

Hyperparameter Tuning Whitepaper

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Keywords machine learning, quantitative trading, hyperparameter optimization, XGBoost, LightGBM

1. LOGISTIC REGRESSION OPTUNA HPO RESULTS

1.a. Best Trial

:label: logistic-regression-best-trial

Best Trial Performance	
Trial Number	26
Performance Score	0.68990
Start Time	2023-11-17 15:55:06
Completion Time	2023-11-17 15:56:22
Execution Duration	1:15.74 (minutes:seconds)
Trial ID	177

1.b. Best Parameters

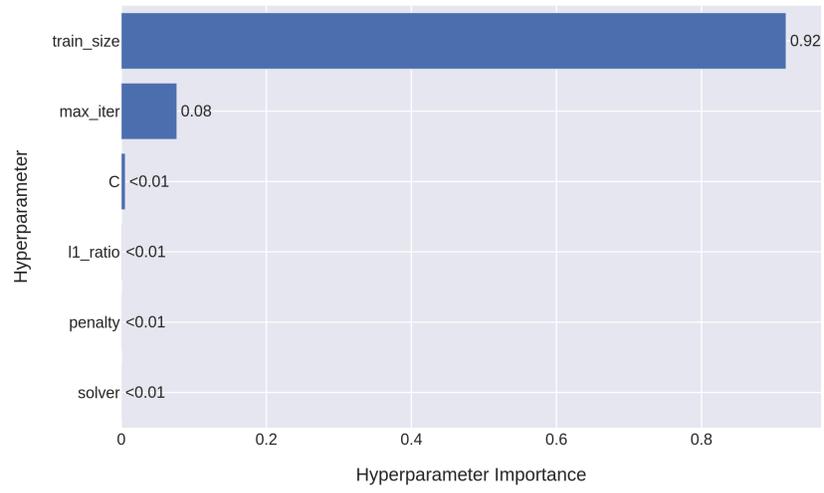
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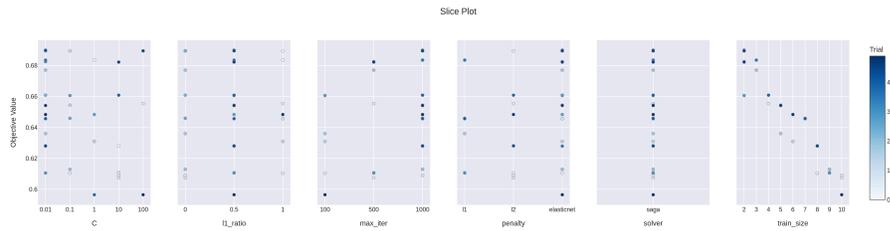
1.c. Embedded Visualizations

1.c.i. Parameter Importances:

Hyperparameter Importances

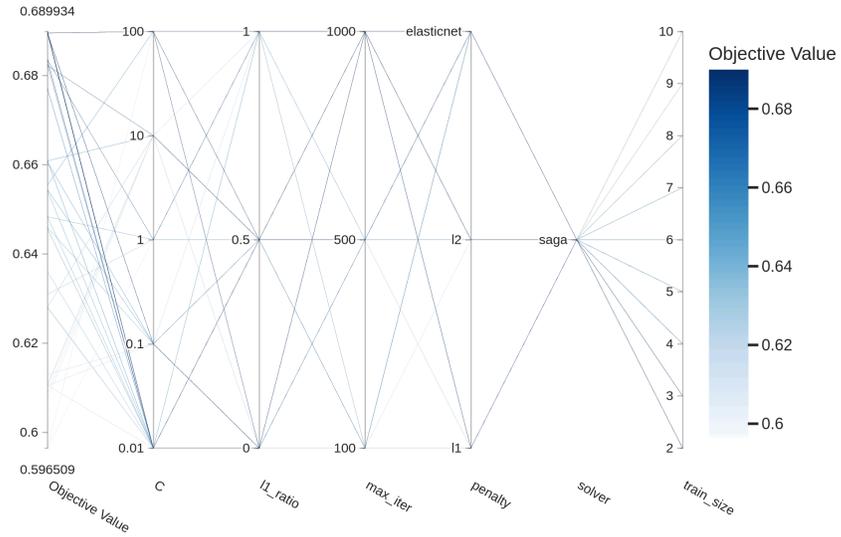


1.c.ii. Slice Plot:



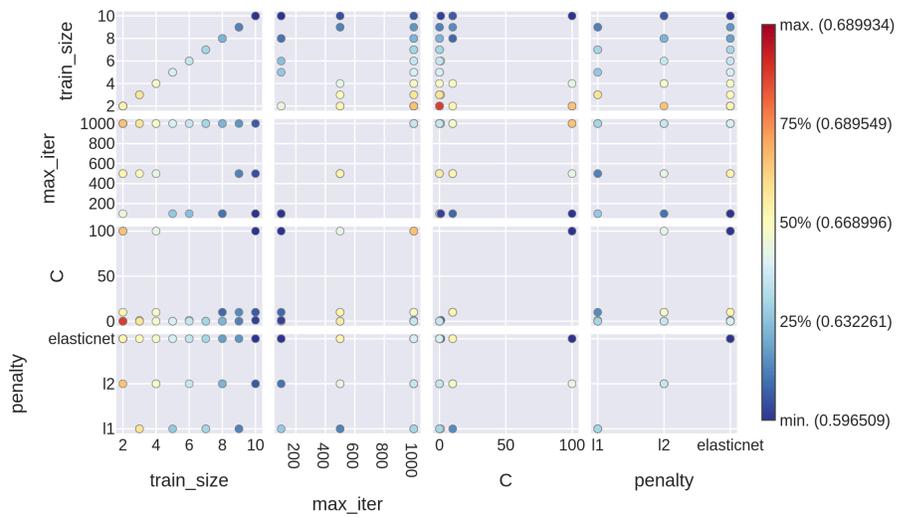
1.c.iii. Parallel Coordinates Plot:

Parallel Coordinate Plot

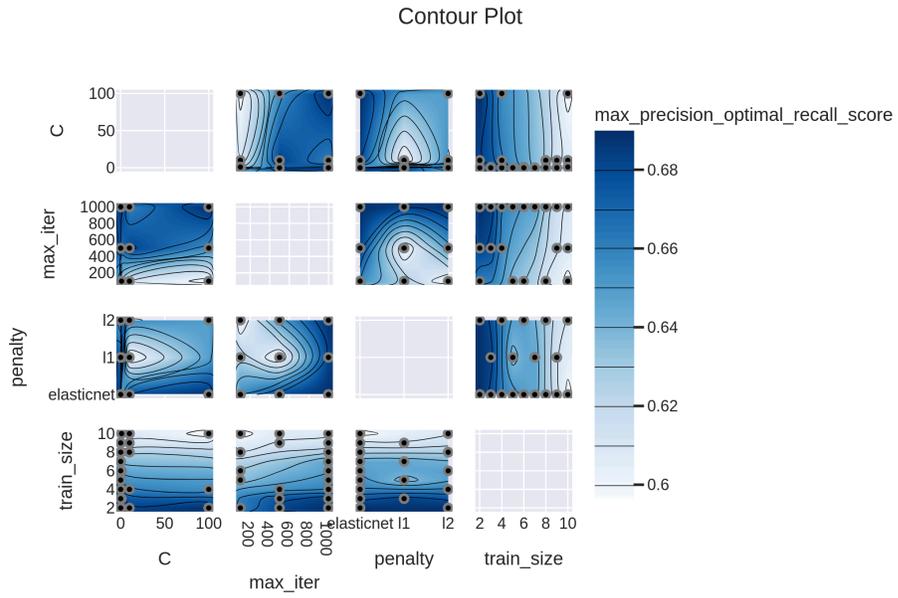


1.c.iv. Rank Plot:

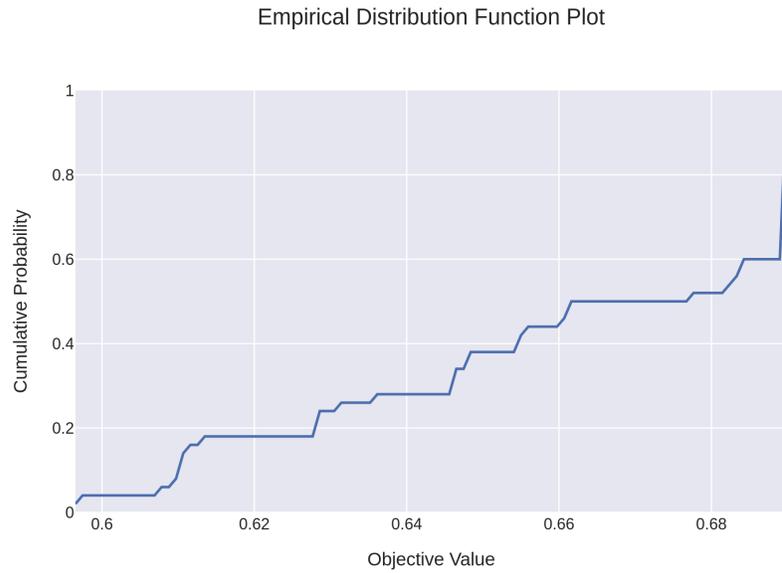
Rank (max_precision_optimal_recall_score)



1.c.v. Contour Plot:

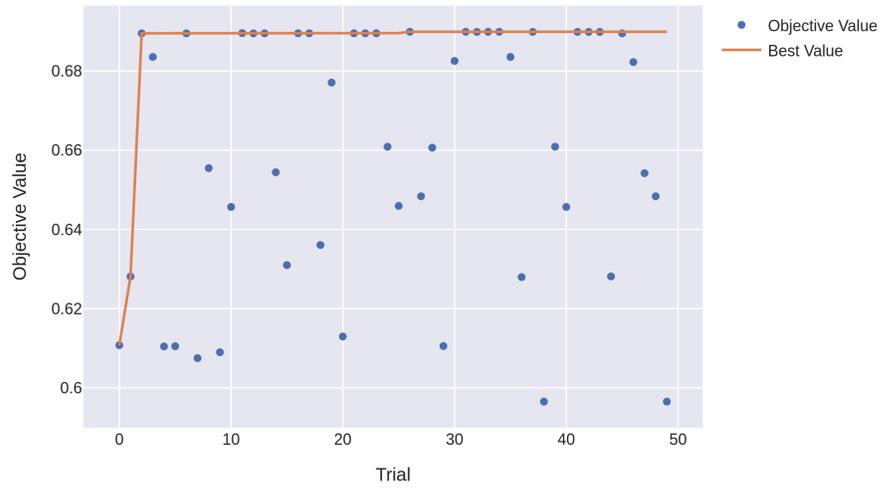


1.c.vi. *EDF Plot:*



1.c.vii. *Optimization History:*

Optimization History Plot



2. RANDOM FOREST OPTUNA HPO RESULTS

2.a. Best Trial

:label: random-forest-best-trial

Best Trial Performance	
Trial Number	46
Performance Score	0.66480
Start Time	2023-11-17 18:23:30
Completion Time	2023-11-17 18:26:19
Execution Duration	2:48.91 (minutes:seconds)
Trial ID	97

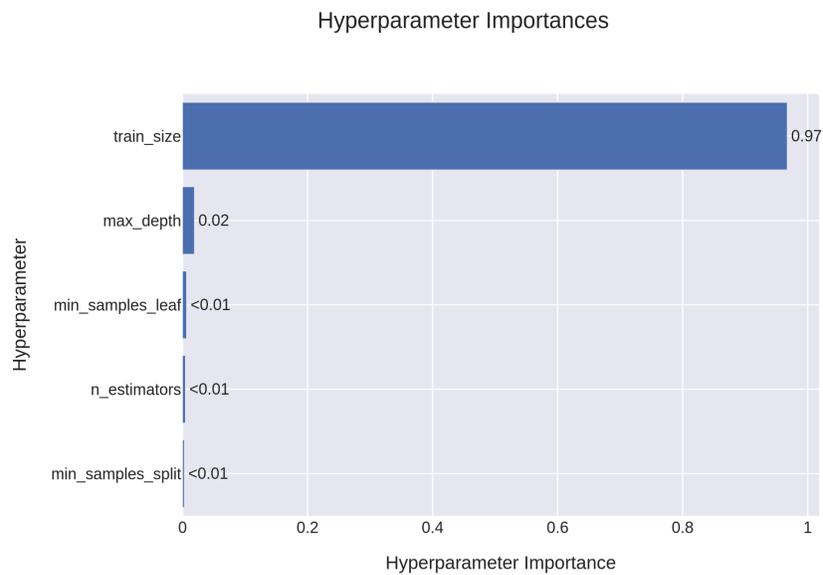
2.b. Best Parameters

:label: random-forest-best-parameters

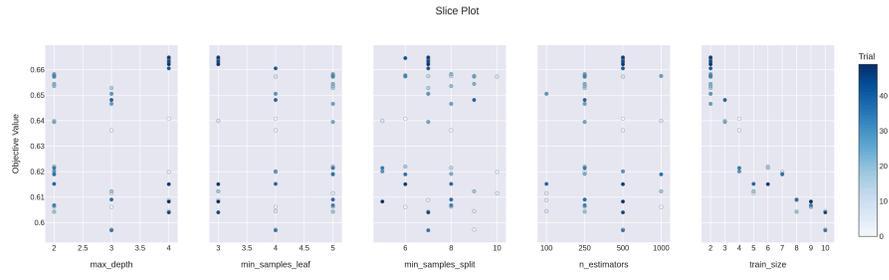
Optimized Hyperparameters	
n_estimators	500
max_depth	4
min_samples_split	7
min_samples_leaf	3
train_size	2

2.c. Embedded Visualizations

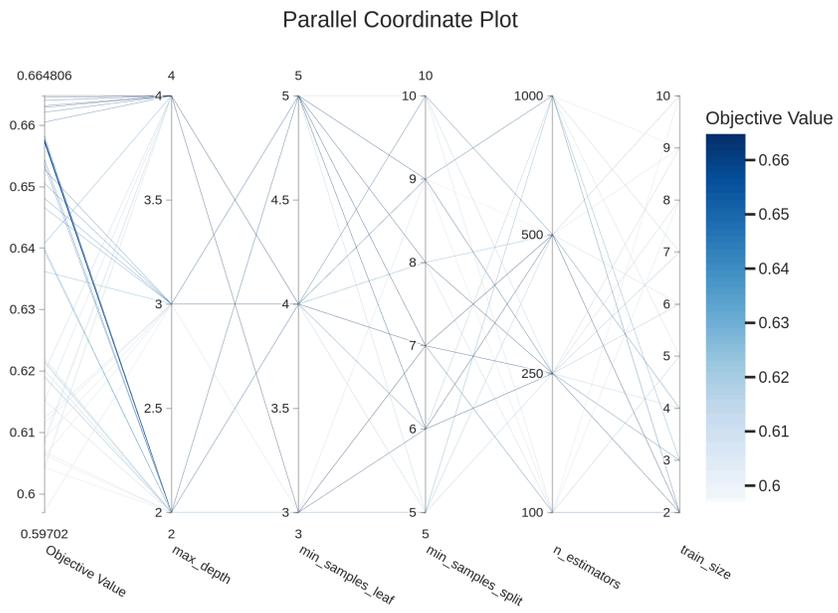
2.c.i. Parameter Importances:



2.c.ii. *Slice Plot:*

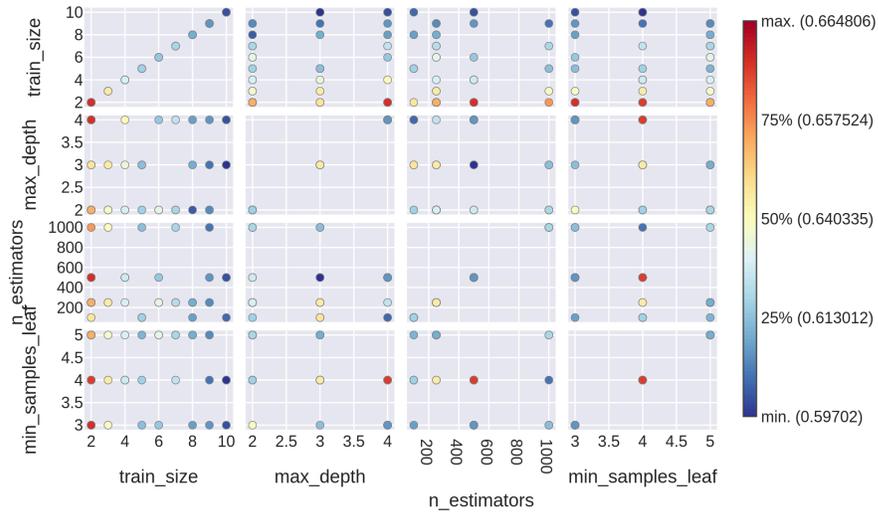


2.c.iii. *Parallel Coordinates Plot:*



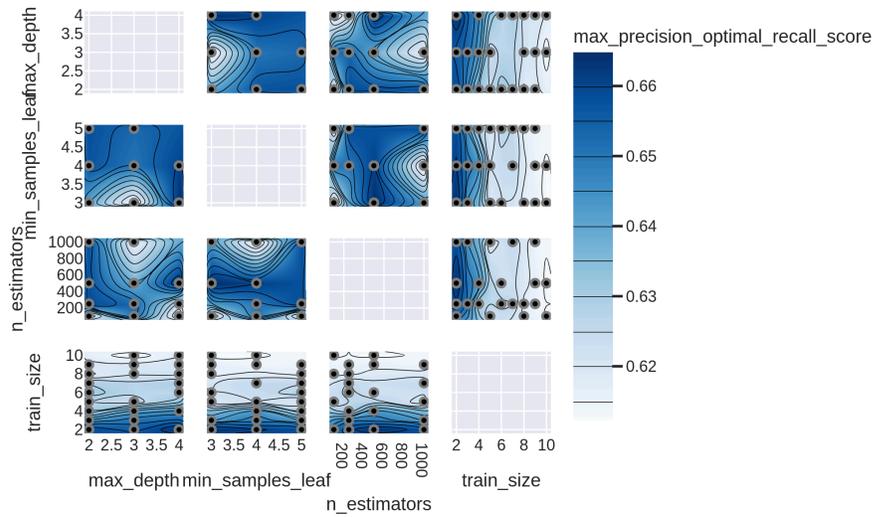
2.c.iv. *Rank Plot:*

Rank (max_precision_optimal_recall_score)



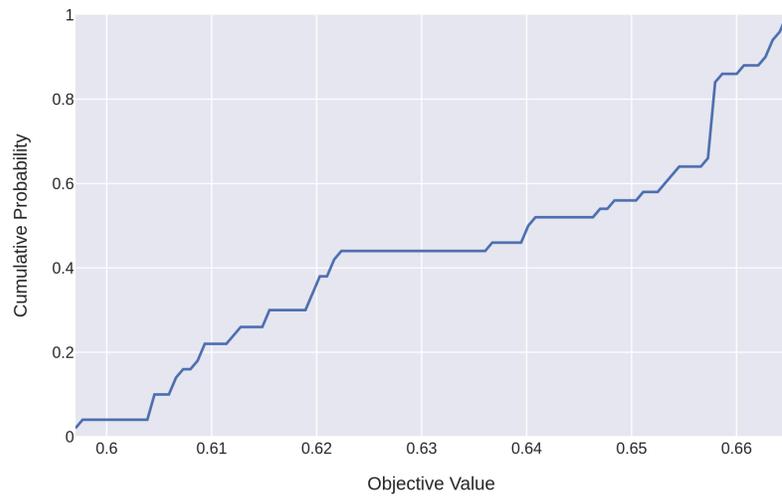
2.c.v. Contour Plot:

Contour Plot



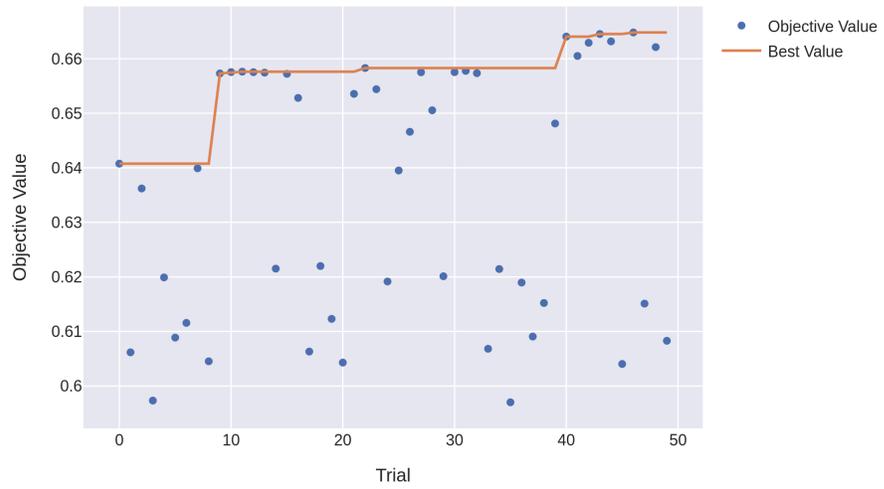
2.c.vi. EDF Plot:

Empirical Distribution Function Plot



2.c.vii. Optimization History:

Optimization History Plot



3. LIGHTGBM OPTUNA HPO RESULTS

3.a. Best Trial

:label: lightgbm-best-trial

Best Trial Performance	
Trial Number	49
Performance Score	0.67460
Start Time	2023-11-18 01:42:25
Completion Time	2023-11-18 01:42:59
Execution Duration	34.48 seconds
Trial ID	50

3.b. Best Parameters

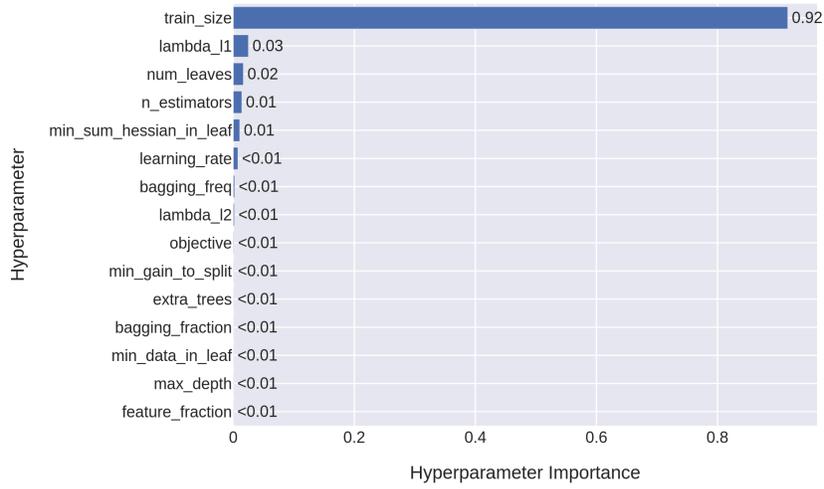
:label: lightgbm-best-parameters

Optimized Hyperparameters	
objective	regression
learning_rate	0.05
n_estimators	100
max_depth	4
num_leaves	31
min_sum_hessian_in_leaf	10
extra_trees	true
min_data_in_leaf	100
feature_fraction	1.0
bagging_fraction	0.8
bagging_freq	0
lambda_l1	2
lambda_l2	0
min_gain_to_split	0.1
train_size	2

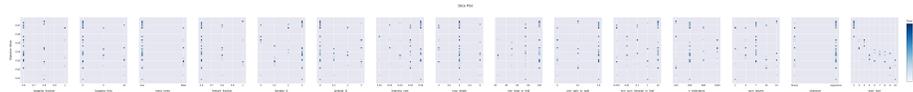
3.c. Embedded Visualizations

3.c.i. Parameter Importances:

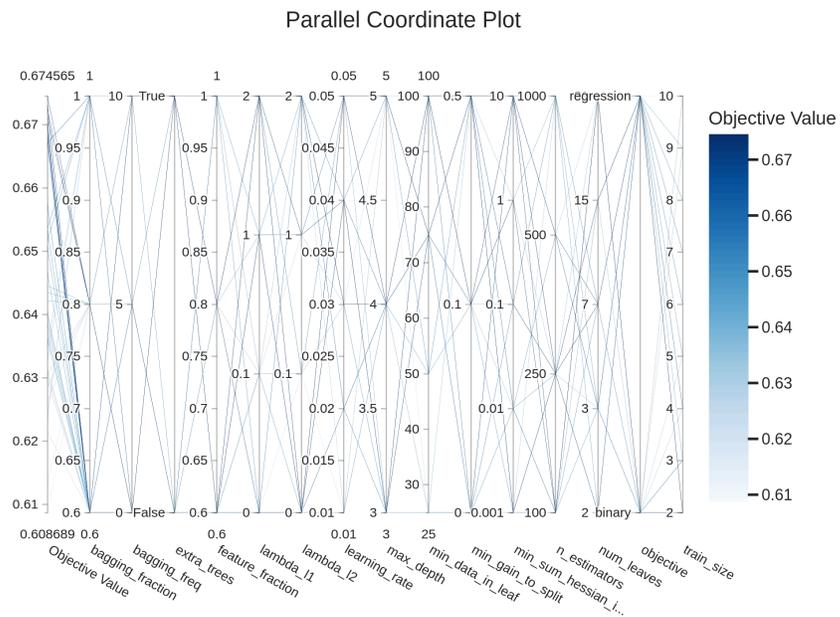
Hyperparameter Importances



3.c.ii. Slice Plot:

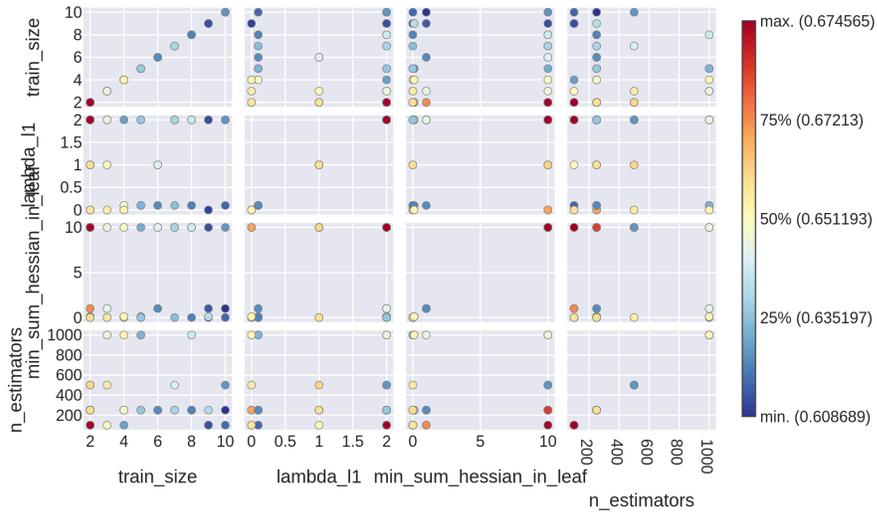


3.c.iii. Parallel Coordinates Plot:



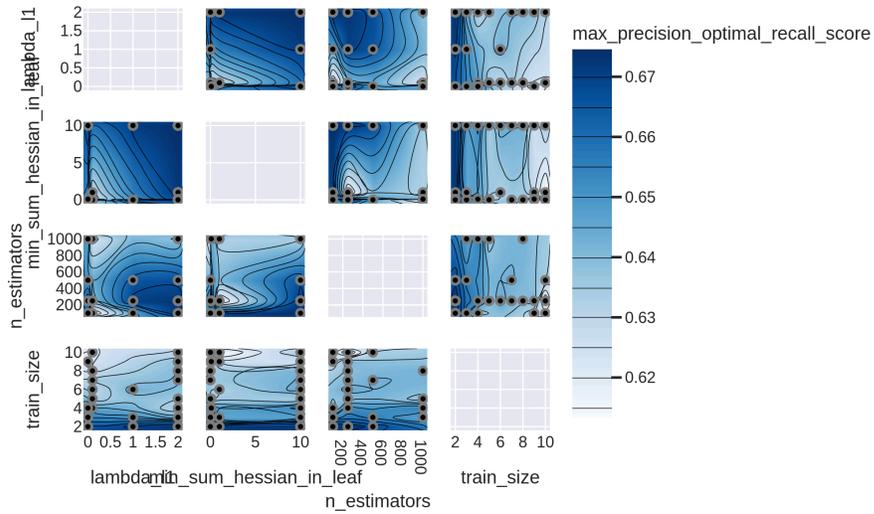
3.c.iv. Rank Plot:

Rank (max_precision_optimal_recall_score)



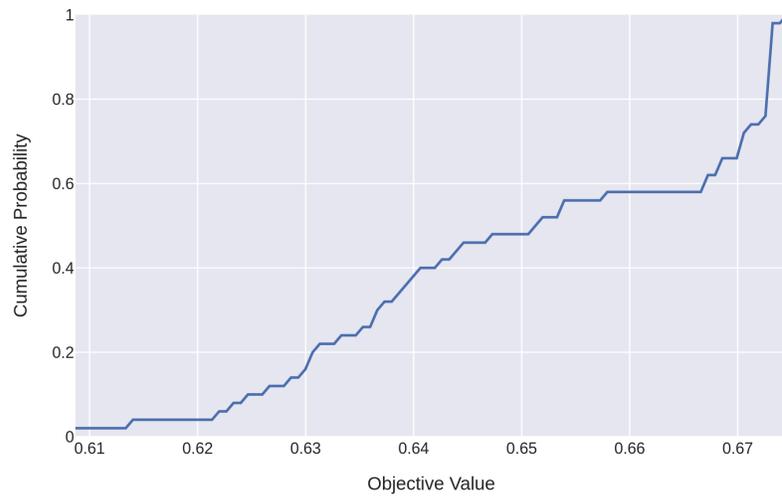
3.c.v. Contour Plot:

Contour Plot



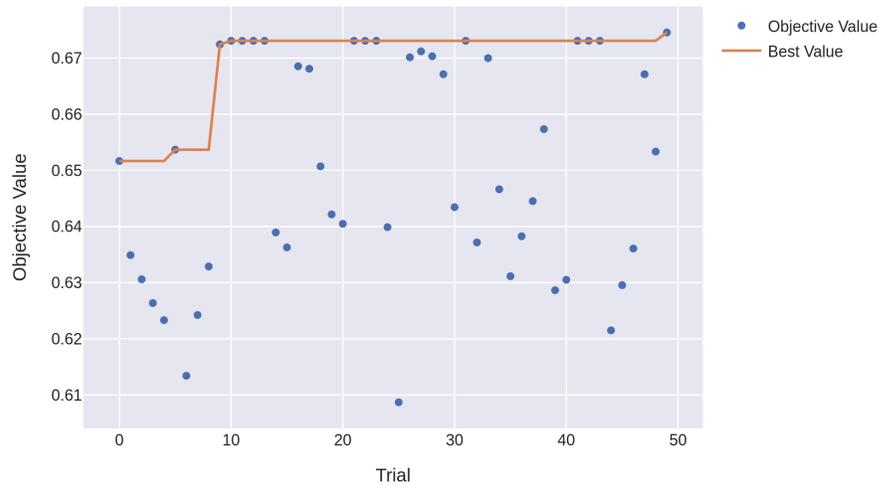
3.c.vi. EDF Plot:

Empirical Distribution Function Plot



3.c.vii. *Optimization History:*

Optimization History Plot



4. XGBOOST OPTUNA HPO RESULTS

4.a. Best Trial

:label: xgboost-best-trial

Best Trial Performance	
Trial Number	21
Performance Score	0.67470
Start Time	2023-11-17 23:02:38
Completion Time	2023-11-17 23:08:38
Execution Duration	5:59.99 (minutes:seconds)
Trial ID	122

4.b. Best Parameters

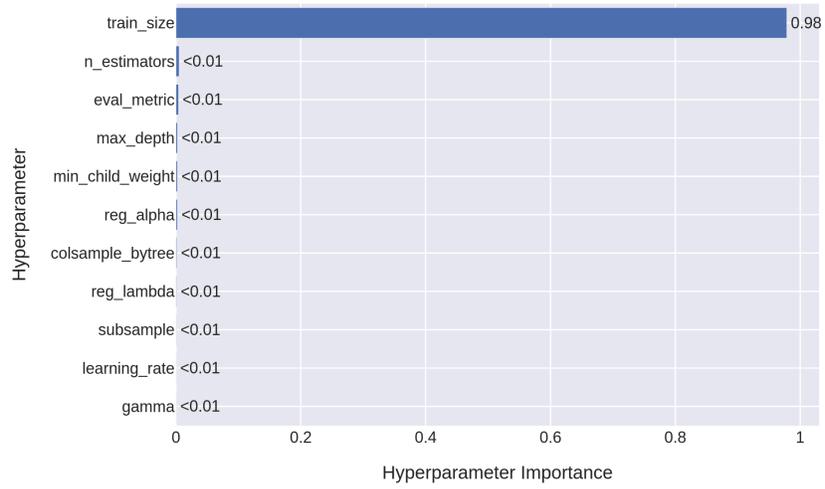
:label: xgboost-best-parameters

Optimized Hyperparameters	
eval_metric	error@0.5
learning_rate	0.03
n_estimators	250
max_depth	4
min_child_weight	8
gamma	0.2
subsample	1.0
colsample_bytree	0.8
reg_alpha	0.2
reg_lambda	2
train_size	2

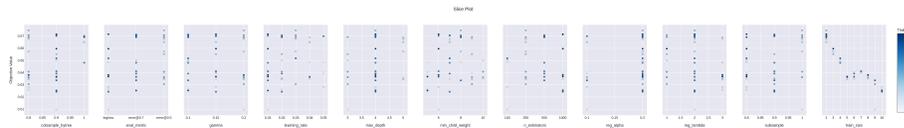
4.c. Embedded Visualizations

4.c.i. Parameter Importances:

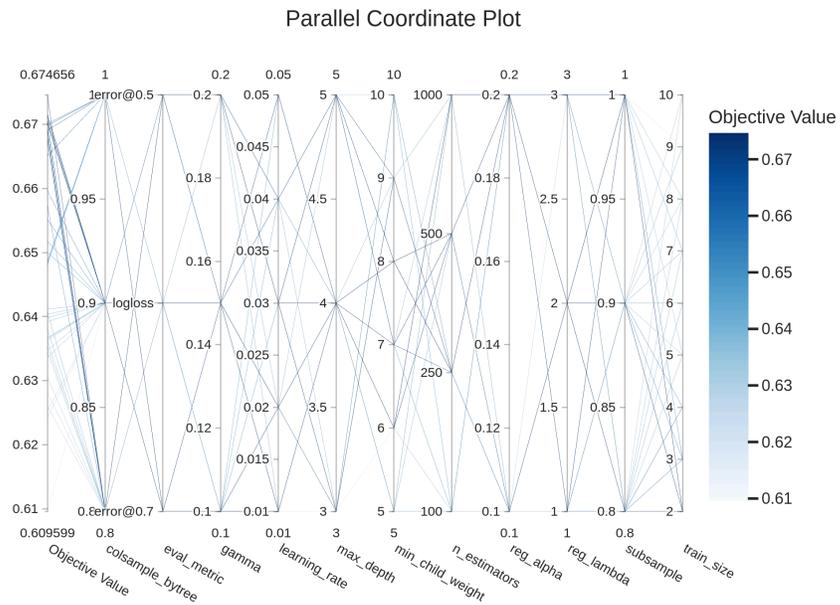
Hyperparameter Importances



4.c.ii. Slice Plot:

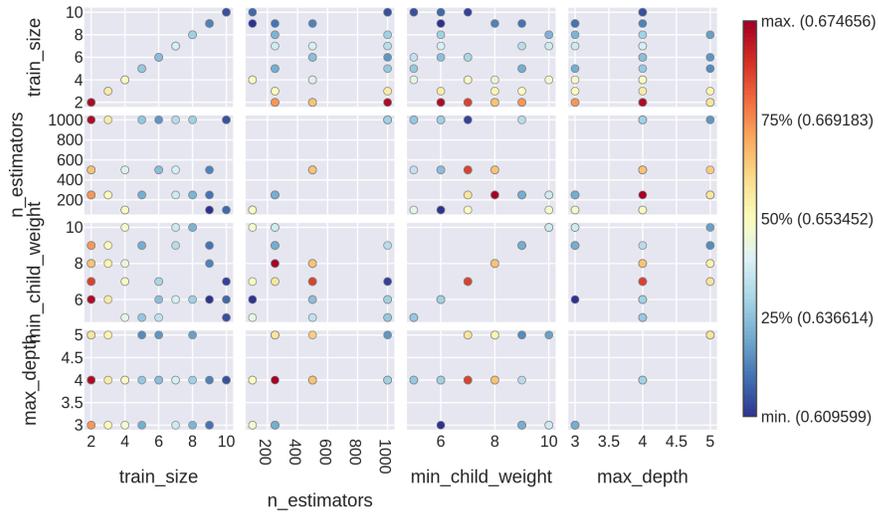


4.c.iii. Parallel Coordinates Plot:



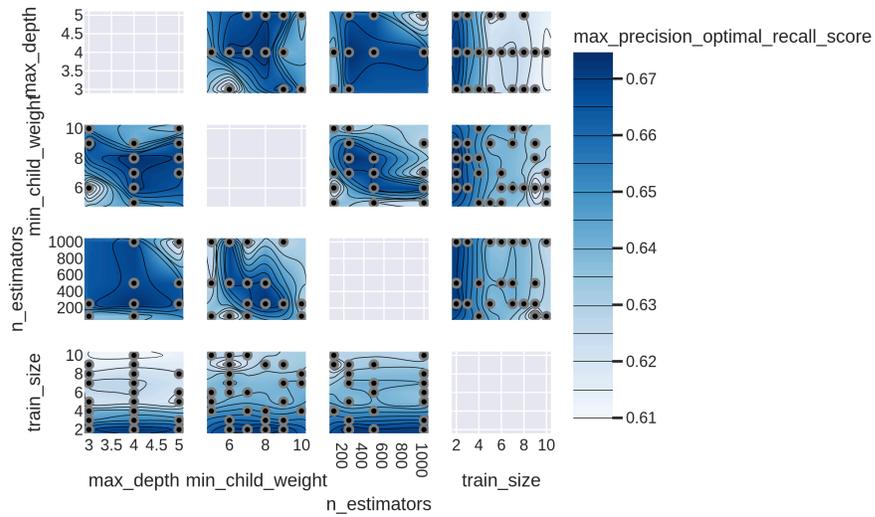
4.c.iv. Rank Plot:

Rank (max_precision_optimal_recall_score)



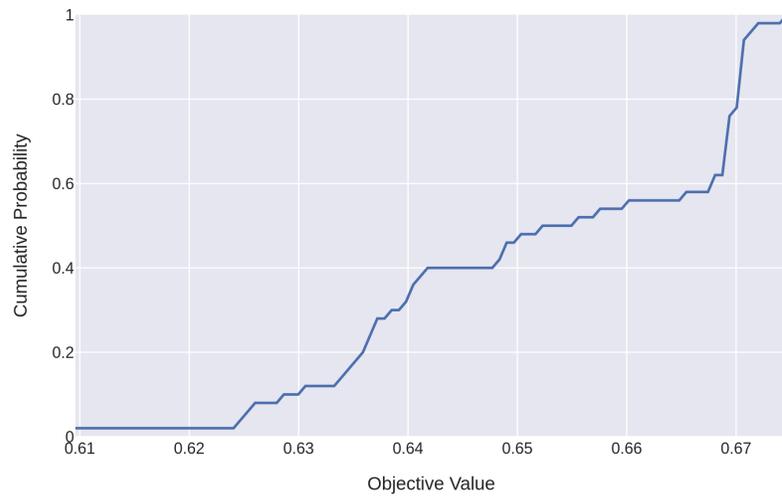
4.c.v. Contour Plot:

Contour Plot



4.c.vi. EDF Plot:

Empirical Distribution Function Plot



4.c.vii. *Optimization History:*

Optimization History Plot

