha': 0.6326530612244897, 'reg_lambda':
 0.6938775510204082, 'colsample_bytree': 0.9555555555555555}
Iteration: 423
{'class_weight': 'balanced', 'boosting_type': 'dart', 'num_leaves': 61,
 'learning_rate': 0.017547515998050538, 'subsample_for_bin': 20000,
 'min_child_samples': 150, 'reg_alpha': 0.9795918367346939, 'reg_lambda':
 0.5510204081632653, 'colsample_bytree': 1.0}
Iteration: 424
{'class_weight': 'balanced', 'boosting_type': 'dart', 'num_leaves': 87,

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'learning_rate': 0.008384610951889282, 'subsample_for_bin': 280000,
'min_child_samples': 445, 'reg_alpha': 0.8979591836734693, 'reg_lambda':
0.7755102040816326, 'colsample_bytree': 0.6888888888888889}
Iteration: 425
{'class_weight': 'balanced', 'boosting_type': 'goss', 'num_leaves': 54,
'learning_rate': 0.010978685969402198, 'subsample_for_bin': 100000,
'min_child_samples': 335, 'reg_alpha': 0.8163265306122448, 'reg_lambda':
0.3877551020408163, 'colsample_bytree': 0.6888888888888889}
Iteration: 426
{'class_weight': 'balanced', 'boosting_type': 'goss', 'num_leaves': 53,
'learning_rate': 0.010234832826887624, 'subsample_for_bin': 40000,
'min_child_samples': 300, 'reg_alpha': 0.22448979591836732, 'reg_lambda':
0.12244897959183673, 'colsample_bytree': 0.8222222222222222}
Iteration: 427
{'class_weight': 'balanced', 'boosting_type': 'dart', 'num_leaves': 139,
'learning_rate': 0.007153611964206487, 'subsample_for_bin': 60000,
'min_child_samples': 355, 'reg_alpha': 0.2857142857142857, 'reg_lambda':
0.6326530612244897, 'colsample_bytree': 0.9111111111111111}
Iteration: 428
{'class_weight': None, 'boosting_type': 'goss', 'num_leaves': 119,
'learning_rate': 0.04600148599214018, 'subsample_for_bin': 220000,
'min_child_samples': 415, 'reg_alpha': 0.0, 'reg_lambda': 0.2040816326530612,
'colsample_bytree': 0.7333333333333333}
Iteration: 429
{'class_weight': 'balanced', 'boosting_type': 'dart', 'num_leaves': 64,
'learning_rate': 0.027029891017739963, 'subsample_for_bin': 20000,
'min_child_samples': 100, 'reg_alpha': 0.2857142857142857, 'reg_lambda':
0.02040816326530612, 'colsample_bytree': 0.8222222222222222}
Iteration: 430
{'class_weight': 'balanced', 'boosting_type': 'dart', 'num_leaves': 117,
'learning_rate': 0.025858321500565308, 'subsample_for_bin': 140000,
'min_child_samples': 35, 'reg_alpha': 0.14285714285714285, 'reg_lambda':
0.16326530612244897, 'colsample_bytree': 0.7333333333333333}
Iteration: 431
{'class_weight': 'balanced', 'boosting_type': 'goss', 'num_leaves': 148,
'learning_rate': 0.13876095937033864, 'subsample_for_bin': 40000,
'min_child_samples': 220, 'reg_alpha': 0.6122448979591836, 'reg_lambda':
0.18367346938775508, 'colsample_bytree': 0.9111111111111111}
Iteration: 432
{'class_weight': 'balanced', 'boosting_type': 'dart', 'num_leaves': 123,
'learning_rate': 0.022225427381851903, 'subsample_for_bin': 200000,
'min_child_samples': 405, 'reg_alpha': 0.4693877551020408, 'reg_lambda':
0.5102040816326531, 'colsample_bytree': 0.8666666666666667}
Iteration: 433
{'class_weight': 'balanced', 'boosting_type': 'gbdt', 'num_leaves': 112,
'learning_rate': 0.032034121820294637, 'subsample_for_bin': 180000,
'min_child_samples': 470, 'reg_alpha': 0.18367346938775508, 'reg_lambda':
0.5510204081632653, 'colsample_bytree': 0.7333333333333333}

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Iteration: 434
{'class_weight': 'balanced', 'boosting_type': 'dart', 'num_leaves': 138,
'learning_rate': 0.00617133088915982, 'subsample_for_bin': 160000,
'min_child_samples': 210, 'reg_alpha': 0.26530612244897955, 'reg_lambda':
0.8163265306122448, 'colsample_bytree': 0.9555555555555555}
Iteration: 435
{'class_weight': 'balanced', 'boosting_type': 'gbdt', 'num_leaves': 62,
'learning_rate': 0.008960842867215223, 'subsample_for_bin': 260000,
'min_child_samples': 180, 'reg_alpha': 0.4897959183673469, 'reg_lambda':
0.7755102040816326, 'colsample_bytree': 0.6888888888888889}
Iteration: 436
{'class_weight': 'balanced', 'boosting_type': 'dart', 'num_leaves': 138,
'learning_rate': 0.040874704315014034, 'subsample_for_bin': 160000,
'min_child_samples': 45, 'reg_alpha': 0.6530612244897959, 'reg_lambda':
0.9387755102040816, 'colsample_bytree': 0.6}
Iteration: 437
{'class_weight': 'balanced', 'boosting_type': 'dart', 'num_leaves': 134,
'learning_rate': 0.029534676778061552, 'subsample_for_bin': 280000,
'min_child_samples': 220, 'reg_alpha': 0.3469387755102041, 'reg_lambda':
0.9183673469387754, 'colsample_bytree': 0.7333333333333333}
Iteration: 438
{'class_weight': None, 'boosting_type': 'goss', 'num_leaves': 62,
'learning_rate': 0.010817719303025709, 'subsample_for_bin': 240000,
'min_child_samples': 450, 'reg_alpha': 0.36734693877551017, 'reg_lambda':
0.14285714285714285, 'colsample_bytree': 0.7333333333333333}
Iteration: 439
{'class_weight': 'balanced', 'boosting_type': 'goss', 'num_leaves': 49,
'learning_rate': 0.005544630207207856, 'subsample_for_bin': 240000,
'min_child_samples': 295, 'reg_alpha': 0.4081632653061224, 'reg_lambda':
0.3877551020408163, 'colsample_bytree': 0.7777777777777778}
Iteration: 440
{'class_weight': 'balanced', 'boosting_type': 'dart', 'num_leaves': 63,
'learning_rate': 0.1899234997489961, 'subsample_for_bin': 200000,
'min_child_samples': 25, 'reg_alpha': 0.12244897959183673, 'reg_lambda':
0.5102040816326531, 'colsample_bytree': 0.8666666666666667}
Iteration: 441
{'class_weight': None, 'boosting_type': 'goss', 'num_leaves': 139,
'learning_rate': 0.14720613573058514, 'subsample_for_bin': 120000,
'min_child_samples': 285, 'reg_alpha': 0.22448979591836732, 'reg_lambda':
0.18367346938775508, 'colsample_bytree': 0.6444444444444444}
Iteration: 442
{'class_weight': None, 'boosting_type': 'dart', 'num_leaves': 87,
'learning_rate': 0.1764027825708195, 'subsample_for_bin': 20000,
'min_child_samples': 170, 'reg_alpha': 0.836734693877551, 'reg_lambda':
0.42857142857142855, 'colsample_bytree': 0.9555555555555555}
Iteration: 443
{'class_weight': 'balanced', 'boosting_type': 'goss', 'num_leaves': 66,
'learning_rate': 0.048442121225583966, 'subsample_for_bin': 20000,

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'min_child_samples': 75, 'reg_alpha': 0.3469387755102041, 'reg_lambda':
0.061224489795918366, 'colsample_bytree': 0.6}
Iteration: 444
{'class_weight': None, 'boosting_type': 'gbdt', 'num_leaves': 89,
'learning_rate': 0.036453652620360474, 'subsample_for_bin': 40000,
'min_child_samples': 45, 'reg_alpha': 0.8571428571428571, 'reg_lambda':
0.2857142857142857, 'colsample_bytree': 0.7333333333333333}
Iteration: 445
{'class_weight': 'balanced', 'boosting_type': 'goss', 'num_leaves': 142,
'learning_rate': 0.0827474048387851, 'subsample_for_bin': 40000,
'min_child_samples': 115, 'reg_alpha': 0.8571428571428571, 'reg_lambda':
0.8979591836734693, 'colsample_bytree': 0.6444444444444444}
Iteration: 446
{'class_weight': 'balanced', 'boosting_type': 'dart', 'num_leaves': 81,
'learning_rate': 0.16505910488604397, 'subsample_for_bin': 120000,
'min_child_samples': 225, 'reg_alpha': 0.24489795918367346, 'reg_lambda':
0.3061224489795918, 'colsample_bytree': 0.9111111111111111}
Iteration: 447
{'class_weight': 'balanced', 'boosting_type': 'goss', 'num_leaves': 114,
'learning_rate': 0.005668844818808548, 'subsample_for_bin': 280000,
'min_child_samples': 215, 'reg_alpha': 0.061224489795918366, 'reg_lambda':
0.7551020408163265, 'colsample_bytree': 0.6444444444444444}
Iteration: 448
{'class_weight': None, 'boosting_type': 'gbdt', 'num_leaves': 129,
'learning_rate': 0.12104078694567788, 'subsample_for_bin': 280000,
'min_child_samples': 125, 'reg_alpha': 0.8571428571428571, 'reg_lambda':
0.836734693877551, 'colsample_bytree': 0.6}
Iteration: 449
{'class_weight': None, 'boosting_type': 'dart', 'num_leaves': 108,
'learning_rate': 0.015250231211196221, 'subsample_for_bin': 40000,
'min_child_samples': 355, 'reg_alpha': 0.6530612244897959, 'reg_lambda':
0.8775510204081632, 'colsample_bytree': 1.0}
Iteration: 450
{'class_weight': 'balanced', 'boosting_type': 'goss', 'num_leaves': 42,
'learning_rate': 0.17253747952889908, 'subsample_for_bin': 100000,
'min_child_samples': 400, 'reg_alpha': 0.673469387755102, 'reg_lambda':
0.5918367346938775, 'colsample_bytree': 0.6444444444444444}
Iteration: 451
{'class_weight': None, 'boosting_type': 'dart', 'num_leaves': 114,
'learning_rate': 0.17000777943708753, 'subsample_for_bin': 180000,
'min_child_samples': 85, 'reg_alpha': 0.9183673469387754, 'reg_lambda':
0.04081632653061224, 'colsample_bytree': 0.9555555555555555}
Iteration: 452
{'class_weight': None, 'boosting_type': 'dart', 'num_leaves': 77,
'learning_rate': 0.00847800965849652, 'subsample_for_bin': 20000,
'min_child_samples': 150, 'reg_alpha': 0.9183673469387754, 'reg_lambda':
0.7959183673469387, 'colsample_bytree': 0.8666666666666667}
Iteration: 453

```

```

{'class_weight': None, 'boosting_type': 'gbdt', 'num_leaves': 66,
'learning_rate': 0.10213232309588141, 'subsample_for_bin': 220000,
'min_child_samples': 55, 'reg_alpha': 0.6938775510204082, 'reg_lambda':
0.6530612244897959, 'colsample_bytree': 0.7777777777777778}
Iteration: 454
{'class_weight': 'balanced', 'boosting_type': 'dart', 'num_leaves': 71,
'learning_rate': 0.09041537957119246, 'subsample_for_bin': 200000,
'min_child_samples': 30, 'reg_alpha': 0.1020408163265306, 'reg_lambda':
0.26530612244897955, 'colsample_bytree': 1.0}
Iteration: 455
{'class_weight': None, 'boosting_type': 'gbdt', 'num_leaves': 40,
'learning_rate': 0.05719894474413977, 'subsample_for_bin': 140000,
'min_child_samples': 485, 'reg_alpha': 0.6326530612244897, 'reg_lambda':
0.5714285714285714, 'colsample_bytree': 0.6444444444444444}
Iteration: 456
{'class_weight': 'balanced', 'boosting_type': 'dart', 'num_leaves': 134,
'learning_rate': 0.07434437865632709, 'subsample_for_bin': 60000,
'min_child_samples': 275, 'reg_alpha': 0.44897959183673464, 'reg_lambda':
0.4081632653061224, 'colsample_bytree': 0.8222222222222222}
Iteration: 457
{'class_weight': 'balanced', 'boosting_type': 'goss', 'num_leaves': 132,
'learning_rate': 0.07771271823726773, 'subsample_for_bin': 260000,
'min_child_samples': 150, 'reg_alpha': 0.6122448979591836, 'reg_lambda':
0.6122448979591836, 'colsample_bytree': 0.6888888888888889}
Iteration: 458
{'class_weight': None, 'boosting_type': 'dart', 'num_leaves': 96,
'learning_rate': 0.03810526748634296, 'subsample_for_bin': 160000,
'min_child_samples': 395, 'reg_alpha': 0.061224489795918366, 'reg_lambda':
0.836734693877551, 'colsample_bytree': 0.7333333333333333}
Iteration: 459
{'class_weight': 'balanced', 'boosting_type': 'dart', 'num_leaves': 87,
'learning_rate': 0.12329630363895973, 'subsample_for_bin': 260000,
'min_child_samples': 365, 'reg_alpha': 0.2040816326530612, 'reg_lambda':
0.5918367346938775, 'colsample_bytree': 0.6}
Iteration: 460
{'class_weight': 'balanced', 'boosting_type': 'goss', 'num_leaves': 94,
'learning_rate': 0.08778352184451428, 'subsample_for_bin': 220000,
'min_child_samples': 135, 'reg_alpha': 0.7551020408163265, 'reg_lambda': 0.0,
'colsample_bytree': 1.0}
Iteration: 461
{'class_weight': None, 'boosting_type': 'gbdt', 'num_leaves': 149,
'learning_rate': 0.18783119153687952, 'subsample_for_bin': 120000,
'min_child_samples': 485, 'reg_alpha': 0.08163265306122448, 'reg_lambda':
0.4693877551020408, 'colsample_bytree': 1.0}
Iteration: 462
{'class_weight': None, 'boosting_type': 'gbdt', 'num_leaves': 70,
'learning_rate': 0.012310166759971456, 'subsample_for_bin': 260000,
'min_child_samples': 105, 'reg_alpha': 0.8775510204081632, 'reg_lambda':

```

```

0.7142857142857142, 'colsample_bytree': 0.8222222222222222}
Iteration: 463
{'class_weight': 'balanced', 'boosting_type': 'dart', 'num_leaves': 58,
'learning_rate': 0.1392742913816653, 'subsample_for_bin': 80000,
'min_child_samples': 430, 'reg_alpha': 0.2040816326530612, 'reg_lambda': 0.0,
'colsample_bytree': 0.8222222222222222}
Iteration: 464
{'class_weight': None, 'boosting_type': 'gbdt', 'num_leaves': 148,
'learning_rate': 0.01996842791981582, 'subsample_for_bin': 180000,
'min_child_samples': 375, 'reg_alpha': 0.2857142857142857, 'reg_lambda':
0.061224489795918366, 'colsample_bytree': 0.8666666666666667}
Iteration: 465
{'class_weight': 'balanced', 'boosting_type': 'goss', 'num_leaves': 92,
'learning_rate': 0.036859720835735944, 'subsample_for_bin': 200000,
'min_child_samples': 425, 'reg_alpha': 0.6530612244897959, 'reg_lambda':
0.7346938775510203, 'colsample_bytree': 0.7777777777777778}
Iteration: 466
{'class_weight': 'balanced', 'boosting_type': 'gbdt', 'num_leaves': 67,
'learning_rate': 0.07828876232228349, 'subsample_for_bin': 220000,
'min_child_samples': 210, 'reg_alpha': 0.4693877551020408, 'reg_lambda':
0.9183673469387754, 'colsample_bytree': 0.9555555555555555}
Iteration: 467
{'class_weight': 'balanced', 'boosting_type': 'goss', 'num_leaves': 46,
'learning_rate': 0.011349672651536741, 'subsample_for_bin': 240000,
'min_child_samples': 250, 'reg_alpha': 0.6122448979591836, 'reg_lambda':
0.6122448979591836, 'colsample_bytree': 0.6888888888888889}
Iteration: 468
{'class_weight': 'balanced', 'boosting_type': 'goss', 'num_leaves': 42,
'learning_rate': 0.09879392446119441, 'subsample_for_bin': 20000,
'min_child_samples': 265, 'reg_alpha': 0.6938775510204082, 'reg_lambda':
0.8163265306122448, 'colsample_bytree': 0.9111111111111111}
Iteration: 469
{'class_weight': 'balanced', 'boosting_type': 'goss', 'num_leaves': 70,
'learning_rate': 0.00540314896341784, 'subsample_for_bin': 120000,
'min_child_samples': 60, 'reg_alpha': 0.2040816326530612, 'reg_lambda':
0.9591836734693877, 'colsample_bytree': 0.6444444444444444}
Iteration: 470
{'class_weight': None, 'boosting_type': 'gbdt', 'num_leaves': 110,
'learning_rate': 0.11665278239979583, 'subsample_for_bin': 40000,
'min_child_samples': 205, 'reg_alpha': 0.8775510204081632, 'reg_lambda':
0.02040816326530612, 'colsample_bytree': 1.0}
Iteration: 471
{'class_weight': None, 'boosting_type': 'gbdt', 'num_leaves': 67,
'learning_rate': 0.12375242573427632, 'subsample_for_bin': 40000,
'min_child_samples': 480, 'reg_alpha': 0.6938775510204082, 'reg_lambda':
0.061224489795918366, 'colsample_bytree': 0.9555555555555555}
Iteration: 472
{'class_weight': 'balanced', 'boosting_type': 'gbdt', 'num_leaves': 106,

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'learning_rate': 0.1499492267569419, 'subsample_for_bin': 40000,
'min_child_samples': 315, 'reg_alpha': 0.5510204081632653, 'reg_lambda':
0.2040816326530612, 'colsample_bytree': 0.6}
Iteration: 473
{'class_weight': 'balanced', 'boosting_type': 'gbdt', 'num_leaves': 71,
'learning_rate': 0.005037062407420691, 'subsample_for_bin': 60000,
'min_child_samples': 305, 'reg_alpha': 0.9387755102040816, 'reg_lambda':
0.36734693877551017, 'colsample_bytree': 0.6888888888888889}
Iteration: 474
{'class_weight': None, 'boosting_type': 'dart', 'num_leaves': 130,
'learning_rate': 0.057836101016393276, 'subsample_for_bin': 200000,
'min_child_samples': 55, 'reg_alpha': 0.16326530612244897, 'reg_lambda':
0.6530612244897959, 'colsample_bytree': 0.7777777777777778}
Iteration: 475
{'class_weight': None, 'boosting_type': 'gbdt', 'num_leaves': 91,
'learning_rate': 0.009863796797595439, 'subsample_for_bin': 260000,
'min_child_samples': 150, 'reg_alpha': 0.1020408163265306, 'reg_lambda':
0.3061224489795918, 'colsample_bytree': 0.7777777777777778}
Iteration: 476
{'class_weight': None, 'boosting_type': 'gbdt', 'num_leaves': 129,
'learning_rate': 0.006080848424946632, 'subsample_for_bin': 20000,
'min_child_samples': 335, 'reg_alpha': 0.8571428571428571, 'reg_lambda':
0.4081632653061224, 'colsample_bytree': 0.9555555555555555}
Iteration: 477
{'class_weight': None, 'boosting_type': 'gbdt', 'num_leaves': 148,
'learning_rate': 0.033983761038311154, 'subsample_for_bin': 20000,
'min_child_samples': 355, 'reg_alpha': 0.673469387755102, 'reg_lambda':
0.4693877551020408, 'colsample_bytree': 0.7333333333333333}
Iteration: 478
{'class_weight': 'balanced', 'boosting_type': 'gbdt', 'num_leaves': 44,
'learning_rate': 0.10063488527646947, 'subsample_for_bin': 80000,
'min_child_samples': 135, 'reg_alpha': 0.5306122448979591, 'reg_lambda':
0.16326530612244897, 'colsample_bytree': 0.7333333333333333}
Iteration: 479
{'class_weight': None, 'boosting_type': 'goss', 'num_leaves': 142,
'learning_rate': 0.00588208376881987, 'subsample_for_bin': 120000,
'min_child_samples': 115, 'reg_alpha': 0.7959183673469387, 'reg_lambda':
0.8979591836734693, 'colsample_bytree': 0.8666666666666667}
Iteration: 480
{'class_weight': None, 'boosting_type': 'gbdt', 'num_leaves': 75,
'learning_rate': 0.10755101209788154, 'subsample_for_bin': 280000,
'min_child_samples': 135, 'reg_alpha': 0.6938775510204082, 'reg_lambda':
0.04081632653061224, 'colsample_bytree': 0.9555555555555555}
Iteration: 481
{'class_weight': None, 'boosting_type': 'goss', 'num_leaves': 51,
'learning_rate': 0.03754657786758937, 'subsample_for_bin': 120000,
'min_child_samples': 125, 'reg_alpha': 0.6326530612244897, 'reg_lambda':
0.3469387755102041, 'colsample_bytree': 0.7333333333333333}

```



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Iteration: 482
{'class_weight': None, 'boosting_type': 'dart', 'num_leaves': 49,
 'learning_rate': 0.13572045654755216, 'subsample_for_bin': 180000,
 'min_child_samples': 280, 'reg_alpha': 0.3061224489795918, 'reg_lambda':
 0.4693877551020408, 'colsample_bytree': 1.0}
Iteration: 483
{'class_weight': None, 'boosting_type': 'dart', 'num_leaves': 114,
 'learning_rate': 0.011561166452715621, 'subsample_for_bin': 180000,
 'min_child_samples': 395, 'reg_alpha': 0.26530612244897955, 'reg_lambda':
 0.26530612244897955, 'colsample_bytree': 0.9555555555555555}
Iteration: 484
{'class_weight': None, 'boosting_type': 'goss', 'num_leaves': 149,
 'learning_rate': 0.009719176349142045, 'subsample_for_bin': 240000,
 'min_child_samples': 305, 'reg_alpha': 0.6530612244897959, 'reg_lambda':
 0.5510204081632653, 'colsample_bytree': 0.6888888888888889}
Iteration: 485
{'class_weight': 'balanced', 'boosting_type': 'dart', 'num_leaves': 132,
 'learning_rate': 0.00581728329815602, 'subsample_for_bin': 220000,
 'min_child_samples': 20, 'reg_alpha': 0.5714285714285714, 'reg_lambda':
 0.26530612244897955, 'colsample_bytree': 0.6888888888888889}
Iteration: 486
{'class_weight': 'balanced', 'boosting_type': 'gbdt', 'num_leaves': 112,
 'learning_rate': 0.03448943627095857, 'subsample_for_bin': 120000,
 'min_child_samples': 210, 'reg_alpha': 0.02040816326530612, 'reg_lambda':
 0.32653061224489793, 'colsample_bytree': 1.0}
Iteration: 487
{'class_weight': 'balanced', 'boosting_type': 'dart', 'num_leaves': 79,
 'learning_rate': 0.005463336267001169, 'subsample_for_bin': 60000,
 'min_child_samples': 80, 'reg_alpha': 0.08163265306122448, 'reg_lambda':
 0.836734693877551, 'colsample_bytree': 0.6}
Iteration: 488
{'class_weight': 'balanced', 'boosting_type': 'dart', 'num_leaves': 66,
 'learning_rate': 0.06273062405565992, 'subsample_for_bin': 240000,
 'min_child_samples': 345, 'reg_alpha': 0.04081632653061224, 'reg_lambda':
 0.18367346938775508, 'colsample_bytree': 0.9111111111111111}
Iteration: 489
{'class_weight': None, 'boosting_type': 'goss', 'num_leaves': 30,
 'learning_rate': 0.08908973256031148, 'subsample_for_bin': 180000,
 'min_child_samples': 150, 'reg_alpha': 0.04081632653061224, 'reg_lambda':
 0.5306122448979591, 'colsample_bytree': 0.9111111111111111}
Iteration: 490
{'class_weight': 'balanced', 'boosting_type': 'gbdt', 'num_leaves': 116,
 'learning_rate': 0.19489663914444297, 'subsample_for_bin': 140000,
 'min_child_samples': 30, 'reg_alpha': 0.3061224489795918, 'reg_lambda':
 0.7551020408163265, 'colsample_bytree': 0.6}
Iteration: 491
{'class_weight': None, 'boosting_type': 'gbdt', 'num_leaves': 42,
 'learning_rate': 0.11409670959818123, 'subsample_for_bin': 200000,

```

```

'min_child_samples': 425, 'reg_alpha': 0.7755102040816326, 'reg_lambda':
0.5918367346938775, 'colsample_bytree': 0.8666666666666667}
Iteration: 492
{'class_weight': 'balanced', 'boosting_type': 'dart', 'num_leaves': 30,
'learning_rate': 0.12466973829864869, 'subsample_for_bin': 80000,
'min_child_samples': 20, 'reg_alpha': 0.24489795918367346, 'reg_lambda':
0.36734693877551017, 'colsample_bytree': 0.9555555555555555}
Iteration: 493
{'class_weight': None, 'boosting_type': 'goss', 'num_leaves': 93,
'learning_rate': 0.08876136893232202, 'subsample_for_bin': 140000,
'min_child_samples': 210, 'reg_alpha': 0.26530612244897955, 'reg_lambda':
0.9183673469387754, 'colsample_bytree': 0.7777777777777778}
Iteration: 494
{'class_weight': None, 'boosting_type': 'dart', 'num_leaves': 97,
'learning_rate': 0.0054835473220934666, 'subsample_for_bin': 140000,
'min_child_samples': 355, 'reg_alpha': 0.5918367346938775, 'reg_lambda': 1.0,
'colsample_bytree': 0.9111111111111111}
Iteration: 495
{'class_weight': 'balanced', 'boosting_type': 'gbdt', 'num_leaves': 125,
'learning_rate': 0.005130924803987385, 'subsample_for_bin': 260000,
'min_child_samples': 80, 'reg_alpha': 0.22448979591836732, 'reg_lambda':
0.32653061224489793, 'colsample_bytree': 0.7333333333333333}
Iteration: 496
{'class_weight': 'balanced', 'boosting_type': 'dart', 'num_leaves': 88,
'learning_rate': 0.03658850918884146, 'subsample_for_bin': 280000,
'min_child_samples': 265, 'reg_alpha': 0.6938775510204082, 'reg_lambda':
0.6122448979591836, 'colsample_bytree': 0.9555555555555555}
Iteration: 497
{'class_weight': None, 'boosting_type': 'dart', 'num_leaves': 67,
'learning_rate': 0.051012245761693865, 'subsample_for_bin': 200000,
'min_child_samples': 120, 'reg_alpha': 1.0, 'reg_lambda': 0.8571428571428571,
'colsample_bytree': 0.8222222222222222}
Iteration: 498
{'class_weight': 'balanced', 'boosting_type': 'goss', 'num_leaves': 62,
'learning_rate': 0.008700006009044876, 'subsample_for_bin': 280000,
'min_child_samples': 375, 'reg_alpha': 0.6938775510204082, 'reg_lambda':
0.673469387755102, 'colsample_bytree': 1.0}
Iteration: 499
{'class_weight': None, 'boosting_type': 'goss', 'num_leaves': 109,
'learning_rate': 0.012310166759971456, 'subsample_for_bin': 80000,
'min_child_samples': 420, 'reg_alpha': 0.4081632653061224, 'reg_lambda':
0.673469387755102, 'colsample_bytree': 0.8222222222222222}
Iteration: 500
{'class_weight': None, 'boosting_type': 'gbdt', 'num_leaves': 35,
'learning_rate': 0.09698664119932507, 'subsample_for_bin': 260000,
'min_child_samples': 265, 'reg_alpha': 0.5306122448979591, 'reg_lambda':
0.9183673469387754, 'colsample_bytree': 1.0}

```

```
[ ]: # Sort results by best validation score
random_results.sort_values('loss', ascending = True, inplace = True)
random_results.reset_index(inplace = True, drop = True)
random_results.head()
```

```
[ ]:      loss      params iteration \
0  0.235492 {'class_weight': 'balanced', 'boosting_type': ...      284
1  0.236641 {'class_weight': None, 'boosting_type': 'dart'...     107
2  0.236871 {'class_weight': None, 'boosting_type': 'dart'...      58
3  0.237046 {'class_weight': 'balanced', 'boosting_type': ...      36
4  0.237181 {'class_weight': 'balanced', 'boosting_type': ...     260

      estimators      time
0           85  2.336585
1          100  2.221347
2          100  2.167675
3           85  2.203272
4          100  2.246852
```

```
[ ]: random_results.loc[0, 'params']
```

```
[ ]: {'boosting_type': 'dart',
      'class_weight': 'balanced',
      'colsample_bytree': 0.6444444444444444,
      'learning_rate': 0.10636616732547971,
      'min_child_samples': 280,
      'num_leaves': 72,
      'reg_alpha': 0.5918367346938775,
      'reg_lambda': 0.9795918367346939,
      'subsample': 0.8232323232323233,
      'subsample_for_bin': 280000}
```

1.0.11 Find the best parameters and number of estimators

```
[ ]: best_random_params = random_results.loc[0, 'params'].copy()
best_random_estimators = int(random_results.loc[0, 'estimators'])
best_random_model = lgb.LGBMClassifier(n_estimators=best_random_estimators,
    ↪ n_jobs = -1,
                                objective = 'binary',
    ↪ **best_random_params, random_state = 50)

# Fit on the training data
best_random_model.fit(features, labels)

# Make test predictions
predictions = best_random_model.predict_proba(test_features)[: , 1]
```

```
print('The best model from random search scores {:.4f} on the test data.'.
      ↪format(roc_auc_score(test_labels, predictions)))
print('This was achieved using {} search iterations.'.format(random_results.
      ↪loc[0, 'iteration']))
```

The best model from random search scores 0.7250 on the test data.
This was achieved using 284 search iterations.

```
[ ]: random_results.to_csv('random_caravan_lgb.csv')
```

1.1 Tuning using Bayesian optimization

```
[ ]: def objective(params, n_folds = N_FOLDS):
      """Objective function for Gradient Boosting Machine Hyperparameter
      ↪Optimization"""

      # Keep track of evals
      global ITERATION

      ITERATION += 1

      # Retrieve the subsample if present otherwise set to 1.0
      subsample = params['boosting_type'].get('subsample', 1.0)

      # Extract the boosting type
      params['boosting_type'] = params['boosting_type']['boosting_type']
      params['subsample'] = subsample

      # Make sure parameters that need to be integers are integers
      for parameter_name in ['num_leaves', 'subsample_for_bin', ↪
      ↪'min_child_samples']:
          params[parameter_name] = int(params[parameter_name])

      start = timer()

      # Perform n_folds cross validation
      cv_results = lgb.cv(params, train_set, num_boost_round = 100, nfold = ↪
      ↪n_folds,
                          metrics = 'auc', seed = 50)

      run_time = timer() - start

      # Extract the best score
      best_score = np.max(cv_results['auc-mean'])
```

```

# Loss must be minimized
loss = 1 - best_score

# Boosting rounds that returned the highest cv score
n_estimators = int(np.argmax(cv_results['auc-mean']) + 1)

# Write to the csv file ('a' means append)
of_connection = open(out_file, 'a')
writer = csv.writer(of_connection)
writer.writerow([loss, params, ITERATION, n_estimators, run_time])

# Dictionary with information for evaluation
return {'loss': loss, 'params': params, 'iteration': ITERATION,
        'estimators': n_estimators,
        'train_time': run_time, 'status': STATUS_OK}

```

Create the learning rate

```

[ ]: learning_rate = {'learning_rate': hp.loguniform('learning_rate', np.log(0.005),
↳ np.log(0.2))}

```

boosting type domain

```

[ ]: boosting_type = {'boosting_type': hp.choice('boosting_type',
        [{'boosting_type': 'gbdt',
↳ 'subsample': hp.uniform('subsample', 0.5, 1)},
        {'boosting_type': 'dart',
↳ 'subsample': hp.uniform('subsample', 0.5, 1)},
        {'boosting_type': 'goss',
↳ 'subsample': 1.0}]})

# Draw a sample
params = sample(boosting_type)
params

```

```

[ ]: {'boosting_type': {'boosting_type': 'dart', 'subsample': 0.7409580574672209}}

```

Define the search space

```

[ ]: space = {
    'class_weight': hp.choice('class_weight', [None, 'balanced']),
    'boosting_type': hp.choice('boosting_type', [{'boosting_type': 'gbdt',
↳ 'subsample': hp.uniform('gdbt_subsample', 0.5, 1)},
        {'boosting_type': 'dart',
↳ 'subsample': hp.uniform('dart_subsample', 0.5, 1)},
        {'boosting_type': 'goss',
↳ 'subsample': 1.0}]})

```

```

    'num_leaves': hp.quniform('num_leaves', 30, 150, 1),
    'learning_rate': hp.loguniform('learning_rate', np.log(0.01), np.log(0.2)),
    'subsample_for_bin': hp.quniform('subsample_for_bin', 20000, 300000, 20000),
    'min_child_samples': hp.quniform('min_child_samples', 20, 500, 5),
    'reg_alpha': hp.uniform('reg_alpha', 0.0, 1.0),
    'reg_lambda': hp.uniform('reg_lambda', 0.0, 1.0),
    'colsample_bytree': hp.uniform('colsample_by_tree', 0.6, 1.0)
}

```

```
[ ]: space
```

```

[ ]: {'boosting_type': <hyperopt.pyll.base.Apply at 0x7f4709272090>,
      'class_weight': <hyperopt.pyll.base.Apply at 0x7f470925a790>,
      'colsample_bytree': <hyperopt.pyll.base.Apply at 0x7f4709371210>,
      'learning_rate': <hyperopt.pyll.base.Apply at 0x7f47092726d0>,
      'min_child_samples': <hyperopt.pyll.base.Apply at 0x7f470b44b5d0>,
      'num_leaves': <hyperopt.pyll.base.Apply at 0x7f4709272a90>,
      'reg_alpha': <hyperopt.pyll.base.Apply at 0x7f47093455d0>,
      'reg_lambda': <hyperopt.pyll.base.Apply at 0x7f4709359510>,
      'subsample_for_bin': <hyperopt.pyll.base.Apply at 0x7f4709272150>}

```

Sample from the full space

```

[ ]: x = sample(space)

# Conditional logic to assign top-level keys
subsample = x['boosting_type'].get('subsample', 1.0)
x['boosting_type'] = x['boosting_type']['boosting_type']
x['subsample'] = subsample

x

```

```

[ ]: {'boosting_type': 'gbdt',
      'class_weight': None,
      'colsample_bytree': 0.8540736516002598,
      'learning_rate': 0.01609300921070659,
      'min_child_samples': 270.0,
      'num_leaves': 131.0,
      'reg_alpha': 0.23629347191623518,
      'reg_lambda': 0.05534013010383987,
      'subsample': 0.6170354179908204,
      'subsample_for_bin': 260000.0}

```

```

[ ]: x = sample(space)
subsample = x['boosting_type'].get('subsample', 1.0)
x['boosting_type'] = x['boosting_type']['boosting_type']
x['subsample'] = subsample

```

```
x
```

```
[ ]: {'boosting_type': 'goss',  
      'class_weight': 'balanced',  
      'colsample_bytree': 0.967883513129898,  
      'learning_rate': 0.010164777570620367,  
      'min_child_samples': 350.0,  
      'num_leaves': 118.0,  
      'reg_alpha': 0.3617330382067684,  
      'reg_lambda': 0.5425455524688315,  
      'subsample': 1.0,  
      'subsample_for_bin': 20000.0}
```

Optimization algorithm

```
[ ]: tpe_algorithm = tpe.suggest
```

```
[ ]: # Keep track of results  
      bayes_trials = Trials()
```

```
[ ]: # File to save first results  
      out_file = 'gbm_trials.csv'  
      of_connection = open(out_file, 'w')  
      writer = csv.writer(of_connection)  
  
      # Write the headers to the file  
      writer.writerow(['loss', 'params', 'iteration', 'estimators', 'train_time'])  
      of_connection.close()
```

```
[ ]: # Global variable  
      global ITERATION  
  
      ITERATION = 0
```

1.1.1 Run optimization

```
[ ]: best = fmin(fn = objective, space = space, algo = tpe.suggest,  
                max_evals = MAX_EVALS, trials = bayes_trials, rstate = np.random.  
                ↪RandomState(50))
```

```
100%|      | 500/500 [14:07<00:00, 1.69s/it, best loss: 0.2314870604562298]
```

```
[ ]: # Sort the trials with lowest loss (highest AUC) first  
      bayes_trials_results = sorted(bayes_trials.results, key = lambda x: x['loss'])  
      bayes_trials_results[:2]
```

```
[ ]: [{ 'estimators': 79,
      'iteration': 439,
      'loss': 0.2314870604562298,
      'params': { 'boosting_type': 'gbdt',
                  'class_weight': None,
                  'colsample_bytree': 0.6957294641173832,
                  'learning_rate': 0.03189034372107593,
                  'min_child_samples': 210,
                  'num_leaves': 64,
                  'reg_alpha': 0.6509724723549177,
                  'reg_lambda': 0.2936899358728862,
                  'subsample': 0.739723306775653,
                  'subsample_for_bin': 200000 },
      'status': 'ok',
      'train_time': 1.420786992000103 },
    { 'estimators': 72,
      'iteration': 83,
      'loss': 0.23157350387278575,
      'params': { 'boosting_type': 'gbdt',
                  'class_weight': None,
                  'colsample_bytree': 0.706175050890931,
                  'learning_rate': 0.03846123550001267,
                  'min_child_samples': 210,
                  'num_leaves': 110,
                  'reg_alpha': 0.5441773884605038,
                  'reg_lambda': 0.034232674562218846,
                  'subsample': 0.7449989536417149,
                  'subsample_for_bin': 60000 },
      'status': 'ok',
      'train_time': 1.4907618770000681 } ]
```

```
[ ]: results = pd.read_csv('gbm_trials.csv')

# Sort with best scores on top and reset index for slicing
results.sort_values('loss', ascending = True, inplace = True)
results.reset_index(inplace = True, drop = True)
results.head()
```

```
[ ]:      loss      params  iteration \
0  0.231487  {'boosting_type': 'gbdt', 'class_weight': None...      439
1  0.231574  {'boosting_type': 'gbdt', 'class_weight': None...      83
2  0.232837  {'boosting_type': 'gbdt', 'class_weight': None...     498
3  0.232907  {'boosting_type': 'gbdt', 'class_weight': 'bal...     217
4  0.233013  {'boosting_type': 'gbdt', 'class_weight': 'bal...     167

      estimators  train_time
0              79      1.420787
```


1	72	1.490762
2	100	1.332803
3	98	1.428482
4	100	1.384389

```
[ ]: import ast
      # Convert from a string to a dictionary
      ast.literal_eval(results.loc[0, 'params'])
```

```
[ ]: {'boosting_type': 'gbdt',
      'class_weight': None,
      'colsample_bytree': 0.6957294641173832,
      'learning_rate': 0.03189034372107593,
      'min_child_samples': 210,
      'num_leaves': 64,
      'reg_alpha': 0.6509724723549177,
      'reg_lambda': 0.2936899358728862,
      'subsample': 0.739723306775653,
      'subsample_for_bin': 200000}
```

1.1.2 Extract the ideal number of estimators and hyperparameters

```
[ ]: best_bayes_estimators = int(results.loc[0, 'estimators'])
      best_bayes_params = ast.literal_eval(results.loc[0, 'params']).copy()

      # Re-create the best model and train on the training data
      best_bayes_model = lgb.LGBMClassifier(n_estimators=best_bayes_estimators,
      ↪ n_jobs = -1,
      ↪
      ↪ objective = 'binary', random_state = 50,
      ↪ **best_bayes_params)
      best_bayes_model.fit(features, labels)
```

```
[ ]: LGBMClassifier(colsample_bytree=0.6957294641173832,
                    learning_rate=0.03189034372107593, min_child_samples=210,
                    n_estimators=79, num_leaves=64, objective='binary',
                    random_state=50, reg_alpha=0.6509724723549177,
                    reg_lambda=0.2936899358728862, subsample=0.739723306775653)
```

1.1.3 Evaluate on the testing data

```
[ ]: preds = best_bayes_model.predict_proba(test_features)[: , 1]
      print('The best model from Bayes optimization scores {:.5f} AUC ROC on the test_
      ↪ set.'.format(roc_auc_score(test_labels, preds)))
      print('This was achieved after {} search iterations'.format(results.loc[0,
      ↪ 'iteration']))
```

The best model from Bayes optimization scores 0.72758 AUC ROC on the test set.
This was achieved after 439 search iterations