Log Data Preparation

1. Baseline (Run full 693k rows)

model	metric	score_type	value
LightGBM	MAE	test	1.037420
		train	1.033931
	MSE	test	2.622168
		train	2.595258
	R2	test	0.967247
		train	0.967583
	RMSE	test	1.619243
		train	1.610973

2. Tune Model LGBM (Run full 693k rows)

```
search_params = {
        "num_leaves" : [128, 256, 384],
        "max_depth" : [9, 10, 12, 14, 16],
        "min_data_in_leaf" : [100, 150, 200],
        "min_gain_in_leaf" : [7, 8, 9, 10],
        "bagging_fraction" : [0.5, 0.6, 0.7],
        "feature_fraction" : [0.7, 0.8, 0.9],
        "reg_alpha" : [0.01, 0.02, 0.03],
        "reg_lambda" : [0.01, 0.04, 0.08],
        "learning_rate" : [0.15, 0.18]
}
```

```
Best Parameters: {'bagging_fraction': 0.5, 'feature_fraction': 0.8, 'learning_r
ate': 0.15, 'max_depth': 10, 'min_data_in_leaf': 100, 'min_gain_in_leaf': 10,
'num_leaves': 128, 'reg_alpha': 0.03, 'reg_lambda': 0.08}
Best Score (RMSE): 1.5790428961619543
```

```
Training set:
R^2: 0.970
MAE: 0.976
MSE: 2.382
RMSE: 1.543

Test set:
R^2: 0.968
MAE: 0.999
MSE: 2.562
RMSE: 1.601
Overfit ratio: 1.076
```

3. Tune Model LGBM to all hyperparameter except learning_rate (Run full 693k rows)

```
search_params = {
        "num_leaves" : [256, 320, 384, 448, 512],
        "max_depth" : [6, 8, 10, 12, 14],
        "min_data_in_leaf" : [120, 130, 150],
        "min_gain_in_leaf" : [9, 10, 12, 14],
        "bagging_fraction" : [0.9, 0.95, 1.0],
        "feature_fraction" : [0.85, 0.9, 0.95],
        "reg_alpha" : [0.01, 0.02, 0.03],
        "reg_lambda" : [0.01, 0.04, 0.08],
        "learning_rate" : [0.15, 0.18]
}
```

```
Training set:
R^2: 0.971
MAE: 0.961
MSE: 2.309
RMSE: 1.519

Test set:
R^2: 0.968
MAE: 0.999
MSE: 2.557
RMSE: 1.599
Overfit ratio: 1.108
```

4. Tune Model LGBM for learning_rate (Run full 693k rows)

```
search_params = {
        "num_leaves" : [256, 320, 384, 448, 512],
        "max_depth" : [6, 8, 10, 12, 14],
        "min_data_in_leaf" : [120, 130, 150],
        "min_gain_in_leaf" : [9, 10, 12, 14],
        "bagging_fraction" : [0.9, 0.95, 1.0],
        "feature_fraction" : [0.85, 0.9, 0.95],
        "reg_alpha" : [0.01, 0.02, 0.03],
        "reg_lambda" : [0.01, 0.04, 0.08],
        "learning_rate" : [0.01, 0.05, 0.10]
}
```

```
Training set:
R^2: 0.967
MAE: 1.043
MSE: 2.648
RMSE: 1.627

Test set:
R^2: 0.966
MAE: 1.053
MSE: 2.745
RMSE: 1.657
Overfit ratio: 1.037
```

```
Best Parameters: {'bagging_fraction': 0.9, 'feature_fraction': 0.9, 'learning_rate': 0.1, 'max_depth': 6,
'min_data_in_leaf': 130, 'min_gain_in_leaf': 9, 'num_leaves': 384, 'reg_alpha': 0.03, 'reg_lambda': 0.01}
Best Score (RMSE): 1.6403408195037994
```

5. Tune Model LGBM for learning_rate (Run 69,3k rows)

```
search_params = {
        "num_leaves" : [256, 320, 384, 448, 512],
        "max_depth" : [6, 8, 10, 12, 14],
        "min_data_in_leaf" : [120, 130, 150],
        "min_gain_in_leaf" : [9, 10, 12, 14],
        "bagging_fraction" : [0.9, 0.95, 1.0],
        "feature_fraction" : [0.85, 0.9, 0.95],
        "reg_alpha" : [0.01, 0.02, 0.03],
        "reg_lambda" : [0.01, 0.04, 0.08],
        "learning_rate" : [0.01, 0.05, 0.10]
}
```

```
Best Parameters: {'bagging_fraction': 0.9, 'feature_fraction': 0.9, 'learning_rate': 0.01, 'ma
x_depth': 14, 'min_data_in_leaf': 120, 'min_gain_in_leaf': 10, 'num_leaves': 320, 'reg_alpha':
0.01, 'reg_lambda': 0.01}
Best Score (RMSE): 4.350841003886117
```

```
Training set:
R^2: 0.777
MAE: 3.009
MSE: 17.855
RMSE: 4.226

Test set:
R^2: 0.765
MAE: 2.910
MSE: 17.676
RMSE: 4.204
Overfit ratio: 0.990
```

6. Tune Model LGBM for learning_rate (Run full 693k rows)

```
search_params = {
        "num_leaves" : [256, 320, 384, 448, 512],
        "max_depth" : [6, 8, 10, 12, 14],
        "min_data_in_leaf" : [120, 130, 150],
        "min_gain_in_leaf" : [9, 10, 12, 14],
        "bagging_fraction" : [0.9, 0.95, 1.0],
        "feature_fraction" : [0.85, 0.9, 0.95],
        "reg_alpha" : [0.01, 0.02, 0.03],
        "reg_lambda" : [0.01, 0.04, 0.08],
        "learning_rate" : [0.002, 0.005, 0.01]
}
```

```
Best Parameters: {'bagging_fraction': 0.9, 'feature_fracti
on': 0.9, 'learning_rate': 0.01, 'max_depth': 14, 'min_dat
a_in_leaf': 120, 'min_gain_in_leaf': 10, 'num_leaves': 51
2, 'reg_alpha': 0.01, 'reg_lambda': 0.01}
Best Score (RMSE): 3.682790242627231
```

```
Training set:
R^2: 0.834
MAE: 2.772
MSE: 13.288
RMSE: 3.645

Test set:
R^2: 0.833
MAE: 2.779
MSE: 13.417
RMSE: 3.663
Overfit ratio: 1.010
```

7. Tune Model LGBM for learning_rate (Run 69,3k rows)

```
search_params = {
        "num_leaves" : [32, 64, 128, 256],
        "max_depth" : [6, 8, 10],
        "min_data_in_leaf" : [120, 135, 150],
        "min_gain_in_leaf" : [9, 10, 12],
        "bagging_fraction" : [0.9, 0.95],
        "feature_fraction" : [0.9, 0.95],
        "reg_alpha" : [0.01, 0.02],
        "reg_lambda" : [0.01, 0.04],
        "learning_rate" : [0.001, 0.003, 0.005]
}
```

```
Best Parameters: {'bagging_fraction': 0.95, 'feature_fraction': 0.95, 'learning_rate':
0.005, 'max_depth': 10, 'min_data_in_leaf': 150, 'min_gain_in_leaf': 12, 'num_leaves':
256, 'reg_alpha': 0.02, 'reg_lambda': 0.04}
Best Score (RMSE): 5.785968059697697
```

```
Training set:
R^2: 0.590
MAE: 4.402
MSE: 32.914
RMSE: 5.737

Test set:
R^2: 0.587
MAE: 4.363
MSE: 32.847
RMSE: 5.731
Overfit ratio: 0.998
```

8. Tune Model LGBM for learning_rate (Run 69,3k rows)

```
search_params = {
        "num_leaves" : [32, 64, 128, 256],
        "max_depth" : [6, 8, 10],
        "min_data_in_leaf" : [120, 135, 150],
        "min_gain_in_leaf" : [9, 10, 12],
        "bagging_fraction" : [0.9, 0.95],
        "feature_fraction" : [0.9, 0.95],
        "reg_alpha" : [0.01, 0.02],
        "reg_lambda" : [0.01, 0.04],
        "learning_rate" : [0.005, 0.007, 0.009]
}
```

```
9  # Fit the HalvingGridSearchCV object to the training data
10 grid_search.fit(X_train, y_train.values.ravel())
```

executed in 1m 15.4s, finished 11:06:24 2023-07-22

```
666:    learn: 1.1413700        total: 3.06s    remaining: 1.53s
```

```
Best Parameters: {'bagging_fraction': 0.9, 'feature_fraction': 0.9, 'learning_rate': 0.009, 'ma
x_depth': 8, 'min_data_in_leaf': 120, 'min_gain_in_leaf': 9, 'num_leaves': 64, 'reg_alpha': 0.0
1, 'reg_lambda': 0.01}
Best Score (RMSE): 4.8255248050005815
```

```
Training set:
R^2: 0.720
MAE: 3.463
MSE: 22.231
RMSE: 4.715

Test set:
R^2: 0.751
MAE: 3.312
MSE: 18.502
RMSE: 4.301
Overfit ratio: 0.832
```

9. Tune Model LGBM for learning_rate (Run 69,3k rows)

```
search_params = {
        "num_leaves" : [32, 64, 128, 256],
        "max_depth" : [6, 8, 10],
        "min_data_in_leaf" : [120, 135, 150],
        "min_gain_in_leaf" : [9, 10, 12],
        "bagging_fraction" : [0.9, 0.95],
        "feature_fraction" : [0.9, 0.95],
        "reg_alpha" : [0.01, 0.02],
        "reg_lambda" : [0.01, 0.04],
        "learning_rate" : [0.012, 0.014, 0.016]
}
```

```
Best Parameters: {'bagging_fraction': 0.9, 'feature_fraction': 0.9, 'learning_rate': 0.016, 'max_depth': 8, 'min_data_in_leaf': 120, 'min_gain_in_leaf': 9, 'num_leaves': 128,
'reg_alpha': 0.01, 'reg_lambda': 0.04}
Best Score (RMSE): 3.542022973489888
```

```
Training set:
R^2: 0.859
MAE: 2.299
MSE: 11.132
RMSE: 3.336

Test set:
R^2: 0.849
MAE: 2.348
MSE: 11.735
RMSE: 3.426
Overfit ratio: 1.054
```

10. Tune Model LGBM for learning_rate (Run 69,3k rows)

```
search_params = {
        "num_leaves" : [32, 64, 128, 256],
        "max_depth" : [6, 8, 10],
        "min_data_in_leaf" : [120, 135, 150],
        "min_gain_in_leaf" : [9, 10, 12],
        "bagging_fraction" : [0.9, 0.95],
        "feature_fraction" : [0.9, 0.95],
        "reg_alpha" : [0.01, 0.02],
        "reg_lambda" : [0.01, 0.04],
        "learning_rate" : [0.016, 0.020, 0.024]
}
```

```
Best Parameters: {'bagging_fraction': 0.9, 'feature_fraction': 0.9, 'learning_rate': 0.024, 'max_depth': 8, 'min_data_in_leaf':
120, 'min_gain_in_leaf': 10, 'num_leaves': 32, 'reg_alpha': 0.01, 'reg_lambda': 0.01}
Best Score (RMSE): 3.1195552896047234
```

```
Training set:
R^2: 0.893
MAE: 1.783
MSE: 8.632
RMSE: 2.938

Test set:
R^2: 0.897
MAE: 1.805
MSE: 7.880
RMSE: 2.807
Overfit ratio: 0.913
```

11. Tune Model LGBM for learning_rate (Run 6,93k rows)

```
search_params = {
        "num_leaves" : [32, 64, 128, 256],
        "max_depth" : [6, 8, 10],
        "min_data_in_leaf" : [120, 135, 150],
        "min_gain_in_leaf" : [9, 10, 12],
        "bagging_fraction" : [0.9, 0.95],
        "feature_fraction" : [0.9, 0.95],
        "reg_alpha" : [0.01, 0.02],
        "reg_lambda" : [0.01, 0.04],
        "learning_rate" : [0.024, 0.032, 0.048]
}
```

```
Best Parameters: {'bagging_fraction': 0.9, 'feature_fraction': 0.9, 'learning_rate': 0.048, 'max
_depth': 8, 'min_data_in_leaf': 120, 'min_gain_in_leaf': 10, 'num_leaves': 64, 'reg_alpha': 0.0
1, 'reg_lambda': 0.01}
Best Score (RMSE): 2.607636483543015
```

```
Training set:
R^2: 0.929
MAE: 1.378
MSE: 5.847
RMSE: 2.418

Test set:
R^2: 0.928
MAE: 1.424
MSE: 5.723
RMSE: 2.392
Overfit ratio: 0.979
```

12. Tune Model LGBM for learning_rate (Run 6,93k rows)

```
search_params = {
        "num_leaves" : [32, 64, 128, 256],
        "max_depth" : [6, 8, 10],
        "min_data_in_leaf" : [120, 135, 150],
        "min_gain_in_leaf" : [9, 10, 12],
        "bagging_fraction" : [0.9, 0.95],
        "feature_fraction" : [0.9, 0.95],
        "reg_alpha" : [0.01, 0.02],
        "reg_lambda" : [0.01, 0.04],
        "learning_rate" : [0.048, 0.060, 0.072, 0.084, 0.1]
}
```

```
Best Parameters: {'bagging_fraction': 0.9, 'feature_fraction': 0.9, 'learning_rate': 0.08
4, 'max_depth': 10, 'min_data_in_leaf': 135, 'min_gain_in_leaf': 10, 'num_leaves': 64, 'r
eg_alpha': 0.01, 'reg_lambda': 0.04}
Best Score (RMSE): 2.9233377867934607
```

```
Training set:
R^2: 0.934
MAE: 1.327
MSE: 5.378
RMSE: 2.319

Test set:
R^2: 0.931
MAE: 1.391
MSE: 5.475
RMSE: 2.340
Overfit ratio: 1.018
```

13. Tune Model LGBM for learning_rate (Run 6,93k rows)

```
search_params = {
        "num_leaves" : [32, 64, 128, 256],
        "max_depth" : [6, 8, 10],
        "min_data_in_leaf" : [120, 135, 150],
        "min_gain_in_leaf" : [9, 10, 12],
        "bagging_fraction" : [0.9, 0.95],
        "feature_fraction" : [0.9, 0.95],
        "reg_alpha" : [0.05, 0.08],
        "reg_lambda" : [0.03, 0.08],
        "learning_rate" : [0.072, 0.075, 0.078, 0.081, 0.084]
}
```

```
Best Parameters: {'bagging_fraction': 0.9, 'feature_fraction': 0.9, 'learning_rate': 0.081, 'max_depth': 10, 'min_data_in_leaf': 120, 'min_gain_in_leaf': 12, 'num_leaves': 64, 'reg_alpha': 0.08, 'reg_lambda': 0.08}
Best Score (RMSE): 2.499031352570706
```

```
Training set:
R^2: 0.946
MAE: 1.228
MSE: 4.274
RMSE: 2.067

Test set:
R^2: 0.939
MAE: 1.339
MSE: 4.489
RMSE: 2.119
Overfit ratio: 1.050
```

14. Tune Model LGBM for learning_rate (Run full 693k rows)

```
search_params = {
        "num_leaves" : [128, 256],
        "max_depth" : [6, 8, 10],
        "min_data_in_leaf" : [120, 135, 150],
        "min_gain_in_leaf" : [9, 10, 12],
        "bagging_fraction" : [0.080, 0.085, 0.9],
        "feature_fraction" : [0.080, 0.085, 0.9],
        "reg_alpha" : [0.05, 0.08],
        "reg_lambda" : [0.03, 0.08],
        "learning_rate" : [0.0808, 0.0809, 0.081]
}
```

```
10  grid_search.fit(X_train, y_train.values.ravel())
```

executed in 13m 26s, finished 22:58:19 2023-07-22

```
Best Parameters: {'bagging_fraction': 0.08, 'feature_fraction': 0.9, 'learning_rate': 0.0808, 'max_depth': 6, 'min_data_in_leaf': 150, 'min_gain_in_leaf': 9, 'num_leaves': 128, 'reg_alpha': 0.08, 'reg_lambda': 0.08}
Best Score (RMSE): 1.6556935824930197
```

```
Training set:
R^2: 0.966
MAE: 1.062
MSE: 2.710
RMSE: 1.646

Test set:
R^2: 0.965
MAE: 1.071
MSE: 2.804
RMSE: 1.674
Overfit ratio: 1.035
```

15. Tune Model LGBM for learning_rate (Run full 693k rows)

```
search_params = {
        "num_leaves" : [256, 288, 320],
        "max_depth" : [9, 10],
        "min_data_in_leaf" : [120, 135, 150],
        "min_gain_in_leaf" : [6, 7, 8],
        "bagging_fraction" : [0.080, 0.085, 0.9],
        "feature_fraction" : [0.070, 0.075, 0.8],
        "reg_alpha" : [0.05, 0.08],
        "reg_lambda" : [0.03, 0.08],
        "learning_rate" : [0.0808, 0.0809, 0.081]
}
```

```
9  # Fit the HalvingGridSearchCV object to the training
10 grid_search.fit(X_train, y_train.values.ravel())
```

executed in 14m 58s, finished 08:05:38 2023-07-23

```
/Users/agagoks/opt/anaconda3/lib/python3.9/site-packages/sci
```

```
Best Parameters: {'bagging_fraction': 0.08, 'feature_fraction':
0.8, 'learning_rate': 0.0808, 'max_depth': 9, 'min_data_in_leaf':
120, 'min_gain_in_leaf': 6, 'num_leaves': 320, 'reg_alpha': 0.05,
'reg_lambda': 0.08}
Best Score (RMSE): 1.602609627371726
```

```
Training set:
R^2: 0.969
MAE: 0.997
MSE: 2.487
RMSE: 1.577

Test set:
R^2: 0.967
MAE: 1.017
MSE: 2.632
RMSE: 1.622
Overfit ratio: 1.058
```

16. Tune Model LGBM for learning_rate (Run full 693k rows)

```
search_params = {
        "num_leaves" : [536, 645, 1126, 1290],
        "max_depth" : [10, 11],
        "min_data_in_leaf" : [120, 135, 150],
        "min_gain_in_leaf" : [6, 7, 8],
        "bagging_fraction" : [0.080, 0.085, 0.9],
        "feature_fraction" : [0.070, 0.075, 0.8],
        "reg_alpha" : [0.12, 0.15],
        "reg_lambda" : [0.08, 0.12],
        "learning_rate" : [0.0808, 0.0809, 0.081]
}
```


```
Best Parameters: {'bagging_fraction': 0.08, 'feature_f
raction': 0.8, 'learning_rate': 0.0808, 'max_depth': 1
1, 'min_data_in_leaf': 120, 'min_gain_in_leaf': 7, 'nu
m_leaves': 645, 'reg_alpha': 0.15, 'reg_lambda': 0.08}
Best Score (RMSE): 1.5917849846232925
```

```
Training set:
R^2: 0.970
MAE: 0.968
MSE: 2.379
RMSE: 1.542

Test set:
R^2: 0.968
MAE: 0.998
MSE: 2.586
RMSE: 1.608
Overfit ratio: 1.087
```

17. Tune Model LGBM for learning_rate (Run full 693k rows)

```
search_params = {
        "num_leaves" : [2252, 2580, 4505],
        "max_depth" : [12, 13],
        "min_data_in_leaf" : [120, 135, 150],
        "min_gain_in_leaf" : [6, 7, 8],
        "bagging_fraction" : [0.080, 0.085, 0.9],
        "feature_fraction" : [0.070, 0.075, 0.8],
        "reg_alpha" : [0.45, 0.6, 0.75],
        "reg_lambda" : [0.55, 0.65, 0.75],
        "learning_rate" : [0.0808, 0.0809, 0.081]
}
```

```
9  # Fit the HalvingGridSearchCV object to the training
10 grid_search.fit(X_train, y_train.values.ravel())
```

executed in 30m 8s, finished 21:24:48 2023-07-23

```
/Users/agagoks/opt/anaconda3/lib/python3.9/site-packages/sci
```

```
Best Parameters: {'bagging_fraction': 0.08, 'feature_fraction': 0.8, 'learning_rate': 0.0808, 'max_depth': 12, 'min_data_in_lea
f': 120, 'min_gain_in_leaf': 6, 'num_leaves': 2252, 'reg_alpha': 0.21, 'reg_lambda': 0.18}
Best Score (RMSE): 1.5893023465754532
```

```
Training set:
R^2: 0.971
MAE: 0.957
MSE: 2.340
RMSE: 1.530

Test set:
R^2: 0.968
MAE: 0.993
MSE: 2.572
RMSE: 1.604
Overfit ratio: 1.099
```

18. Tune Model LGBM for learning_rate (Run full 693k rows)

```
search_params = {
        "num_leaves" : [2000, 2252, 2580],
        "max_depth" : [12, 13],
        "min_data_in_leaf" : [120, 135, 150],
        "min_gain_in_leaf" : [6, 7, 8],
        "bagging_fraction" : [0.080, 0.085, 0.9],
        "feature_fraction" : [0.070, 0.075, 0.8],
        "reg_alpha" : [0.45, 0.6, 0.75],
        "reg_lambda" : [0.55, 0.65, 0.75],
        "learning_rate" : [0.0808, 0.0809, 0.081]
}
```

```
9  # Fit the HalvingGridSearchCV object to the training data
10 grid_search.fit(X_train, y_train.values.ravel())
```

executed in 30m 6s, finished 22:57:37 2023-07-23

```
/Users/agagoks/opt/anaconda3/lib/python3.9/site-packages/scipy/__
23.0 is required for this version of SciPy (detected version 1.24
```

```
Best Parameters: {'bagging_fraction': 0.08, 'feature_fraction': 0.075, 'learning_rate': 0.081, 'max_depth': 12, 'min_data_in_le
af': 150, 'min_gain_in_leaf': 7, 'num_leaves': 2580, 'reg_alpha': 0.6, 'reg_lambda': 0.55}
Best Score (RMSE): 3.7056403794101285
```

```
Training set:
R^2: 0.833
MAE: 2.651
MSE: 13.396
RMSE: 3.660

Test set:
R^2: 0.827
MAE: 2.687
MSE: 13.862
RMSE: 3.723
Overfit ratio: 1.035
```

19. Tune Model LGBM for learning_rate (Run full 693k rows)

```
search_params = {
        "num_leaves" : [4505, 5160],
        "max_depth" : [13, 14],
        "min_data_in_leaf" : [150, 185, 220],
        "min_gain_in_leaf" : [6, 7, 8],
        "bagging_fraction" : [0.080, 0.085, 0.9],
        "feature_fraction" : [0.070, 0.075, 0.8],
        "reg_alpha" : [0.45, 0.6, 0.75],
        "reg_lambda" : [0.55, 0.65, 0.75],
        "learning_rate" : [0.0808, 0.0809, 0.081]
}
```

```
9  # Fit the HalvingGridSearchCV object to the traini
10 grid_search.fit(X_train, y_train.values.ravel())
```

executed in 51m 50s, finished 15:04:12 2023-07-24

/Users/agagoks/opt/anaconda3/lib/python3.9/site-packages/s

```
Best Parameters: {'bagging_fraction': 0.08, 'feature_fraction': 0.8, 'learning_rate': 0.0808, 'max_depth': 14, 'min_data_in_lea
f': 150, 'min_gain_in_leaf': 6, 'num_leaves': 4505, 'reg_alpha': 0.45, 'reg_lambda': 0.55}
Best Score (RMSE): 1.5900301175966587
```

```
Training set:
R^2: 0.971
MAE: 0.946
MSE: 2.300
RMSE: 1.517

Test set:
R^2: 0.968
MAE: 0.991
MSE: 2.576
RMSE: 1.605
Overfit ratio: 1.120
```

20. Tune Model LGBM for learning_rate (Run full 693k rows)

```
search_params = {
        "num_leaves" : [4505, 5160],
        "max_depth" : [13, 14],
        "min_data_in_leaf" : [150, 185, 220],
        "min_gain_in_leaf" : [6, 7, 8],
        "bagging_fraction" : [0.080, 0.085, 0.9],
        "feature_fraction" : [0.070, 0.075, 0.8],
        "reg_alpha" : [1.45, 1.6, 1.75],
        "reg_lambda" : [0.75, 0.85, 0.95],
        "learning_rate" : [0.0808, 0.0809, 0.081]
}
```

```
9  # Fit the HalvingGridSearchCV object
10 grid_search.fit(X_train, y_train.valu
```

executed in 34m 8s, finished 23:12:16 2023-07-24

```
  23.0 is required for this version of SciPy
    warnings.warn(f"A NumPy version >={np_min
  /Users/agagoks/opt/anaconda3/lib/python3.9/
```

```
Best Parameters: {'bagging_fraction': 0.08, 'feature_fraction': 0.8, 'learning_rate': 0.0808, 'max_depth': 14, 'min_data_in_lea
f': 150, 'min_gain_in_leaf': 6, 'num_leaves': 5160, 'reg_alpha': 1.75, 'reg_lambda': 0.85}
Best Score (RMSE): 1.5897450763592318
```

```
Training set:
R^2: 0.971
MAE: 0.949
MSE: 2.312
RMSE: 1.520

Test set:
R^2: 0.968
MAE: 0.992
MSE: 2.576
RMSE: 1.605
Overfit ratio: 1.115
```