Kaggle Playground

Problem Statement / Real World Implementations

1. Importing Libraries

```python
In [1]:
# --- 1. Importing Libraries ---
import numpy as np
import pandas as pd
import warnings
import matplotlib.pyplot as plt
import seaborn as sns
from IPython.display import display
from sklearn.model_selection import KFold, train_test_split
from sklearn.preprocessing import OrdinalEncoder, StandardScaler
from sklearn.metrics import mean_squared_error, mean_absolute_error, r2_score
from xgboost import XGBRegressor
from lightgbm import LGBMRegressor
import optuna


# Notebook settings
warnings.filterwarnings('ignore')
pd.set_option('display.max_columns', None)
```

2. Loading Dataset

```python
In [2]:
# Define file paths
TRAIN_PATH = "/kaggle/input/playground-series-s5e11/train.csv"
TEST_PATH = "/kaggle/input/playground-series-s5e11/test.csv"
SUBMISSION_PATH = "/kaggle/input/playground-series-s5e11/sample_submission.csv"

# Load the datasets into pandas DataFrames
train_df = pd.read_csv(TRAIN_PATH)
test_df = pd.read_csv(TEST_PATH)
submission_df = pd.read_csv(SUBMISSION_PATH)
```

```python
In [3]:
# Save the test IDs now, before we drop the 'id' column
test_ids = test_df['id']

# Drop 'id' from both, as it's not a feature
train_df = train_df.drop('id', axis=1)
test_df = test_df.drop('id', axis=1)
```

3. Normalization of data

```python
In [4]:
# --- 3. Feature Engineering (Financial Ratios) ---
def create_financial_features(df):
    """
    Creates new financial features from the existing columns.
    """
    df['monthly_income'] = df['annual_income'] / 12
    df['total_monthly_debt'] = df['debt_to_income_ratio'] * df['monthly_income']
    df['available_income'] = df['monthly_income'] - df['total_monthly_debt']
    df['loan_to_income_ratio'] = df['loan_amount'] / df['annual_income']
    df['loan_to_available_income'] = df['loan_amount'] / df['available_income']

    # Clean up any 'inf' values created by dividing by zero
    df.replace([np.inf, -np.inf], np.nan, inplace=True)
```

```
    # Drop the original, redundant columns
    cols_to_drop = ['annual_income', 'debt_to_income_ratio']
    df = df.drop(columns=cols_to_drop)

    return df

print("Creating financial features for train_df...")
train_df = create_financial_features(train_df)
print("Creating financial features for test_df...")
test_df = create_financial_features(test_df)
```

```
Creating financial features for train_df...
Creating financial features for test_df...
```

4. Encoding & Processing

In [5]:
```python
# --- 4. Smart Encoding & Processing (The "Best of Both Worlds" Fix) ---
def process_and_encode_features(df_train, df_test):
    """
    Applies binning, logical ordinal mapping, and
    ordinal encoding to both train and test sets.

    *** Fills NaNs with -1 so the Scaler can run ***
    """
    # Save target and combine for consistent processing
    train_target = df_train['loan_paid_back']
    df_train = df_train.drop('loan_paid_back', axis=1)

    df_train['source'] = 'train'
    df_test['source'] = 'test'
    combined_df = pd.concat([df_train, df_test], ignore_index=True)

    # --- 1. Bin Credit Score ---
    score_bins = [300, 579, 669, 739, 799, 850]
    score_labels = ['Poor', 'Fair', 'Good', 'Very Good', 'Excellent']
    combined_df['credit_score_bin'] = pd.cut(combined_df['credit_score'],
                                             bins=score_bins,
                                             labels=score_labels,
                                             include_lowest=True)

    # --- 2. Logical Ordinal Mapping ---
    education_map = {
        'Other': 0, 'High School': 1, 'Bachelor\'s': 2, 'Master\'s': 3, 'PhD': 4
    }
    grades = ['A', 'B', 'C', 'D', 'E', 'F', 'G']
    subgrades = ['1', '2', '3', '4', '5']
    grade_map = {g + s: i for i, (g, s) in enumerate((g, s) for g in grades for

    combined_df['education_level_ordinal'] = combined_df['education_level'].map(
    combined_df['grade_subgrade_ordinal'] = combined_df['grade_subgrade'].map(gr

    # --- 3. Ordinal Encode Remaining Categoricals ---
    categorical_cols = [
        'gender', 'marital_status', 'employment_status',
        'loan_purpose', 'credit_score_bin'
    ]

    encoder = OrdinalEncoder(handle_unknown='use_encoded_value', unknown_value=-
    combined_df['credit_score_bin'] = combined_df['credit_score_bin'].astype(str
    combined_df[categorical_cols] = encoder.fit_transform(combined_df[categorica
```

```python
    # --- 4. HANDLE NaNs (The FIX) ---
    # Fill education with the mode (most common)
    if combined_df['education_level_ordinal'].isnull().any():
        mode_val = combined_df['education_level_ordinal'].mode()[0]
        combined_df['education_level_ordinal'] = combined_df['education_level_or

    # Fill our powerful ratio feature with -1
    # This preserves the "missing" signal while allowing the scaler to run
    if combined_df['loan_to_available_income'].isnull().any():
        combined_df['loan_to_available_income'] = combined_df['loan_to_available

    # --- 5. Drop old columns and split back ---
    cols_to_drop = ['credit_score', 'education_level', 'grade_subgrade']
    combined_df = combined_df.drop(columns=cols_to_drop)

    train_processed = combined_df[combined_df['source'] == 'train'].drop('source
    test_processed = combined_df[combined_df['source'] == 'test'].drop('source',

    # Add target back
    train_processed['loan_paid_back'] = train_target

    return train_processed, test_processed

# --- Re-run the processing ---
print("Processing and encoding all features (filling NaNs with -1)...")
train_processed, test_processed = process_and_encode_features(train_df, test_df)
print("Processing complete.")
```

```
Processing and encoding all features (filling NaNs with -1)...
Processing complete.
```

5.Train test split

```python
# --- 5. Train-Test Split (for Validation) ---
X = train_processed.drop("loan_paid_back", axis=1)
y = train_processed["loan_paid_back"]
X = X.select_dtypes(include=[np.number])

X_train, X_test, y_train, y_test = train_test_split(
    X, y, test_size=0.2, random_state=42
)

# --- 6. SCALING (Keeping this, as it proved to be better) ---
selected_method = 'Standard Scaling'
scaler = StandardScaler()

X_train_scaled = scaler.fit_transform(X_train)
X_test_scaled = scaler.transform(X_test)
print("Scaling complete.")
```

```
Scaling complete.
```

7. Hyperparameter Tuning

```python
# --- 7. Hyperparameter Tuning (Optuna) ---
# --- Hyperparameter tuning for XGBRegressor ---
def objective_xgb(trial):
    param = {
        'tree_method': 'gpu_hist', 'predictor': 'gpu_predictor', 'gpu_id': 0,
        'lambda': trial.suggest_loguniform('lambda', 1e-3, 10.0),
```

```python
        'alpha': trial.suggest_loguniform('alpha', 1e-3, 10.0),
        'colsample_bytree': trial.suggest_categorical('colsample_bytree', [0.3,
        'subsample': trial.suggest_categorical('subsample', [0.5, 0.6, 0.7, 0.8,
        'learning_rate': trial.suggest_float('learning_rate', 0.005, 0.05, log=T
        'n_estimators': trial.suggest_int('n_estimators', 200, 1000, step=100),
        'max_depth': trial.suggest_int('max_depth', 3, 12),
        'min_child_weight': trial.suggest_int('min_child_weight', 1, 300),
        'random_state': 42
    }
    model = XGBRegressor(**param, verbosity=0)
    model.fit(X_train_scaled, y_train)
    y_pred = model.predict(X_test_scaled)
    mse = mean_squared_error(y_test, y_pred)
    return mse

# --- Hyperparameter tuning for LGBMRegressor ---
def objective_lgbm(trial):
    param = {
        'device': 'gpu', 'gpu_platform_id': 0, 'gpu_device_id': 0,
        'boosting_type': 'gbdt', 'objective': 'regression', 'metric': 'mse',
        'lambda_l1': trial.suggest_float('lambda_l1', 1e-5, 1.0, log=True),
        'lambda_l2': trial.suggest_float('lambda_l2', 1e-5, 1.0, log=True),
        'num_leaves': trial.suggest_int('num_leaves', 16, 256),
        'feature_fraction': trial.suggest_float('feature_fraction', 0.5, 1.0),
        'bagging_fraction': trial.suggest_float('bagging_fraction', 0.5, 1.0),
        'bagging_freq': trial.suggest_int('bagging_freq', 1, 7),
        'min_child_samples': trial.suggest_int('min_child_samples', 10, 100),
        'learning_rate': trial.suggest_float('learning_rate', 0.005, 0.3, log=Tr
        'n_estimators': trial.suggest_int('n_estimators', 200, 1000, step=100),
        'max_depth': trial.suggest_int('max_depth', 3, 12),
        'random_state': 42, 'verbosity': -1
    }
    model = LGBMRegressor(**param)
    model.fit(X_train_scaled, y_train)
    y_pred = model.predict(X_test_scaled)
    mse = mean_squared_error(y_test, y_pred)
    return mse

# --- Run GPU-accelerated Optuna optimization (Increased Trials) ---
print("🚀 Tuning XGBRegressor (GPU)...")
study_xgb = optuna.create_study(direction='minimize')
study_xgb.optimize(objective_xgb, n_trials=150, timeout=7200) # Increased
best_params_xgb = study_xgb.best_params
print(f"✅ Best XGBRegressor parameters: {best_params_xgb}")

print("\n🚀 Tuning LGBMRegressor (GPU)...")
study_lgbm = optuna.create_study(direction='minimize')
study_lgbm.optimize(objective_lgbm, n_trials=150, timeout=7200) # Increased
best_params_lgbm = study_lgbm.best_params
print(f"✅ Best LGBMRegressor parameters: {best_params_lgbm}")

# --- 8. Initialize and Evaluate Tuned Models ---
xgb_model = XGBRegressor(**best_params_xgb, tree_method='gpu_hist', predictor='g
lgbm_model = LGBMRegressor(**best_params_lgbm, device='gpu')
models = [("XGBRegressor (GPU)", xgb_model), ("LGBMRegressor (GPU)", lgbm_model)

print("\n⚡ Evaluating Tuned Models on GPU...\n")
mse_scores = []
model_names = []
```

```python
for name, model in models:
    model.fit(X_train_scaled, y_train)
    y_pred = model.predict(X_test_scaled)
    mse = mean_squared_error(y_test, y_pred)
    mae = mean_absolute_error(y_test, y_pred)
    r2 = r2_score(y_test, y_pred)
    mse_scores.append(mse)
    model_names.append(name)
    print(f"{name:<30} | MSE: {mse:.5f} | MAE: {mae:.5f} | R²: {r2:.5f}")
```

[I 2025-11-04 03:01:34,873] A new study created in memory with name: no-name-09e1da07-4063-4790-8b3e-ff99a4a82532

🚀 Tuning XGBRegressor (GPU)...

```
[I 2025-11-04 03:01:39,340] Trial 0 finished with value: 0.0759050184958897 and
parameters: {'lambda': 0.011729875907652626, 'alpha': 0.358901418539635,
'colsample_bytree': 0.9, 'subsample': 0.8, 'learning_rate': 0.012282003890444506,
'n_estimators': 300, 'max_depth': 9, 'min_child_weight': 215}. Best is trial 0 with v
0.0759050184958897.
[I 2025-11-04 03:01:44,416] Trial 1 finished with value: 0.0760456548067001 and
parameters: {'lambda': 0.002649726696909202, 'alpha': 0.07495968631094024,
'colsample_bytree': 0.9, 'subsample': 0.7, 'learning_rate': 0.00807192015935209,
'n_estimators': 900, 'max_depth': 5, 'min_child_weight': 263}. Best is trial 0 with v
0.0759050184958897.
[I 2025-11-04 03:01:45,768] Trial 2 finished with value: 0.07686247056421217 and
parameters: {'lambda': 0.0016630560265005465, 'alpha': 0.07303484062421765,
'colsample_bytree': 0.7, 'subsample': 0.7, 'learning_rate': 0.03778229385809103,
'n_estimators': 200, 'max_depth': 4, 'min_child_weight': 78}. Best is trial 0 with va
0.0759050184958897.
[I 2025-11-04 03:02:00,585] Trial 3 finished with value: 0.07558057936826253 and
parameters: {'lambda': 0.0019972223866344886, 'alpha': 0.07556652176141028,
'colsample_bytree': 0.7, 'subsample': 0.5, 'learning_rate': 0.012241699853589987,
'n_estimators': 900, 'max_depth': 12, 'min_child_weight': 196}. Best is trial 3 with
0.07558057936826253.
[I 2025-11-04 03:02:04,776] Trial 4 finished with value: 0.07855694325702972 and
parameters: {'lambda': 0.0011580652444766106, 'alpha': 0.18336055673632684,
'colsample_bytree': 0.5, 'subsample': 0.8, 'learning_rate': 0.005829963627726008,
'n_estimators': 1000, 'max_depth': 3, 'min_child_weight': 223}. Best is trial 3 with
0.07558057936826253.
[I 2025-11-04 03:02:16,047] Trial 5 finished with value: 0.07563925792632561 and
parameters: {'lambda': 0.020179517655149064, 'alpha': 0.002615602811130983,
'colsample_bytree': 1.0, 'subsample': 1.0, 'learning_rate': 0.012815701104282968,
'n_estimators': 800, 'max_depth': 11, 'min_child_weight': 292}. Best is trial 3 with
0.07558057936826253.
[I 2025-11-04 03:02:25,997] Trial 6 finished with value: 0.07552034660950382 and
parameters: {'lambda': 0.016295727405934816, 'alpha': 1.3745087052877334,
'colsample_bytree': 1.0, 'subsample': 0.5, 'learning_rate': 0.009218079416343379,
'n_estimators': 800, 'max_depth': 10, 'min_child_weight': 166}. Best is trial 6 with
0.07552034660950382.
[I 2025-11-04 03:02:27,637] Trial 7 finished with value: 0.0774528336425621 and param
{'lambda': 2.1324476917727178, 'alpha': 0.06240379568059866, 'colsample_bytree': 0.7,
'subsample': 1.0, 'learning_rate': 0.016380486857644566, 'n_estimators': 300, 'max_de
4, 'min_child_weight': 37}. Best is trial 6 with value: 0.07552034660950382.
[I 2025-11-04 03:02:31,962] Trial 8 finished with value: 0.07621990981196342 and
parameters: {'lambda': 0.001566424460626402, 'alpha': 0.0023947644065552103,
'colsample_bytree': 0.9, 'subsample': 0.8, 'learning_rate': 0.0067826821353885415,
'n_estimators': 800, 'max_depth': 5, 'min_child_weight': 51}. Best is trial 6 with va
0.07552034660950382.
[I 2025-11-04 03:02:38,764] Trial 9 finished with value: 0.07558274544354569 and
parameters: {'lambda': 0.00720208995517631, 'alpha': 2.505055627643212, 'colsample_by
0.9, 'subsample': 0.5, 'learning_rate': 0.013026109805949792, 'n_estimators': 500,
'max_depth': 11, 'min_child_weight': 284}. Best is trial 6 with value: 0.075520346609
[I 2025-11-04 03:02:44,174] Trial 10 finished with value: 0.0754476420154359 and
parameters: {'lambda': 0.24809184858267214, 'alpha': 8.984809745822954, 'colsample_by
1.0, 'subsample': 0.6, 'learning_rate': 0.028792696443014448, 'n_estimators': 600,
'max_depth': 8, 'min_child_weight': 138}. Best is trial 10 with value: 0.07544764201!
[I 2025-11-04 03:02:49,590] Trial 11 finished with value: 0.07547127790545864 and
parameters: {'lambda': 0.23974187469014147, 'alpha': 9.797637497901128, 'colsample_by
1.0, 'subsample': 0.6, 'learning_rate': 0.03264087447106464, 'n_estimators': 600,
'max_depth': 8, 'min_child_weight': 125}. Best is trial 10 with value: 0.07544764201!
[I 2025-11-04 03:02:54,166] Trial 12 finished with value: 0.07545679010006004 and
parameters: {'lambda': 0.3133228843098191, 'alpha': 7.935209698939875, 'colsample_by
1.0, 'subsample': 0.6, 'learning_rate': 0.03347623521213897, 'n_estimators': 600,
'max_depth': 7, 'min_child_weight': 112}. Best is trial 10 with value: 0.07544764201!
```

[I 2025-11-04 03:02:57,843] Trial 13 finished with value: 0.07684447200467386 and parameters: {'lambda': 0.303259003503212, 'alpha': 7.619158956966194, 'colsample_byt 0.3, 'subsample': 0.6, 'learning_rate': 0.02468233578938199, 'n_estimators': 500, 'max_depth': 7, 'min_child_weight': 114}. Best is trial 10 with value: 0.07544764201!
[I 2025-11-04 03:03:01,633] Trial 14 finished with value: 0.07552047245400681 and parameters: {'lambda': 2.210695235226527, 'alpha': 1.371270059803962, 'colsample_byt 1.0, 'subsample': 0.6, 'learning_rate': 0.024319681490094322, 'n_estimators': 600, 'max_depth': 6, 'min_child_weight': 97}. Best is trial 10 with value: 0.075447642015
[I 2025-11-04 03:03:06,128] Trial 15 finished with value: 0.07557085113360568 and parameters: {'lambda': 0.11339020855257685, 'alpha': 3.9610487798436362, 'colsample_bytree': 1.0, 'subsample': 0.6, 'learning_rate': 0.04812030756690889, 'n_estimators': 500, 'max_depth': 8, 'min_child_weight': 155}. Best is trial 10 with 0.0754476420154359.
[I 2025-11-04 03:03:10,583] Trial 16 finished with value: 0.07563762554722062 and parameters: {'lambda': 0.5508542584346687, 'alpha': 0.013143776479582528, 'colsample_bytree': 0.5, 'subsample': 0.6, 'learning_rate': 0.021959422930258897, 'n_estimators': 600, 'max_depth': 7, 'min_child_weight': 70}. Best is trial 10 with v 0.0754476420154359.
[I 2025-11-04 03:03:18,986] Trial 17 finished with value: 0.07586193941442114 and parameters: {'lambda': 7.6968086979654515, 'alpha': 0.8022420829873919, 'colsample_by 1.0, 'subsample': 0.6, 'learning_rate': 0.03309088873597375, 'n_estimators': 700, 'max_depth': 9, 'min_child_weight': 6}. Best is trial 10 with value: 0.0754476420154
[I 2025-11-04 03:03:21,636] Trial 18 finished with value: 0.07652406383733464 and parameters: {'lambda': 0.053619037782514416, 'alpha': 0.46981017636074984, 'colsample_bytree': 0.3, 'subsample': 0.6, 'learning_rate': 0.0466759818606574, 'n_estimators': 400, 'max_depth': 6, 'min_child_weight': 135}. Best is trial 10 with 0.0754476420154359.
[I 2025-11-04 03:03:28,855] Trial 19 finished with value: 0.07542622822941057 and parameters: {'lambda': 1.1071756529607828, 'alpha': 3.5300893394861825, 'colsample_by 1.0, 'subsample': 0.6, 'learning_rate': 0.01871415823306676, 'n_estimators': 700, 'max_depth': 9, 'min_child_weight': 172}. Best is trial 19 with value: 0.07542622822!
[I 2025-11-04 03:03:35,816] Trial 20 finished with value: 0.07555516904384171 and parameters: {'lambda': 0.9802800577739413, 'alpha': 0.018707414571475706, 'colsample_bytree': 1.0, 'subsample': 1.0, 'learning_rate': 0.01960422106388274, 'n_estimators': 700, 'max_depth': 9, 'min_child_weight': 175}. Best is trial 19 with 0.07542622822941057.
[I 2025-11-04 03:03:41,880] Trial 21 finished with value: 0.07548108749823972 and parameters: {'lambda': 0.09009601890549772, 'alpha': 4.637223717997953, 'colsample_by 1.0, 'subsample': 0.6, 'learning_rate': 0.031308604805590896, 'n_estimators': 700, 'max_depth': 8, 'min_child_weight': 142}. Best is trial 19 with value: 0.07542622822!
[I 2025-11-04 03:03:50,316] Trial 22 finished with value: 0.0754935638379936 and parameters: {'lambda': 1.3358104137011741, 'alpha': 3.047926360117889, 'colsample_byt 1.0, 'subsample': 0.6, 'learning_rate': 0.017199420641386364, 'n_estimators': 700, 'max_depth': 10, 'min_child_weight': 186}. Best is trial 19 with value: 0.07542622822941057.
[I 2025-11-04 03:03:54,145] Trial 23 finished with value: 0.07547890596273614 and parameters: {'lambda': 8.177983123461692, 'alpha': 7.952994375998705, 'colsample_byt 1.0, 'subsample': 0.6, 'learning_rate': 0.02828986669972344, 'n_estimators': 500, 'max_depth': 7, 'min_child_weight': 105}. Best is trial 19 with value: 0.07542622822!
[I 2025-11-04 03:03:57,848] Trial 24 finished with value: 0.07550181559514271 and parameters: {'lambda': 0.27533385328684545, 'alpha': 1.7350053709995175, 'colsample_bytree': 1.0, 'subsample': 0.6, 'learning_rate': 0.040142263182871354, 'n_estimators': 600, 'max_depth': 6, 'min_child_weight': 237}. Best is trial 19 with 0.07542622822941057.
[I 2025-11-04 03:04:03,409] Trial 25 finished with value: 0.075675911686398 and param {'lambda': 0.68853631125642, 'alpha': 0.8421336477961116, 'colsample_bytree': 0.5, 'subsample': 0.7, 'learning_rate': 0.019933890044679028, 'n_estimators': 400, 'max_dep 10, 'min_child_weight': 156}. Best is trial 19 with value: 0.07542622822941057.
[I 2025-11-04 03:04:10,084] Trial 26 finished with value: 0.075515791623310113 and parameters: {'lambda': 2.593482740870638, 'alpha': 5.893829833341295, 'colsample_byt

1.0, 'subsample': 0.6, 'learning_rate': 0.027378946954229044, 'n_estimators': 600, 'max_depth': 9, 'min_child_weight': 91}. Best is trial 19 with value: 0.075426228229<
[I 2025-11-04 03:04:13,639] Trial 27 finished with value: 0.07648003322809688 and parameters: {'lambda': 0.05774347890346204, 'alpha': 2.6736278992337925, 'colsample_bytree': 0.3, 'subsample': 0.6, 'learning_rate': 0.03850364316739976, 'n_estimators': 400, 'max_depth': 8, 'min_child_weight': 202}. Best is trial 19 with 0.07542622822941057.
[I 2025-11-04 03:04:19,390] Trial 28 finished with value: 0.07546455126156697 and parameters: {'lambda': 0.13498824362364623, 'alpha': 0.19844339726082227, 'colsample_bytree': 1.0, 'subsample': 0.6, 'learning_rate': 0.014983949191648657, 'n_estimators': 800, 'max_depth': 7, 'min_child_weight': 125}. Best is trial 19 with 0.07542622822941057.
[I 2025-11-04 03:04:26,813] Trial 29 finished with value: 0.07551490165641972 and parameters: {'lambda': 4.0701544071160765, 'alpha': 0.46502907102314084, 'colsample_bytree': 1.0, 'subsample': 0.8, 'learning_rate': 0.010083483330112624, 'n_estimators': 700, 'max_depth': 9, 'min_child_weight': 244}. Best is trial 19 with 0.07542622822941057.
[I 2025-11-04 03:04:38,116] Trial 30 finished with value: 0.07653404095228919 and parameters: {'lambda': 0.34776621027812943, 'alpha': 4.823128492372265, 'colsample_by 0.3, 'subsample': 0.5, 'learning_rate': 0.019358892354526598, 'n_estimators': 900, 'max_depth': 11, 'min_child_weight': 171}. Best is trial 19 with value: 0.07542622822941057.
[I 2025-11-04 03:04:43,878] Trial 31 finished with value: 0.07545686039658127 and parameters: {'lambda': 0.1573625117646403, 'alpha': 0.22692760099403672, 'colsample_bytree': 1.0, 'subsample': 0.6, 'learning_rate': 0.014825378185330754, 'n_estimators': 800, 'max_depth': 7, 'min_child_weight': 123}. Best is trial 19 with 0.07542622822941057.
[I 2025-11-04 03:04:49,193] Trial 32 finished with value: 0.07548244712292008 and parameters: {'lambda': 0.040828072840271845, 'alpha': 0.02447187665575335, 'colsample_bytree': 1.0, 'subsample': 0.6, 'learning_rate': 0.023554480116269465, 'n_estimators': 900, 'max_depth': 6, 'min_child_weight': 114}. Best is trial 19 with 0.07542622822941057.
[I 2025-11-04 03:04:57,456] Trial 33 finished with value: 0.0754166080789546 and parameters: {'lambda': 0.17906951377685817, 'alpha': 0.1808628963714788, 'colsample_bytree': 0.9, 'subsample': 0.7, 'learning_rate': 0.014635177369344915, 'n_estimators': 1000, 'max_depth': 8, 'min_child_weight': 148}. Best is trial 33 with value: 0.0754166080789546.
[I 2025-11-04 03:04:59,652] Trial 34 finished with value: 0.07558827798694534 and parameters: {'lambda': 0.5524446595073018, 'alpha': 0.005871499319074038, 'colsample_bytree': 0.9, 'subsample': 0.7, 'learning_rate': 0.027959926891055812, 'n_estimators': 200, 'max_depth': 8, 'min_child_weight': 147}. Best is trial 33 with 0.0754166080789546.
[I 2025-11-04 03:05:11,637] Trial 35 finished with value: 0.0754583072749793 and parameters: {'lambda': 1.2366884210953002, 'alpha': 0.854459308259646, 'colsample_by† 0.9, 'subsample': 0.7, 'learning_rate': 0.010899439088449887, 'n_estimators': 1000, 'max_depth': 10, 'min_child_weight': 212}. Best is trial 33 with value: 0.0754166080†
[I 2025-11-04 03:05:16,910] Trial 36 finished with value: 0.07569837024022422 and parameters: {'lambda': 0.19771102028991602, 'alpha': 9.335065469724794, 'colsample_by 0.9, 'subsample': 0.7, 'learning_rate': 0.017416786717131223, 'n_estimators': 1000, 'max_depth': 5, 'min_child_weight': 76}. Best is trial 33 with value: 0.0754166080789
[I 2025-11-04 03:05:22,025] Trial 37 finished with value: 0.07554423088735465 and parameters: {'lambda': 0.0280950960095189, 'alpha': 2.013286602107812, 'colsample_by† 0.9, 'subsample': 0.7, 'learning_rate': 0.04215733469708585, 'n_estimators': 500, 'max_depth': 9, 'min_child_weight': 186}. Best is trial 33 with value: 0.0754166080787
[I 2025-11-04 03:05:29,166] Trial 38 finished with value: 0.0755679197846069 and parameters: {'lambda': 0.4622919109352865, 'alpha': 0.035993357972821806, 'colsample_bytree': 0.7, 'subsample': 0.7, 'learning_rate': 0.035317355023327814, 'n_estimators': 900, 'max_depth': 8, 'min_child_weight': 164}. Best is trial 33 with 0.0754166080789546.
[I 2025-11-04 03:05:38,130] Trial 39 finished with value: 0.0805878173180969 and

parameters: {'lambda': 0.005998511591035295, 'alpha': 0.1006224506150652, 'colsample_bytree': 0.7, 'subsample': 1.0, 'learning_rate': 0.00719004418295469, 'n_estimators': 300, 'max_depth': 12, 'min_child_weight': 138}. Best is trial 33 with value: 0.0754166080789546.
[I 2025-11-04 03:05:46,610] Trial 40 finished with value: 0.0756001210493139 and parameters: {'lambda': 0.8275672964807176, 'alpha': 3.8530659311230733, 'colsample_by 0.5, 'subsample': 0.8, 'learning_rate': 0.014370464179420568, 'n_estimators': 600, 'max_depth': 10, 'min_child_weight': 52}. Best is trial 33 with value: 0.07541660807
[I 2025-11-04 03:05:52,417] Trial 41 finished with value: 0.07550541203507984 and parameters: {'lambda': 0.17077470437673312, 'alpha': 0.1061162185676523, 'colsample_bytree': 1.0, 'subsample': 0.6, 'learning_rate': 0.0114117487628949, 'n_estimators': 800, 'max_depth': 7, 'min_child_weight': 90}. Best is trial 33 with v 0.0754166080789546.
[I 2025-11-04 03:05:57,513] Trial 42 finished with value: 0.07551777859605513 and parameters: {'lambda': 0.09500921963263624, 'alpha': 0.054443417724316684, 'colsample_bytree': 0.9, 'subsample': 0.5, 'learning_rate': 0.013412082542103427, 'n_estimators': 700, 'max_depth': 7, 'min_child_weight': 114}. Best is trial 33 with 0.0754166080789546.
[I 2025-11-04 03:06:02,370] Trial 43 finished with value: 0.07552396731351278 and parameters: {'lambda': 0.4227169158267817, 'alpha': 0.2847736908155127, 'colsample_by 1.0, 'subsample': 0.6, 'learning_rate': 0.01691781427156001, 'n_estimators': 800, 'max_depth': 6, 'min_child_weight': 134}. Best is trial 33 with value: 0.07541660807
[I 2025-11-04 03:06:10,864] Trial 44 finished with value: 0.07555457707266747 and parameters: {'lambda': 0.1755612306073731, 'alpha': 0.16221529728897563, 'colsample_bytree': 1.0, 'subsample': 1.0, 'learning_rate': 0.009232236370964313, 'n_estimators': 1000, 'max_depth': 8, 'min_child_weight': 182}. Best is trial 33 with value: 0.0754166080789546.
[I 2025-11-04 03:06:18,943] Trial 45 finished with value: 0.0754653600642226 and parameters: {'lambda': 0.07195056638011982, 'alpha': 1.2784362802999383, 'colsample_bytree': 0.7, 'subsample': 0.8, 'learning_rate': 0.021330605064993714, 'n_estimators': 800, 'max_depth': 9, 'min_child_weight': 123}. Best is trial 33 with 0.0754166080789546.
[I 2025-11-04 03:06:22,594] Trial 46 finished with value: 0.07702950746591286 and parameters: {'lambda': 0.2562763374278461, 'alpha': 6.480741671582932, 'colsample_byt 1.0, 'subsample': 0.6, 'learning_rate': 0.014306448628276345, 'n_estimators': 900, 'max_depth': 3, 'min_child_weight': 157}. Best is trial 33 with value: 0.07541660807
[I 2025-11-04 03:06:27,128] Trial 47 finished with value: 0.07553149665423144 and parameters: {'lambda': 1.4459456727680156, 'alpha': 0.4224153118017409, 'colsample_by 0.9, 'subsample': 0.7, 'learning_rate': 0.012037041381944186, 'n_estimators': 600, 'max_depth': 7, 'min_child_weight': 104}. Best is trial 33 with value: 0.07541660807
[I 2025-11-04 03:06:33,042] Trial 48 finished with value: 0.07548350659585977 and parameters: {'lambda': 0.13521713903115395, 'alpha': 0.14909781662582688, 'colsample_bytree': 1.0, 'subsample': 0.6, 'learning_rate': 0.015329294670936239, 'n_estimators': 700, 'max_depth': 8, 'min_child_weight': 202}. Best is trial 33 with 0.0754166080789546.
[I 2025-11-04 03:06:36,341] Trial 49 finished with value: 0.07610102111651808 and parameters: {'lambda': 0.028030387580231735, 'alpha': 0.23524907209649448, 'colsample_bytree': 0.5, 'subsample': 0.5, 'learning_rate': 0.024713992983163798, 'n_estimators': 600, 'max_depth': 5, 'min_child_weight': 62}. Best is trial 33 with v 0.0754166080789546.
[I 2025-11-04 03:06:39,505] Trial 50 finished with value: 0.0755470888774685 and parameters: {'lambda': 0.6919332122422017, 'alpha': 0.001494632347174641, 'colsample_bytree': 1.0, 'subsample': 0.6, 'learning_rate': 0.03004238432312031, 'n_estimators': 500, 'max_depth': 6, 'min_child_weight': 146}. Best is trial 33 with 0.0754166080789546.
[I 2025-11-04 03:06:53,179] Trial 51 finished with value: 0.07549863856565861 and parameters: {'lambda': 1.261748695546359, 'alpha': 0.7688567314279228, 'colsample_byt 0.9, 'subsample': 0.7, 'learning_rate': 0.010820317321753798, 'n_estimators': 1000, 'max_depth': 11, 'min_child_weight': 233}. Best is trial 33 with value: 0.0754166080
[I 2025-11-04 03:07:05,239] Trial 52 finished with value: 0.07546014712829222 and

parameters: {'lambda': 2.882903219200566, 'alpha': 0.6262882452091207, 'colsample_by
0.9, 'subsample': 0.7, 'learning_rate': 0.00953964697017368, 'n_estimators': 1000,
'max_depth': 10, 'min_child_weight': 214}. Best is trial 33 with value: 0.0754166080
[I 2025-11-04 03:07:14,446] Trial 53 finished with value: 0.0754954895910954 and
parameters: {'lambda': 5.448024942218332, 'alpha': 1.25028382983907, 'colsample_bytr
0.9, 'subsample': 0.7, 'learning_rate': 0.008630913829763807, 'n_estimators': 900,
'max_depth': 9, 'min_child_weight': 279}. Best is trial 33 with value: 0.07541660807β
[I 2025-11-04 03:07:26,332] Trial 54 finished with value: 0.07546149354746548 and
parameters: {'lambda': 1.882914992141995, 'alpha': 3.309386395628633, 'colsample_bytr
0.9, 'subsample': 0.7, 'learning_rate': 0.012755587341463525, 'n_estimators': 1000,
'max_depth': 10, 'min_child_weight': 213}. Best is trial 33 with value: 0.0754166080
[I 2025-11-04 03:07:32,291] Trial 55 finished with value: 0.07543630885476095 and
parameters: {'lambda': 0.3306810283221024, 'alpha': 0.3061230074555396, 'colsample_by
0.9, 'subsample': 0.6, 'learning_rate': 0.018306707368534098, 'n_estimators': 700,
'max_depth': 8, 'min_child_weight': 164}. Best is trial 33 with value: 0.07541660807β
[I 2025-11-04 03:07:38,155] Trial 56 finished with value: 0.07544206584796002 and
parameters: {'lambda': 0.3774612343969024, 'alpha': 0.3544193102241715, 'colsample_by
1.0, 'subsample': 0.6, 'learning_rate': 0.019009359968975, 'n_estimators': 700,
'max_depth': 8, 'min_child_weight': 170}. Best is trial 33 with value: 0.07541660807β
[I 2025-11-04 03:07:44,257] Trial 57 finished with value: 0.07658553657591634 and
parameters: {'lambda': 0.32562977713556307, 'alpha': 0.32471977939103974,
'colsample_bytree': 0.3, 'subsample': 0.6, 'learning_rate': 0.018507695714253584,
'n_estimators': 700, 'max_depth': 8, 'min_child_weight': 164}. Best is trial 33 with
0.0754166080789546.
[I 2025-11-04 03:07:51,404] Trial 58 finished with value: 0.07547561690184244 and
parameters: {'lambda': 0.4115466402465583, 'alpha': 6.084218840232458, 'colsample_byt
1.0, 'subsample': 0.6, 'learning_rate': 0.022315294828796885, 'n_estimators': 700,
'max_depth': 9, 'min_child_weight': 192}. Best is trial 33 with value: 0.07541660807β
[I 2025-11-04 03:07:57,116] Trial 59 finished with value: 0.07612200096466798 and
parameters: {'lambda': 0.9643859388580177, 'alpha': 1.9050196043395289, 'colsample_by
1.0, 'subsample': 0.6, 'learning_rate': 0.005086257689005849, 'n_estimators': 600,
'max_depth': 8, 'min_child_weight': 170}. Best is trial 33 with value: 0.07541660807β
[I 2025-11-04 03:08:01,433] Trial 60 finished with value: 0.07545816693508109 and
parameters: {'lambda': 0.5363441428154002, 'alpha': 0.1336945853785204, 'colsample_by
0.9, 'subsample': 0.6, 'learning_rate': 0.03424896777546123, 'n_estimators': 500,
'max_depth': 8, 'min_child_weight': 176}. Best is trial 33 with value: 0.07541660807β
[I 2025-11-04 03:08:06,500] Trial 61 finished with value: 0.07548802688844206 and
parameters: {'lambda': 0.21575848462208425, 'alpha': 0.26396123716700376,
'colsample_bytree': 1.0, 'subsample': 0.6, 'learning_rate': 0.016000851436240655,
'n_estimators': 700, 'max_depth': 7, 'min_child_weight': 131}. Best is trial 33 with
0.0754166080789546.
[I 2025-11-04 03:08:12,130] Trial 62 finished with value: 0.07544883280006871 and
parameters: {'lambda': 0.11098060560191222, 'alpha': 0.060991565947639534,
'colsample_bytree': 1.0, 'subsample': 0.6, 'learning_rate': 0.018171133877132165,
'n_estimators': 800, 'max_depth': 7, 'min_child_weight': 157}. Best is trial 33 with
0.0754166080789546.
[I 2025-11-04 03:08:16,503] Trial 63 finished with value: 0.07549183083543737 and
parameters: {'lambda': 0.08472481762989768, 'alpha': 0.05044414681273719,
'colsample_bytree': 1.0, 'subsample': 0.6, 'learning_rate': 0.018543868549982172,
'n_estimators': 600, 'max_depth': 7, 'min_child_weight': 152}. Best is trial 33 with
0.0754166080789546.
[I 2025-11-04 03:08:23,005] Trial 64 finished with value: 0.07547313710342511 and
parameters: {'lambda': 0.3219991293948467, 'alpha': 0.028811301936784592,
'colsample_bytree': 1.0, 'subsample': 0.6, 'learning_rate': 0.025875815101220383,
'n_estimators': 800, 'max_depth': 8, 'min_child_weight': 156}. Best is trial 33 with
0.0754166080789546.
[I 2025-11-04 03:08:30,002] Trial 65 finished with value: 0.0754633680676901β and
parameters: {'lambda': 0.10769071524748194, 'alpha': 0.06435529842071282,
'colsample_bytree': 1.0, 'subsample': 0.6, 'learning_rate': 0.021342689505007496,
'n_estimators': 700, 'max_depth': 9, 'min_child_weight': 144}. Best is trial 33 with

0.0754166080789546.
[I 2025-11-04 03:08:35,634] Trial 66 finished with value: 0.0756680352658216 and
parameters: {'lambda': 0.237672564294404, 'alpha': 9.577940280710576, 'colsample_byt
0.5, 'subsample': 1.0, 'learning_rate': 0.020528544856030638, 'n_estimators': 800,
'max_depth': 7, 'min_child_weight': 191}. Best is trial 33 with value: 0.07541660807
[I 2025-11-04 03:08:39,931] Trial 67 finished with value: 0.07555761671199628 and
parameters: {'lambda': 0.05968784817344432, 'alpha': 0.01621830634199931,
'colsample_bytree': 1.0, 'subsample': 0.6, 'learning_rate': 0.018030234363620813,
'n_estimators': 700, 'max_depth': 6, 'min_child_weight': 179}. Best is trial 33 with
0.0754166080789546.
[I 2025-11-04 03:08:45,101] Trial 68 finished with value: 0.07636945039444934 and
parameters: {'lambda': 0.7297255381634032, 'alpha': 0.07742353267835027,
'colsample_bytree': 0.3, 'subsample': 0.6, 'learning_rate': 0.03054444319728575,
'n_estimators': 600, 'max_depth': 8, 'min_child_weight': 201}. Best is trial 33 with
0.0754166080789546.
[I 2025-11-04 03:08:52,064] Trial 69 finished with value: 0.07566307654190964 and
parameters: {'lambda': 0.13476116372616742, 'alpha': 5.025678070911382, 'colsample_by
0.7, 'subsample': 0.8, 'learning_rate': 0.04495031418927106, 'n_estimators': 700,
'max_depth': 9, 'min_child_weight': 164}. Best is trial 33 with value: 0.07541660807
[I 2025-11-04 03:08:57,040] Trial 70 finished with value: 0.07546481350494105 and
parameters: {'lambda': 0.3848125878640154, 'alpha': 0.007586575164938924,
'colsample_bytree': 1.0, 'subsample': 0.6, 'learning_rate': 0.023001112728903043,
'n_estimators': 600, 'max_depth': 8, 'min_child_weight': 105}. Best is trial 33 with
0.0754166080789546.
[I 2025-11-04 03:09:02,501] Trial 71 finished with value: 0.07545308721803248 and
parameters: {'lambda': 0.13752454804694259, 'alpha': 0.2063561098219015,
'colsample_bytree': 1.0, 'subsample': 0.6, 'learning_rate': 0.016268254949635706,
'n_estimators': 800, 'max_depth': 7, 'min_child_weight': 117}. Best is trial 33 with
0.0754166080789546.
[I 2025-11-04 03:09:07,927] Trial 72 finished with value: 0.07545132777348763 and
parameters: {'lambda': 0.046774539413169676, 'alpha': 0.12231271187696727,
'colsample_bytree': 1.0, 'subsample': 0.6, 'learning_rate': 0.016334225724771247,
'n_estimators': 800, 'max_depth': 7, 'min_child_weight': 121}. Best is trial 33 with
0.0754166080789546.
[I 2025-11-04 03:09:13,435] Trial 73 finished with value: 0.07547879672160009 and
parameters: {'lambda': 0.04392266448234817, 'alpha': 0.12017754421788586,
'colsample_bytree': 1.0, 'subsample': 0.6, 'learning_rate': 0.013838821096950287,
'n_estimators': 800, 'max_depth': 7, 'min_child_weight': 127}. Best is trial 33 with
0.0754166080789546.
[I 2025-11-04 03:09:18,012] Trial 74 finished with value: 0.07550582714429482 and
parameters: {'lambda': 0.017745750622204973, 'alpha': 0.08360116454607283,
'colsample_bytree': 1.0, 'subsample': 0.6, 'learning_rate': 0.019609471635537633,
'n_estimators': 800, 'max_depth': 6, 'min_child_weight': 140}. Best is trial 33 with
0.0754166080789546.
[I 2025-11-04 03:09:25,215] Trial 75 finished with value: 0.0754427035054201 and
parameters: {'lambda': 0.07389440294431794, 'alpha': 0.18287491253412733,
'colsample_bytree': 1.0, 'subsample': 0.6, 'learning_rate': 0.016273887825409762,
'n_estimators': 900, 'max_depth': 8, 'min_child_weight': 118}. Best is trial 33 with
0.0754166080789546.
[I 2025-11-04 03:09:32,439] Trial 76 finished with value: 0.07545049825232024 and
parameters: {'lambda': 0.009875677321867645, 'alpha': 0.04182526696434311,
'colsample_bytree': 1.0, 'subsample': 0.5, 'learning_rate': 0.015704147771336448,
'n_estimators': 900, 'max_depth': 8, 'min_child_weight': 87}. Best is trial 33 with
0.0754166080789546.
[I 2025-11-04 03:09:39,604] Trial 77 finished with value: 0.07547678847951504 and
parameters: {'lambda': 0.0038540387049727986, 'alpha': 0.051207322436862275,
'colsample_bytree': 0.9, 'subsample': 0.5, 'learning_rate': 0.017779218310892818,
'n_estimators': 900, 'max_depth': 8, 'min_child_weight': 90}. Best is trial 33 with
0.0754166080789546.
[I 2025-11-04 03:09:48,101] Trial 78 finished with value: 0.07551460269312284 and

parameters: {'lambda': 0.009893006229189977, 'alpha': 0.0417601517039067, 'colsample_bytree': 1.0, 'subsample': 0.5, 'learning_rate': 0.015378830606131684, 'n_estimators': 900, 'max_depth': 9, 'min_child_weight': 160}. Best is trial 33 with 0.0754166080789546.
[I 2025-11-04 03:09:55,571] Trial 79 finished with value: 0.0754848284428059 and parameters: {'lambda': 0.0016343877590901594, 'alpha': 0.6326789622832101, 'colsample_bytree': 1.0, 'subsample': 0.5, 'learning_rate': 0.01912966103219111, 'n_estimators': 900, 'max_depth': 8, 'min_child_weight': 84}. Best is trial 33 with 0.0754166080789546.
[I 2025-11-04 03:10:03,260] Trial 80 finished with value: 0.07545784948779949 and parameters: {'lambda': 0.0023033825567733827, 'alpha': 0.02926574844315481, 'colsample_bytree': 0.9, 'subsample': 0.5, 'learning_rate': 0.01716430789079124, 'n_estimators': 900, 'max_depth': 8, 'min_child_weight': 36}. Best is trial 33 with 0.0754166080789546.
[I 2025-11-04 03:10:09,911] Trial 81 finished with value: 0.07544612150862144 and parameters: {'lambda': 0.029188096816941365, 'alpha': 0.1694574566199397, 'colsample_bytree': 1.0, 'subsample': 0.6, 'learning_rate': 0.016479539707374927, 'n_estimators': 800, 'max_depth': 8, 'min_child_weight': 151}. Best is trial 33 with 0.0754166080789546.
[I 2025-11-04 03:10:18,950] Trial 82 finished with value: 0.07547122283013186 and parameters: {'lambda': 0.01381803513606536, 'alpha': 0.17274360883087803, 'colsample_bytree': 1.0, 'subsample': 0.6, 'learning_rate': 0.013118542339706402, 'n_estimators': 900, 'max_depth': 9, 'min_child_weight': 150}. Best is trial 33 with 0.0754166080789546.
[I 2025-11-04 03:10:24,940] Trial 83 finished with value: 0.07546629274467473 and parameters: {'lambda': 0.028478325619700245, 'alpha': 0.3674039133401037, 'colsample_bytree': 1.0, 'subsample': 0.6, 'learning_rate': 0.014521919348088254, 'n_estimators': 700, 'max_depth': 8, 'min_child_weight': 172}. Best is trial 33 with 0.0754166080789546.
[I 2025-11-04 03:10:34,338] Trial 84 finished with value: 0.07564974194674207 and parameters: {'lambda': 0.008612730800408365, 'alpha': 0.1010837377419681, 'colsample_bytree': 1.0, 'subsample': 1.0, 'learning_rate': 0.021025726382346295, 'n_estimators': 1000, 'max_depth': 9, 'min_child_weight': 138}. Best is trial 33 with value: 0.0754166080789546.
[I 2025-11-04 03:10:40,968] Trial 85 finished with value: 0.07545403788111567 and parameters: {'lambda': 0.07147237767493474, 'alpha': 0.08200105659913152, 'colsample_bytree': 1.0, 'subsample': 0.5, 'learning_rate': 0.015611253290283355, 'n_estimators': 800, 'max_depth': 8, 'min_child_weight': 184}. Best is trial 33 with 0.0754166080789546.
[I 2025-11-04 03:10:48,796] Trial 86 finished with value: 0.07560525550898159 and parameters: {'lambda': 0.005732959533386318, 'alpha': 0.29211721775730626, 'colsample_bytree': 0.5, 'subsample': 0.6, 'learning_rate': 0.012183073259649825, 'n_estimators': 900, 'max_depth': 8, 'min_child_weight': 132}. Best is trial 33 with 0.0754166080789546.
[I 2025-11-04 03:10:56,308] Trial 87 finished with value: 0.07543650503806962 and parameters: {'lambda': 0.021047433980599377, 'alpha': 0.5316675347517563, 'colsample_bytree': 0.7, 'subsample': 0.8, 'learning_rate': 0.017021964233949475, 'n_estimators': 700, 'max_depth': 9, 'min_child_weight': 98}. Best is trial 33 with 0.0754166080789546.
[I 2025-11-04 03:11:05,424] Trial 88 finished with value: 0.07548922011017548 and parameters: {'lambda': 0.032271315971018934, 'alpha': 0.5752621650414641, 'colsample_bytree': 0.7, 'subsample': 0.8, 'learning_rate': 0.01720686587922549, 'n_estimators': 700, 'max_depth': 10, 'min_child_weight': 98}. Best is trial 33 with 0.0754166080789546.
[I 2025-11-04 03:11:12,942] Trial 89 finished with value: 0.0754469216356508 and parameters: {'lambda': 0.1963529951390052, 'alpha': 1.080850380831153, 'colsample_by 0.7, 'subsample': 0.8, 'learning_rate': 0.013773899211791727, 'n_estimators': 700, 'max_depth': 9, 'min_child_weight': 149}. Best is trial 33 with value: 0.075416608078
[I 2025-11-04 03:11:20,458] Trial 90 finished with value: 0.07545055528922257 and parameters: {'lambda': 0.019055299030036055, 'alpha': 0.38938218082509185,

'colsample_bytree': 0.7, 'subsample': 0.8, 'learning_rate': 0.013944030051215193,
'n_estimators': 700, 'max_depth': 9, 'min_child_weight': 148}. Best is trial 33 with
0.0754166080789546.
[I 2025-11-04 03:11:27,616] Trial 91 finished with value: 0.07544657233956263 and
parameters: {'lambda': 0.20303793166732884, 'alpha': 0.9488974547084459,
'colsample_bytree': 0.7, 'subsample': 0.8, 'learning_rate': 0.020224675570715035,
'n_estimators': 700, 'max_depth': 9, 'min_child_weight': 166}. Best is trial 33 with
0.0754166080789546.
[I 2025-11-04 03:11:34,776] Trial 92 finished with value: 0.07542529950780827 and
parameters: {'lambda': 0.207264811745585, 'alpha': 0.9723762037330235, 'colsample_byt
0.7, 'subsample': 0.8, 'learning_rate': 0.020290048373878294, 'n_estimators': 700,
'max_depth': 9, 'min_child_weight': 165}. Best is trial 33 with value: 0.07541660807
[I 2025-11-04 03:11:41,918] Trial 93 finished with value: 0.07543198318731845 and
parameters: {'lambda': 0.170319673487005, 'alpha': 1.0867360419882472, 'colsample_byt
0.7, 'subsample': 0.8, 'learning_rate': 0.020101703869738242, 'n_estimators': 700,
'max_depth': 9, 'min_child_weight': 169}. Best is trial 33 with value: 0.07541660807
[I 2025-11-04 03:11:49,009] Trial 94 finished with value: 0.07543905245148977 and
parameters: {'lambda': 0.5283284765737055, 'alpha': 0.506129637007668, 'colsample_byt
0.7, 'subsample': 0.8, 'learning_rate': 0.020296148478146935, 'n_estimators': 700,
'max_depth': 9, 'min_child_weight': 193}. Best is trial 33 with value: 0.07541660807
[I 2025-11-04 03:11:57,273] Trial 95 finished with value: 0.07548056418084682 and
parameters: {'lambda': 0.5230455292357775, 'alpha': 0.5705158439831103, 'colsample_by
0.7, 'subsample': 0.8, 'learning_rate': 0.022402263670959845, 'n_estimators': 700,
'max_depth': 10, 'min_child_weight': 197}. Best is trial 33 with value: 0.0754166080
[I 2025-11-04 03:12:04,231] Trial 96 finished with value: 0.07546098529751584 and
parameters: {'lambda': 0.02218173078231241, 'alpha': 0.4771999889303489,
'colsample_bytree': 0.7, 'subsample': 0.8, 'learning_rate': 0.024427152265889086,
'n_estimators': 700, 'max_depth': 9, 'min_child_weight': 189}. Best is trial 33 with
0.0754166080789546.
[I 2025-11-04 03:12:12,648] Trial 97 finished with value: 0.07545520240122446 and
parameters: {'lambda': 0.2781273468952556, 'alpha': 0.7514728587002497, 'colsample_by
0.7, 'subsample': 0.8, 'learning_rate': 0.018873311959572096, 'n_estimators': 700,
'max_depth': 10, 'min_child_weight': 222}. Best is trial 33 with value: 0.0754166080
[I 2025-11-04 03:12:20,604] Trial 98 finished with value: 0.07549093911033858 and
parameters: {'lambda': 0.8752862238094457, 'alpha': 2.408527756288145, 'colsample_byt
0.7, 'subsample': 0.8, 'learning_rate': 0.02568834900919891, 'n_estimators': 800,
'max_depth': 9, 'min_child_weight': 176}. Best is trial 33 with value: 0.07541660807
[I 2025-11-04 03:12:27,128] Trial 99 finished with value: 0.07544864107101924 and
parameters: {'lambda': 0.6113054408082523, 'alpha': 0.23360958271310153,
'colsample_bytree': 0.7, 'subsample': 0.8, 'learning_rate': 0.016590840115987323,
'n_estimators': 600, 'max_depth': 9, 'min_child_weight': 170}. Best is trial 33 with
0.0754166080789546.
[I 2025-11-04 03:12:35,552] Trial 100 finished with value: 0.07547621717117046 and
parameters: {'lambda': 0.03705800852110161, 'alpha': 0.35106135860929605,
'colsample_bytree': 0.7, 'subsample': 0.8, 'learning_rate': 0.01994943784240979,
'n_estimators': 700, 'max_depth': 10, 'min_child_weight': 205}. Best is trial 33 with
value: 0.0754166080789546.
[I 2025-11-04 03:12:42,731] Trial 101 finished with value: 0.07542774197017514 and
parameters: {'lambda': 0.1802109523317116, 'alpha': 1.4880868430963146, 'colsample_by
0.7, 'subsample': 0.8, 'learning_rate': 0.020339978730887318, 'n_estimators': 700,
'max_depth': 9, 'min_child_weight': 165}. Best is trial 33 with value: 0.07541660807
[I 2025-11-04 03:12:49,789] Trial 102 finished with value: 0.07545030710276052 and
parameters: {'lambda': 0.16178927608724536, 'alpha': 1.1456299938875938,
'colsample_bytree': 0.7, 'subsample': 0.8, 'learning_rate': 0.0217594296978216,
'n_estimators': 700, 'max_depth': 9, 'min_child_weight': 178}. Best is trial 33 with
0.0754166080789546.
[I 2025-11-04 03:12:57,010] Trial 103 finished with value: 0.07543516815941737 and
parameters: {'lambda': 0.2500116704521533, 'alpha': 1.7677907085019897, 'colsample_by
0.7, 'subsample': 0.8, 'learning_rate': 0.01798333842085713, 'n_estimators': 700,
'max_depth': 9, 'min_child_weight': 183}. Best is trial 33 with value: 0.07541660807

[I 2025-11-04 03:13:04,079] Trial 104 finished with value: 0.07545827500874222 and
parameters: {'lambda': 0.001012570748949244, 'alpha': 1.655293507502654,
'colsample_bytree': 0.7, 'subsample': 0.8, 'learning_rate': 0.02347204624786269,
'n_estimators': 700, 'max_depth': 9, 'min_child_weight': 184}. Best is trial 33 with
0.0754166080789546.
[I 2025-11-04 03:13:11,540] Trial 105 finished with value: 0.0754584769264996 and
parameters: {'lambda': 0.27209176449616457, 'alpha': 1.6412948339051205,
'colsample_bytree': 0.7, 'subsample': 0.8, 'learning_rate': 0.019172744195329976,
'n_estimators': 600, 'max_depth': 10, 'min_child_weight': 196}. Best is trial 33 with
value: 0.0754166080789546.
[I 2025-11-04 03:13:18,641] Trial 106 finished with value: 0.07544870740326139 and
parameters: {'lambda': 0.4610191146155382, 'alpha': 1.5555888798226425, 'colsample_by
0.7, 'subsample': 0.8, 'learning_rate': 0.020721557000564887, 'n_estimators': 700,
'max_depth': 9, 'min_child_weight': 208}. Best is trial 33 with value: 0.075416608078
[I 2025-11-04 03:13:21,257] Trial 107 finished with value: 0.07641065499589031 and
parameters: {'lambda': 0.3648194001200425, 'alpha': 2.243337134765464, 'colsample_by1
0.7, 'subsample': 0.8, 'learning_rate': 0.017788207702754653, 'n_estimators': 200,
'max_depth': 9, 'min_child_weight': 160}. Best is trial 33 with value: 0.075416608078
[I 2025-11-04 03:13:27,620] Trial 108 finished with value: 0.07545149688489777 and
parameters: {'lambda': 1.5593213068846679, 'alpha': 2.861100261093775, 'colsample_by1
0.7, 'subsample': 0.8, 'learning_rate': 0.018398324522438034, 'n_estimators': 600,
'max_depth': 9, 'min_child_weight': 169}. Best is trial 33 with value: 0.075416608078
[I 2025-11-04 03:13:34,777] Trial 109 finished with value: 0.07543574666830292 and
parameters: {'lambda': 0.24257191474071046, 'alpha': 0.5100815860576228,
'colsample_bytree': 0.7, 'subsample': 0.8, 'learning_rate': 0.02004272731537927,
'n_estimators': 700, 'max_depth': 9, 'min_child_weight': 182}. Best is trial 33 with
0.0754166080789546.
[I 2025-11-04 03:13:43,011] Trial 110 finished with value: 0.07552881785086626 and
parameters: {'lambda': 0.22850794627829474, 'alpha': 0.9971393314377901,
'colsample_bytree': 0.7, 'subsample': 0.8, 'learning_rate': 0.026690590710975827,
'n_estimators': 700, 'max_depth': 10, 'min_child_weight': 181}. Best is trial 33 with
value: 0.0754166080789546.
[I 2025-11-04 03:13:50,147] Trial 111 finished with value: 0.07544368316618771 and
parameters: {'lambda': 0.12800008187214762, 'alpha': 0.4538641806979059,
'colsample_bytree': 0.7, 'subsample': 0.8, 'learning_rate': 0.020104785822677898,
'n_estimators': 700, 'max_depth': 9, 'min_child_weight': 189}. Best is trial 33 with
0.0754166080789546.
[I 2025-11-04 03:13:57,240] Trial 112 finished with value: 0.07545236038793235 and
parameters: {'lambda': 0.1802050916259549, 'alpha': 0.7590200427504629, 'colsample_by
0.7, 'subsample': 0.8, 'learning_rate': 0.02243018139834862, 'n_estimators': 700,
'max_depth': 9, 'min_child_weight': 161}. Best is trial 33 with value: 0.075416608078
[I 2025-11-04 03:14:04,526] Trial 113 finished with value: 0.07543474357768709 and
parameters: {'lambda': 0.3168839819643343, 'alpha': 1.3679241840153336, 'colsample_by
0.7, 'subsample': 0.8, 'learning_rate': 0.01739488074729177, 'n_estimators': 700,
'max_depth': 9, 'min_child_weight': 176}. Best is trial 33 with value: 0.075416608078
[I 2025-11-04 03:14:12,989] Trial 114 finished with value: 0.07546937455282834 and
parameters: {'lambda': 0.3167798770446023, 'alpha': 3.646269806375731, 'colsample_byt
0.7, 'subsample': 0.8, 'learning_rate': 0.017488331090746455, 'n_estimators': 700,
'max_depth': 10, 'min_child_weight': 221}. Best is trial 33 with value: 0.07541660807
[I 2025-11-04 03:14:20,405] Trial 115 finished with value: 0.0754694757659778 and
parameters: {'lambda': 0.24350447206035913, 'alpha': 1.3311129417001657,
'colsample_bytree': 0.7, 'subsample': 0.8, 'learning_rate': 0.015027062823238894,
'n_estimators': 700, 'max_depth': 9, 'min_child_weight': 196}. Best is trial 33 with
0.0754166080789546.
[I 2025-11-04 03:14:26,769] Trial 116 finished with value: 0.07542722040608417 and
parameters: {'lambda': 0.4649634162804511, 'alpha': 2.022564533068857, 'colsample_byt
0.7, 'subsample': 0.8, 'learning_rate': 0.01893409666362448, 'n_estimators': 600,
'max_depth': 9, 'min_child_weight': 174}. Best is trial 33 with value: 0.075416608078
[I 2025-11-04 03:14:31,289] Trial 117 finished with value: 0.07550173198991143 and
parameters: {'lambda': 0.15391058282574305, 'alpha': 2.1106087064234496,

'colsample_bytree': 0.7, 'subsample': 0.8, 'learning_rate': 0.02111738778763952,
'n_estimators': 400, 'max_depth': 9, 'min_child_weight': 183}. Best is trial 33 with
0.0754166080789546.
[I 2025-11-04 03:14:37,642] Trial 118 finished with value: 0.07543488622758923 and
parameters: {'lambda': 1.1389166800074741, 'alpha': 2.6578604530182335, 'colsample_by
0.7, 'subsample': 0.8, 'learning_rate': 0.019580115184099904, 'n_estimators': 600,
'max_depth': 9, 'min_child_weight': 176}. Best is trial 33 with value: 0.0754166080787
[I 2025-11-04 03:14:45,019] Trial 119 finished with value: 0.07544738417806802 and
parameters: {'lambda': 2.655779961183167, 'alpha': 4.2175612539496745, 'colsample_byt
0.7, 'subsample': 0.8, 'learning_rate': 0.023239496719850778, 'n_estimators': 600,
'max_depth': 10, 'min_child_weight': 174}. Best is trial 33 with value: 0.0754166080787
[I 2025-11-04 03:14:51,366] Trial 120 finished with value: 0.07545314158860687 and
parameters: {'lambda': 1.090914360402022, 'alpha': 3.0519938748260507, 'colsample_byt
0.7, 'subsample': 0.8, 'learning_rate': 0.018334898095228036, 'n_estimators': 600,
'max_depth': 9, 'min_child_weight': 167}. Best is trial 33 with value: 0.0754166080787
[I 2025-11-04 03:14:56,879] Trial 121 finished with value: 0.07544009936477435 and
parameters: {'lambda': 0.7463124026728845, 'alpha': 1.521814034566832, 'colsample_byt
0.7, 'subsample': 0.8, 'learning_rate': 0.020379051467947447, 'n_estimators': 500,
'max_depth': 9, 'min_child_weight': 175}. Best is trial 33 with value: 0.0754166080787
[I 2025-11-04 03:15:03,253] Trial 122 finished with value: 0.07542695261013381 and
parameters: {'lambda': 0.43682113457211125, 'alpha': 0.9115663949085453,
'colsample_bytree': 0.7, 'subsample': 0.8, 'learning_rate': 0.01938598029101041,
'n_estimators': 600, 'max_depth': 9, 'min_child_weight': 156}. Best is trial 33 with
0.0754166080789546.
[I 2025-11-04 03:15:09,644] Trial 123 finished with value: 0.07544420581324963 and
parameters: {'lambda': 0.4317600634204114, 'alpha': 1.9146966078692942, 'colsample_by
0.7, 'subsample': 0.8, 'learning_rate': 0.019443892045884495, 'n_estimators': 600,
'max_depth': 9, 'min_child_weight': 155}. Best is trial 33 with value: 0.0754166080787
[I 2025-11-04 03:15:15,190] Trial 124 finished with value: 0.07544842979425495 and
parameters: {'lambda': 0.2819779969550614, 'alpha': 0.9385382807061093, 'colsample_by
0.9, 'subsample': 0.8, 'learning_rate': 0.01737446236467745, 'n_estimators': 500,
'max_depth': 9, 'min_child_weight': 164}. Best is trial 33 with value: 0.0754166080787
[I 2025-11-04 03:15:24,061] Trial 125 finished with value: 0.07548733025832112 and
parameters: {'lambda': 0.3505861179992573, 'alpha': 0.6886346370699249, 'colsample_by
0.7, 'subsample': 0.7, 'learning_rate': 0.01878003655155713, 'n_estimators': 600,
'max_depth': 11, 'min_child_weight': 179}. Best is trial 33 with value: 0.0754166080787
[I 2025-11-04 03:15:31,577] Trial 126 finished with value: 0.0754533717587831 and
parameters: {'lambda': 0.18405025283178345, 'alpha': 1.1987004671094204,
'colsample_bytree': 0.7, 'subsample': 0.8, 'learning_rate': 0.021468535075564087,
'n_estimators': 600, 'max_depth': 10, 'min_child_weight': 156}. Best is trial 33 with
value: 0.0754166080789546.
[I 2025-11-04 03:15:38,157] Trial 127 finished with value: 0.07677980223787233 and
parameters: {'lambda': 1.7630144013772955, 'alpha': 1.4373144346740745, 'colsample_by
0.3, 'subsample': 0.8, 'learning_rate': 0.0179645165217614, 'n_estimators': 600,
'max_depth': 9, 'min_child_weight': 144}. Best is trial 33 with value: 0.0754166080787
[I 2025-11-04 03:15:45,735] Trial 128 finished with value: 0.07545684476436501 and
parameters: {'lambda': 0.10049132417065806, 'alpha': 2.7964014429028743,
'colsample_bytree': 0.7, 'subsample': 0.8, 'learning_rate': 0.016918929008750267,
'n_estimators': 600, 'max_depth': 10, 'min_child_weight': 185}. Best is trial 33 with
value: 0.0754166080789546.
[I 2025-11-04 03:15:52,086] Trial 129 finished with value: 0.07544141884342125 and
parameters: {'lambda': 0.22045484467229354, 'alpha': 2.49141252251437, 'colsample_byt
0.9, 'subsample': 0.8, 'learning_rate': 0.01930993778682617, 'n_estimators': 600,
'max_depth': 9, 'min_child_weight': 172}. Best is trial 33 with value: 0.0754166080787
[I 2025-11-04 03:15:56,745] Trial 130 finished with value: 0.0755737845147082 and
parameters: {'lambda': 0.672878040078271, 'alpha': 0.8885957678796844, 'colsample_by
0.7, 'subsample': 1.0, 'learning_rate': 0.015708346422221835, 'n_estimators': 500,
'max_depth': 8, 'min_child_weight': 160}. Best is trial 33 with value: 0.0754166080787
[I 2025-11-04 03:16:03,858] Trial 131 finished with value: 0.07544710331468009 and
parameters: {'lambda': 0.481507455824649, 'alpha': 0.5435032171573903, 'colsample_by

0.7, 'subsample': 0.8, 'learning_rate': 0.020137312615074017, 'n_estimators': 700, 'max_depth': 9, 'min_child_weight': 192}. Best is trial 33 with value: 0.07541660807
[I 2025-11-04 03:16:10,928] Trial 132 finished with value: 0.07545040814207356 and parameters: {'lambda': 1.0847377213778737, 'alpha': 1.8728435175711333, 'colsample_by 0.7, 'subsample': 0.8, 'learning_rate': 0.02210851229815238, 'n_estimators': 700, 'max_depth': 9, 'min_child_weight': 199}. Best is trial 33 with value: 0.07541660807
[I 2025-11-04 03:16:19,244] Trial 133 finished with value: 0.07550502560427252 and parameters: {'lambda': 0.5817486790482984, 'alpha': 0.512059587115406, 'colsample_byt 0.7, 'subsample': 0.8, 'learning_rate': 0.018381732360969814, 'n_estimators': 700, 'max_depth': 9, 'min_child_weight': 8}. Best is trial 33 with value: 0.0754166080789
[I 2025-11-04 03:16:26,359] Trial 134 finished with value: 0.07545188935868545 and parameters: {'lambda': 0.299881847610152, 'alpha': 1.1694760391429448, 'colsample_byt 0.7, 'subsample': 0.8, 'learning_rate': 0.021145607711433093, 'n_estimators': 700, 'max_depth': 9, 'min_child_weight': 191}. Best is trial 33 with value: 0.07541660807
[I 2025-11-04 03:16:33,655] Trial 135 finished with value: 0.07545214355494345 and parameters: {'lambda': 0.4084338055991936, 'alpha': 0.2778457114646361, 'colsample_by 0.7, 'subsample': 0.7, 'learning_rate': 0.01697668900968014, 'n_estimators': 700, 'max_depth': 9, 'min_child_weight': 166}. Best is trial 33 with value: 0.07541660807
[I 2025-11-04 03:16:38,877] Trial 136 finished with value: 0.07542001401958258 and parameters: {'lambda': 0.25639915032021166, 'alpha': 0.6886112084756625, 'colsample_bytree': 0.9, 'subsample': 0.8, 'learning_rate': 0.019549022873374625, 'n_estimators': 600, 'max_depth': 8, 'min_child_weight': 177}. Best is trial 33 with 0.0754166080789546.
[I 2025-11-04 03:16:44,130] Trial 137 finished with value: 0.07542301009102018 and parameters: {'lambda': 0.12340406863039176, 'alpha': 0.6767149596211777, 'colsample_bytree': 0.9, 'subsample': 0.8, 'learning_rate': 0.01922819795942914, 'n_estimators': 600, 'max_depth': 8, 'min_child_weight': 179}. Best is trial 33 with 0.0754166080789546.
[I 2025-11-04 03:16:49,268] Trial 138 finished with value: 0.07542522955761176 and parameters: {'lambda': 0.1273054431798414, 'alpha': 0.6914023507517774, 'colsample_by 0.9, 'subsample': 0.8, 'learning_rate': 0.02418806212416372, 'n_estimators': 600, 'max_depth': 8, 'min_child_weight': 178}. Best is trial 33 with value: 0.07541660807
[I 2025-11-04 03:16:54,406] Trial 139 finished with value: 0.07543543528238864 and parameters: {'lambda': 0.1170777232478224, 'alpha': 0.803473434707642, 'colsample_byt 0.9, 'subsample': 0.8, 'learning_rate': 0.023922777359040696, 'n_estimators': 600, 'max_depth': 8, 'min_child_weight': 177}. Best is trial 33 with value: 0.07541660807
[I 2025-11-04 03:16:59,549] Trial 140 finished with value: 0.0754289799492485 and parameters: {'lambda': 0.14595360054857942, 'alpha': 0.7738334486572053, 'colsample_bytree': 0.9, 'subsample': 0.8, 'learning_rate': 0.024258388118260327, 'n_estimators': 600, 'max_depth': 8, 'min_child_weight': 176}. Best is trial 33 with 0.0754166080789546.
[I 2025-11-04 03:17:04,685] Trial 141 finished with value: 0.07543617460333643 and parameters: {'lambda': 0.11362119231995874, 'alpha': 0.8207075279831002, 'colsample_bytree': 0.9, 'subsample': 0.8, 'learning_rate': 0.02534474159707345, 'n_estimators': 600, 'max_depth': 8, 'min_child_weight': 177}. Best is trial 33 with 0.0754166080789546.
[I 2025-11-04 03:17:07,596] Trial 142 finished with value: 0.07547563089262353 and parameters: {'lambda': 0.15194876748845873, 'alpha': 0.6858347578985473, 'colsample_bytree': 0.9, 'subsample': 0.8, 'learning_rate': 0.029340546283755955, 'n_estimators': 300, 'max_depth': 8, 'min_child_weight': 171}. Best is trial 33 with 0.0754166080789546.
[I 2025-11-04 03:17:12,816] Trial 143 finished with value: 0.07542123042464931 and parameters: {'lambda': 0.08223750094260453, 'alpha': 1.0305865504614296, 'colsample_bytree': 0.9, 'subsample': 0.8, 'learning_rate': 0.0230822767893964, 'n_estimators': 600, 'max_depth': 8, 'min_child_weight': 153}. Best is trial 33 with 0.0754166080789546.
[I 2025-11-04 03:17:17,345] Trial 144 finished with value: 0.0754408081004061 and parameters: {'lambda': 0.09426108274202741, 'alpha': 0.9966871927917269, 'colsample_bytree': 0.9, 'subsample': 0.8, 'learning_rate': 0.02283734618115936, 'n_estimators': 500, 'max_depth': 8, 'min_child_weight': 150}. Best is trial 33 with

0.0754166080789546.
[I 2025-11-04 03:17:20,297] Trial 145 finished with value: 0.07612065178028488 and
parameters: {'lambda': 0.13977662726004045, 'alpha': 1.3906814801058764,
'colsample_bytree': 0.9, 'subsample': 0.8, 'learning_rate': 0.026802068627463572,
'n_estimators': 600, 'max_depth': 4, 'min_child_weight': 162}. Best is trial 33 with
0.0754166080789546.
[I 2025-11-04 03:17:25,508] Trial 146 finished with value: 0.07540042114878598 and
parameters: {'lambda': 0.08711498738568378, 'alpha': 1.074686582887978, 'colsample_by
0.9, 'subsample': 0.8, 'learning_rate': 0.024548215992985237, 'n_estimators': 600,
'max_depth': 8, 'min_child_weight': 153}. Best is trial 146 with value:
0.07540042114878598.
[I 2025-11-04 03:17:30,713] Trial 147 finished with value: 0.07541181932196409 and
parameters: {'lambda': 0.07829282163473547, 'alpha': 1.0907063200359972,
'colsample_bytree': 0.9, 'subsample': 0.8, 'learning_rate': 0.024370565866230993,
'n_estimators': 600, 'max_depth': 8, 'min_child_weight': 157}. Best is trial 146 with
value: 0.07540042114878598.
[I 2025-11-04 03:17:35,871] Trial 148 finished with value: 0.07542832896230448 and
parameters: {'lambda': 0.058535175106103676, 'alpha': 1.0919038775175514,
'colsample_bytree': 0.9, 'subsample': 0.8, 'learning_rate': 0.028103512346886413,
'n_estimators': 600, 'max_depth': 8, 'min_child_weight': 141}. Best is trial 146 with
value: 0.07540042114878598.
[I 2025-11-04 03:17:41,035] Trial 149 finished with value: 0.07541530058172077 and
parameters: {'lambda': 0.06386018342300877, 'alpha': 1.108899138149776, 'colsample_by
0.9, 'subsample': 0.8, 'learning_rate': 0.028527794621344513, 'n_estimators': 600,
'max_depth': 8, 'min_child_weight': 138}. Best is trial 146 with value:
0.07540042114878598.
[I 2025-11-04 03:17:41,036] A new study created in memory with name: no-name-c0794166
ef54-4394-9015-b07dc75c0706
✅ Best XGBRegressor parameters: {'lambda': 0.08711498738568378, 'alpha':
1.074686582887978, 'colsample_bytree': 0.9, 'subsample': 0.8, 'learning_rate':
0.024548215992985237, 'n_estimators': 600, 'max_depth': 8, 'min_child_weight': 153}

🚀 Tuning LGBMRegressor (GPU)...

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[I 2025-11-04 03:18:03,326] Trial 0 finished with value: 0.07616998058116585 and
parameters: {'lambda_l1': 0.018286397780276024, 'lambda_l2': 2.925989115542006e-05,
'num_leaves': 184, 'feature_fraction': 0.5795139775510085, 'bagging_fraction':
0.7580195101629237, 'bagging_freq': 4, 'min_child_samples': 16, 'learning_rate':
0.18017724291980208, 'n_estimators': 600, 'max_depth': 5}. Best is trial 0 with value
0.07616998058116585.
[I 2025-11-04 03:18:35,386] Trial 1 finished with value: 0.07610431697215772 and
parameters: {'lambda_l1': 0.0015514532517643864, 'lambda_l2': 0.037475672421999284,
'num_leaves': 153, 'feature_fraction': 0.9033699698380346, 'bagging_fraction':
0.9221281720771373, 'bagging_freq': 1, 'min_child_samples': 34, 'learning_rate':
0.0570082538227452, 'n_estimators': 900, 'max_depth': 11}. Best is trial 1 with value
0.07610431697215772.
[I 2025-11-04 03:19:02,028] Trial 2 finished with value: 0.07547701587656801 and
parameters: {'lambda_l1': 0.1857704314414471, 'lambda_l2': 0.008034019296213538,
'num_leaves': 183, 'feature_fraction': 0.8712002326716373, 'bagging_fraction':
0.851286809881847, 'bagging_freq': 2, 'min_child_samples': 30, 'learning_rate':
0.023089812276559592, 'n_estimators': 400, 'max_depth': 9}. Best is trial 2 with valu
0.07547701587656801.
[I 2025-11-04 03:19:12,817] Trial 3 finished with value: 0.08016325937230856 and
parameters: {'lambda_l1': 0.00015835566864244943, 'lambda_l2': 0.0011444349618324806,
'num_leaves': 146, 'feature_fraction': 0.990924042651423, 'bagging_fraction':
0.8799740062376201, 'bagging_freq': 6, 'min_child_samples': 70, 'learning_rate':
0.00565886307064818, 'n_estimators': 400, 'max_depth': 4}. Best is trial 2 with value
0.07547701587656801.
[I 2025-11-04 03:19:40,847] Trial 4 finished with value: 0.07561625624692607 and
parameters: {'lambda_l1': 0.19710949514360193, 'lambda_l2': 0.005954193493373975,
'num_leaves': 246, 'feature_fraction': 0.7965827775732885, 'bagging_fraction':

0.6529080284675611, 'bagging_freq': 6, 'min_child_samples': 49, 'learning_rate':
0.01622302892403321, 'n_estimators': 800, 'max_depth': 6}. Best is trial 2 with value
0.07547701587656801.
[I 2025-11-04 03:20:12,495] Trial 5 finished with value: 0.07584824175768579 and
parameters: {'lambda_l1': 0.025314562693491395, 'lambda_l2': 0.00012770935824816192,
'num_leaves': 39, 'feature_fraction': 0.6127675399057457, 'bagging_fraction':
0.9866628282521683, 'bagging_freq': 6, 'min_child_samples': 44, 'learning_rate':
0.009644897482843856, 'n_estimators': 800, 'max_depth': 8}. Best is trial 2 with value
0.07547701587656801.
[I 2025-11-04 03:20:51,820] Trial 6 finished with value: 0.07585386050535507 and
parameters: {'lambda_l1': 1.62139315862583e-05, 'lambda_l2': 0.029664179685220348,
'num_leaves': 217, 'feature_fraction': 0.5143032511851355, 'bagging_fraction':
0.8732136542159398, 'bagging_freq': 4, 'min_child_samples': 85, 'learning_rate':
0.05699961066668624, 'n_estimators': 600, 'max_depth': 10}. Best is trial 2 with value
0.07547701587656801.
[I 2025-11-04 03:21:19,374] Trial 7 finished with value: 0.07559636948700331 and
parameters: {'lambda_l1': 0.0005258300771439843, 'lambda_l2': 0.00017450294733361077,
'num_leaves': 98, 'feature_fraction': 0.510208827565731, 'bagging_fraction':
0.5402537098185862, 'bagging_freq': 7, 'min_child_samples': 96, 'learning_rate':
0.022533159342102007, 'n_estimators': 700, 'max_depth': 7}. Best is trial 2 with value
0.07547701587656801.
[I 2025-11-04 03:21:51,538] Trial 8 finished with value: 0.07553971474430225 and
parameters: {'lambda_l1': 0.08233137774309301, 'lambda_l2': 2.2786181107364e-05,
'num_leaves': 124, 'feature_fraction': 0.834734728918397, 'bagging_fraction':
0.8024552483513856, 'bagging_freq': 7, 'min_child_samples': 32, 'learning_rate':
0.027068986033607696, 'n_estimators': 700, 'max_depth': 10}. Best is trial 2 with value
0.07547701587656801.
[I 2025-11-04 03:22:56,359] Trial 9 finished with value: 0.07723909860313506 and
parameters: {'lambda_l1': 0.0024100593916170144, 'lambda_l2': 0.08475569304883045,
'num_leaves': 196, 'feature_fraction': 0.6875644220133745, 'bagging_fraction':
0.7790841477301427, 'bagging_freq': 3, 'min_child_samples': 83, 'learning_rate':
0.07574138211296384, 'n_estimators': 1000, 'max_depth': 10}. Best is trial 2 with value
0.07547701587656801.
[I 2025-11-04 03:23:01,299] Trial 10 finished with value: 0.07650157920829449 and
parameters: {'lambda_l1': 0.4895087892854166, 'lambda_l2': 0.40719370232724045,
'num_leaves': 74, 'feature_fraction': 0.9292064765870762, 'bagging_fraction':
0.6499632096574267, 'bagging_freq': 1, 'min_child_samples': 11, 'learning_rate':
0.20171857863632958, 'n_estimators': 200, 'max_depth': 12}. Best is trial 2 with value
0.07547701587656801.
[I 2025-11-04 03:23:21,145] Trial 11 finished with value: 0.07550454784061375 and
parameters: {'lambda_l1': 0.054927206120291026, 'lambda_l2': 0.0014265365435180252,
'num_leaves': 117, 'feature_fraction': 0.8159406674659888, 'bagging_fraction':
0.8076239437000583, 'bagging_freq': 3, 'min_child_samples': 29, 'learning_rate':
0.025034235000086433, 'n_estimators': 400, 'max_depth': 9}. Best is trial 2 with value
0.07547701587656801.
[I 2025-11-04 03:23:44,338] Trial 12 finished with value: 0.07567575679194667 and
parameters: {'lambda_l1': 0.01979136955016914, 'lambda_l2': 0.002129137614805125,
'num_leaves': 169, 'feature_fraction': 0.7389969251972808, 'bagging_fraction':
0.6604150727391651, 'bagging_freq': 2, 'min_child_samples': 25, 'learning_rate':
0.013158719788960854, 'n_estimators': 400, 'max_depth': 8}. Best is trial 2 with value
0.07547701587656801.
[I 2025-11-04 03:24:03,660] Trial 13 finished with value: 0.07545350035861813 and
parameters: {'lambda_l1': 0.8664345546365401, 'lambda_l2': 0.005830871218354138,
'num_leaves': 104, 'feature_fraction': 0.8552252997531017, 'bagging_fraction':
0.8370111862592196, 'bagging_freq': 3, 'min_child_samples': 62, 'learning_rate':
0.036759954674627206, 'n_estimators': 400, 'max_depth': 9}. Best is trial 13 with value
0.07545350035861813.
[I 2025-11-04 03:24:09,539] Trial 14 finished with value: 0.0767341197596222 and
parameters: {'lambda_l1': 0.978393003988984, 'lambda_l2': 0.015666420493499877,
'num_leaves': 65, 'feature_fraction': 0.8883074026544937, 'bagging_fraction':

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0.9812302826009931, 'bagging_freq': 2, 'min_child_samples': 62, 'learning_rate':
0.11723099848040633, 'n_estimators': 200, 'max_depth': 3}. Best is trial 13 with valu
0.07545350035861813.
[I 2025-11-04 03:24:30,803] Trial 15 finished with value: 0.0756672993326456 and
parameters: {'lambda_l1': 0.32250726241452676, 'lambda_l2': 0.9465128713631722,
'num_leaves': 255, 'feature_fraction': 0.9986622050908245, 'bagging_fraction':
0.863068397574945, 'bagging_freq': 3, 'min_child_samples': 62, 'learning_rate':
0.04238589950271571, 'n_estimators': 300, 'max_depth': 12}. Best is trial 13 with val
0.07545350035861813.
[I 2025-11-04 03:24:47,467] Trial 16 finished with value: 0.07696846288494148 and
parameters: {'lambda_l1': 0.007682268836663441, 'lambda_l2': 0.00033107807868831287,
'num_leaves': 25, 'feature_fraction': 0.7347429982466424, 'bagging_fraction':
0.717070075759946, 'bagging_freq': 4, 'min_child_samples': 42, 'learning_rate':
0.007467720904875604, 'n_estimators': 500, 'max_depth': 7}. Best is trial 13 with val
0.07545350035861813.
[I 2025-11-04 03:25:04,069] Trial 17 finished with value: 0.0754770113157787 and
parameters: {'lambda_l1': 0.1725539773552142, 'lambda_l2': 0.006290668113273014,
'num_leaves': 96, 'feature_fraction': 0.8591154718385051, 'bagging_fraction':
0.9218742641200977, 'bagging_freq': 2, 'min_child_samples': 56, 'learning_rate':
0.03307654462730821, 'n_estimators': 300, 'max_depth': 9}. Best is trial 13 with valu
0.07545350035861813.
[I 2025-11-04 03:25:16,318] Trial 18 finished with value: 0.07568550238055628 and
parameters: {'lambda_l1': 0.7163655904969, 'lambda_l2': 0.11180235434772334, 'num_lea
93, 'feature_fraction': 0.9416406538780311, 'bagging_fraction': 0.9273109200914005,
'bagging_freq': 5, 'min_child_samples': 72, 'learning_rate': 0.10335020939712108,
'n_estimators': 300, 'max_depth': 9}. Best is trial 13 with value: 0.0754535003586181
[I 2025-11-04 03:25:30,100] Trial 19 finished with value: 0.07566121931984307 and
parameters: {'lambda_l1': 0.07183618781409777, 'lambda_l2': 0.0007253445131339001,
'num_leaves': 56, 'feature_fraction': 0.775990284287826, 'bagging_fraction':
0.9303490107582748, 'bagging_freq': 2, 'min_child_samples': 57, 'learning_rate':
0.037084774289283584, 'n_estimators': 300, 'max_depth': 6}. Best is trial 13 with val
0.07545350035861813.
[I 2025-11-04 03:25:52,418] Trial 20 finished with value: 0.07551289811925767 and
parameters: {'lambda_l1': 0.005898996421745586, 'lambda_l2': 0.004495279776462104,
'num_leaves': 96, 'feature_fraction': 0.6819482518424239, 'bagging_fraction':
0.7018596843398558, 'bagging_freq': 3, 'min_child_samples': 73, 'learning_rate':
0.03679777431402127, 'n_estimators': 500, 'max_depth': 11}. Best is trial 13 with val
0.07545350035861813.
[I 2025-11-04 03:26:23,718] Trial 21 finished with value: 0.07547724474012713 and
parameters: {'lambda_l1': 0.2133937556826457, 'lambda_l2': 0.008909393598450728,
'num_leaves': 127, 'feature_fraction': 0.857566191627718, 'bagging_fraction':
0.8364254381303585, 'bagging_freq': 2, 'min_child_samples': 50, 'learning_rate':
0.015980129270242612, 'n_estimators': 500, 'max_depth': 9}. Best is trial 13 with val
0.07545350035861813.
[I 2025-11-04 03:26:36,460] Trial 22 finished with value: 0.07553705481394866 and
parameters: {'lambda_l1': 0.15478096017568707, 'lambda_l2': 0.020264549768352333,
'num_leaves': 214, 'feature_fraction': 0.869714852023657, 'bagging_fraction':
0.9044603125828876, 'bagging_freq': 1, 'min_child_samples': 39, 'learning_rate':
0.022118027413264418, 'n_estimators': 300, 'max_depth': 8}. Best is trial 13 with val
0.07545350035861813.
[I 2025-11-04 03:27:00,943] Trial 23 finished with value: 0.07558947963217827 and
parameters: {'lambda_l1': 0.7895950231944865, 'lambda_l2': 0.0035327347657237436,
'num_leaves': 156, 'feature_fraction': 0.9283273385674629, 'bagging_fraction':
0.8338593481038623, 'bagging_freq': 2, 'min_child_samples': 55, 'learning_rate':
0.04788181384727912, 'n_estimators': 400, 'max_depth': 9}. Best is trial 13 with valu
0.07545350035861813.
[I 2025-11-04 03:27:11,903] Trial 24 finished with value: 0.0756021173024518 and
parameters: {'lambda_l1': 0.045499143952150205, 'lambda_l2': 0.10347253989122338,
'num_leaves': 102, 'feature_fraction': 0.8384451426862041, 'bagging_fraction':
0.9548756212734004, 'bagging_freq': 3, 'min_child_samples': 19, 'learning_rate':
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0.031305655485947936, 'n_estimators': 200, 'max_depth': 11}. Best is trial 13 with va
0.07545350035861813.
[I 2025-11-04 03:27:25,287] Trial 25 finished with value: 0.07569232277422464 and
parameters: {'lambda_l1': 0.1379567101263394, 'lambda_l2': 0.00047221679557406525,
'num_leaves': 80, 'feature_fraction': 0.7742920447865116, 'bagging_fraction':
0.8318116338764228, 'bagging_freq': 1, 'min_child_samples': 64, 'learning_rate':
0.07293525865643874, 'n_estimators': 500, 'max_depth': 10}. Best is trial 13 with va
0.07545350035861813.
[I 2025-11-04 03:27:42,519] Trial 26 finished with value: 0.07603644969595158 and
parameters: {'lambda_l1': 0.4032243596197774, 'lambda_l2': 0.008792975134939122,
'num_leaves': 173, 'feature_fraction': 0.9507694304012888, 'bagging_fraction':
0.8880261739652581, 'bagging_freq': 2, 'min_child_samples': 79, 'learning_rate':
0.011509744142903506, 'n_estimators': 300, 'max_depth': 7}. Best is trial 13 with va
0.07545350035861813.
[I 2025-11-04 03:28:01,718] Trial 27 finished with value: 0.07550577550658251 and
parameters: {'lambda_l1': 5.947153062471629e-05, 'lambda_l2': 0.002115357366092897,
'num_leaves': 140, 'feature_fraction': 0.892708571767611, 'bagging_fraction':
0.5016824559476847, 'bagging_freq': 4, 'min_child_samples': 51, 'learning_rate':
0.016809516353692548, 'n_estimators': 400, 'max_depth': 8}. Best is trial 13 with va
0.07545350035861813.
[I 2025-11-04 03:28:11,163] Trial 28 finished with value: 0.07609360595516321 and
parameters: {'lambda_l1': 0.00775961192401914, 'lambda_l2': 0.04834827810722819,
'num_leaves': 50, 'feature_fraction': 0.8070879401729638, 'bagging_fraction':
0.9562269573411121, 'bagging_freq': 3, 'min_child_samples': 99, 'learning_rate':
0.020761044792387377, 'n_estimators': 200, 'max_depth': 9}. Best is trial 13 with va
0.07545350035861813.
[I 2025-11-04 03:28:31,407] Trial 29 finished with value: 0.0779026753109891 and
parameters: {'lambda_l1': 0.028167541017408967, 'lambda_l2': 8.14765505454692e-05,
'num_leaves': 114, 'feature_fraction': 0.7008251901464173, 'bagging_fraction':
0.7513193981213757, 'bagging_freq': 5, 'min_child_samples': 37, 'learning_rate':
0.28885784518449875, 'n_estimators': 600, 'max_depth': 6}. Best is trial 13 with valu
0.07545350035861813.
[I 2025-11-04 03:28:48,835] Trial 30 finished with value: 0.075710719897722879 and
parameters: {'lambda_l1': 0.2886402232670303, 'lambda_l2': 0.011282007210847773,
'num_leaves': 192, 'feature_fraction': 0.86983165877564, 'bagging_fraction':
0.7776948648023828, 'bagging_freq': 2, 'min_child_samples': 25, 'learning_rate':
0.10145293204453483, 'n_estimators': 500, 'max_depth': 5}. Best is trial 13 with valu
0.07545350035861813.
[I 2025-11-04 03:29:20,220] Trial 31 finished with value: 0.07545019514059305 and
parameters: {'lambda_l1': 0.12177655590617667, 'lambda_l2': 0.007119800410421962,
'num_leaves': 132, 'feature_fraction': 0.8435145166139824, 'bagging_fraction':
0.8465235475372987, 'bagging_freq': 2, 'min_child_samples': 48, 'learning_rate':
0.016315795493885135, 'n_estimators': 500, 'max_depth': 9}. Best is trial 31 with va
0.07545019514059305.
[I 2025-11-04 03:29:44,503] Trial 32 finished with value: 0.07548897985788396 and
parameters: {'lambda_l1': 0.10775548497048493, 'lambda_l2': 0.004611221884151043,
'num_leaves': 136, 'feature_fraction': 0.8503499592091327, 'bagging_fraction':
0.8271342836767976, 'bagging_freq': 1, 'min_child_samples': 45, 'learning_rate':
0.029206332673865097, 'n_estimators': 600, 'max_depth': 10}. Best is trial 31 with va
0.07545019514059305.
[I 2025-11-04 03:30:12,061] Trial 33 finished with value: 0.07587344179157113 and
parameters: {'lambda_l1': 0.5269029014746169, 'lambda_l2': 0.035912672520657475,
'num_leaves': 158, 'feature_fraction': 0.9667173031746343, 'bagging_fraction':
0.8601550321357363, 'bagging_freq': 2, 'min_child_samples': 57, 'learning_rate':
0.008275170848387622, 'n_estimators': 400, 'max_depth': 11}. Best is trial 31 with va
0.07545019514059305.
[I 2025-11-04 03:30:25,357] Trial 34 finished with value: 0.07551029227140804 and
parameters: {'lambda_l1': 0.038580475111192294, 'lambda_l2': 0.0008625144235251928,
'num_leaves': 77, 'feature_fraction': 0.9135881741890041, 'bagging_fraction':
0.9073191160898009, 'bagging_freq': 1, 'min_child_samples': 48, 'learning_rate':
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0.01774304967555982, 'n_estimators': 400, 'max_depth': 9}. Best is trial 31 with valu
0.07545019514059305.
[I 2025-11-04 03:30:40,769] Trial 35 finished with value: 0.07547540797499697 and
parameters: {'lambda_l1': 0.1718697184841706, 'lambda_l2': 1.0097514072027714e-05,
'num_leaves': 109, 'feature_fraction': 0.7817202562453593, 'bagging_fraction':
0.9495542253740653, 'bagging_freq': 3, 'min_child_samples': 67, 'learning_rate':
0.05449437271277164, 'n_estimators': 300, 'max_depth': 8}. Best is trial 31 with valu
0.07545019514059305.
[I 2025-11-04 03:30:55,966] Trial 36 finished with value: 0.07548476953717663 and
parameters: {'lambda_l1': 0.012691104832085062, 'lambda_l2': 7.941665797863909e-05,
'num_leaves': 109, 'feature_fraction': 0.7615852408988744, 'bagging_fraction':
0.9526743389670953, 'bagging_freq': 3, 'min_child_samples': 67, 'learning_rate':
0.05492609691378466, 'n_estimators': 300, 'max_depth': 8}. Best is trial 31 with valu
0.07545019514059305.
[I 2025-11-04 03:31:08,771] Trial 37 finished with value: 0.07552328775896856 and
parameters: {'lambda_l1': 0.2586124884955732, 'lambda_l2': 1.5497075630351294e-05,
'num_leaves': 83, 'feature_fraction': 0.8007761591181948, 'bagging_fraction':
0.9942472778697801, 'bagging_freq': 5, 'min_child_samples': 55, 'learning_rate':
0.07384056290769808, 'n_estimators': 300, 'max_depth': 7}. Best is trial 31 with valu
0.07545019514059305.
[I 2025-11-04 03:31:47,833] Trial 38 finished with value: 0.07545660038128453 and
parameters: {'lambda_l1': 0.09452861418900683, 'lambda_l2': 0.0015161917033980827,
'num_leaves': 131, 'feature_fraction': 0.6537074117105771, 'bagging_fraction':
0.8976018923169085, 'bagging_freq': 3, 'min_child_samples': 77, 'learning_rate':
0.03199155881112338, 'n_estimators': 700, 'max_depth': 8}. Best is trial 31 with valu
0.07545019514059305.
[I 2025-11-04 03:32:10,340] Trial 39 finished with value: 0.07569722958705713 and
parameters: {'lambda_l1': 0.0002566153667365941, 'lambda_l2': 0.00023926188431019793,
'num_leaves': 131, 'feature_fraction': 0.6152146712322804, 'bagging_fraction':
0.8885972531109839, 'bagging_freq': 4, 'min_child_samples': 77, 'learning_rate':
0.04520594494947493, 'n_estimators': 700, 'max_depth': 5}. Best is trial 31 with valu
0.07545019514059305.
[I 2025-11-04 03:32:39,459] Trial 40 finished with value: 0.07561234803090677 and
parameters: {'lambda_l1': 0.0014347122165458204, 'lambda_l2': 3.3206300131950414e-05,
'num_leaves': 151, 'feature_fraction': 0.6509385325014436, 'bagging_fraction':
0.783574406969184, 'bagging_freq': 4, 'min_child_samples': 91, 'learning_rate':
0.0625534602141085, 'n_estimators': 800, 'max_depth': 6}. Best is trial 31 with value
0.07545019514059305.
[I 2025-11-04 03:33:12,345] Trial 41 finished with value: 0.07548621070036174 and
parameters: {'lambda_l1': 0.12687865018895247, 'lambda_l2': 1.0451481196747068e-05,
'num_leaves': 119, 'feature_fraction': 0.54725700755115, 'bagging_fraction':
0.9358930758768398, 'bagging_freq': 3, 'min_child_samples': 68, 'learning_rate':
0.03276064487968569, 'n_estimators': 600, 'max_depth': 8}. Best is trial 31 with valu
0.07545019514059305.
[I 2025-11-04 03:33:48,813] Trial 42 finished with value: 0.07547820816038842 and
parameters: {'lambda_l1': 0.08177030029824352, 'lambda_l2': 0.0023521395918078055,
'num_leaves': 107, 'feature_fraction': 0.8210682595727188, 'bagging_fraction':
0.911052831148846, 'bagging_freq': 3, 'min_child_samples': 60, 'learning_rate':
0.03745280956893868, 'n_estimators': 700, 'max_depth': 8}. Best is trial 31 with valu
0.07545019514059305.
[I 2025-11-04 03:34:38,211] Trial 43 finished with value: 0.0757861081617224 and
parameters: {'lambda_l1': 0.4979519627037645, 'lambda_l2': 0.02043689874618998,
'num_leaves': 144, 'feature_fraction': 0.7234197480840091, 'bagging_fraction':
0.8817009709869195, 'bagging_freq': 2, 'min_child_samples': 76, 'learning_rate':
0.050291801379438554, 'n_estimators': 800, 'max_depth': 10}. Best is trial 31 with va
0.07545019514059305.
[I 2025-11-04 03:35:33,072] Trial 44 finished with value: 0.07543999784683231 and
parameters: {'lambda_l1': 0.2152904897174259, 'lambda_l2': 0.0014647855138019011,
'num_leaves': 96, 'feature_fraction': 0.7930117268087227, 'bagging_fraction':
0.971554375848803, 'bagging_freq': 3, 'min_child_samples': 88, 'learning_rate':

0.013260335803078754, 'n_estimators': 1000, 'max_depth': 9}. Best is trial 44 with va
0.07543999784683231.
[I 2025-11-04 03:36:25,843] Trial 45 finished with value: 0.07568254173775738 and
parameters: {'lambda_l1': 0.9591020317901181, 'lambda_l2': 0.0013079165538187113,
'num_leaves': 87, 'feature_fraction': 0.7805151832883878, 'bagging_fraction':
0.9760288958622103, 'bagging_freq': 4, 'min_child_samples': 87, 'learning_rate':
0.005733438336454009, 'n_estimators': 1000, 'max_depth': 7}. Best is trial 44 with va
0.07543999784683231.
[I 2025-11-04 03:36:55,945] Trial 46 finished with value: 0.0757505721563739 and
parameters: {'lambda_l1': 0.039208218258558115, 'lambda_l2': 0.0005392290345819342,
'num_leaves': 125, 'feature_fraction': 0.5976002896940263, 'bagging_fraction':
0.9705673150208945, 'bagging_freq': 3, 'min_child_samples': 81, 'learning_rate':
0.012817429128524042, 'n_estimators': 500, 'max_depth': 8}. Best is trial 44 with val
0.07543999784683231.
[I 2025-11-04 03:37:33,668] Trial 47 finished with value: 0.07546835472653424 and
parameters: {'lambda_l1': 0.3252273028255728, 'lambda_l2': 0.2955786305989357,
'num_leaves': 67, 'feature_fraction': 0.7146606945086621, 'bagging_fraction':
0.8592884187889942, 'bagging_freq': 4, 'min_child_samples': 88, 'learning_rate':
0.01930675008019407, 'n_estimators': 900, 'max_depth': 10}. Best is trial 44 with val
0.07543999784683231.
[I 2025-11-04 03:38:09,881] Trial 48 finished with value: 0.07548018265939736 and
parameters: {'lambda_l1': 0.34032319974585284, 'lambda_l2': 0.9389532494447488,
'num_leaves': 68, 'feature_fraction': 0.6578754296518385, 'bagging_fraction':
0.8113703432638778, 'bagging_freq': 4, 'min_child_samples': 91, 'learning_rate':
0.019400673693666808, 'n_estimators': 900, 'max_depth': 11}. Best is trial 44 with va
0.07543999784683231.
[I 2025-11-04 03:38:39,017] Trial 49 finished with value: 0.07570131389455928 and
parameters: {'lambda_l1': 0.0638079018770061, 'lambda_l2': 0.16214125088050924,
'num_leaves': 31, 'feature_fraction': 0.7066758006000654, 'bagging_fraction':
0.7280350421664858, 'bagging_freq': 5, 'min_child_samples': 85, 'learning_rate':
0.014145582111624835, 'n_estimators': 900, 'max_depth': 10}. Best is trial 44 with va
0.07543999784683231.
[I 2025-11-04 03:39:21,309] Trial 50 finished with value: 0.07556637131152438 and
parameters: {'lambda_l1': 0.01664988601568699, 'lambda_l2': 0.21777932453025797,
'num_leaves': 52, 'feature_fraction': 0.7519671557969331, 'bagging_fraction':
0.79440280400929, 'bagging_freq': 4, 'min_child_samples': 92, 'learning_rate':
0.009743439745433177, 'n_estimators': 1000, 'max_depth': 10}. Best is trial 44 with v
0.07543999784683231.
[I 2025-11-04 03:40:09,500] Trial 51 finished with value: 0.07546290504935402 and
parameters: {'lambda_l1': 0.2287098226035837, 'lambda_l2': 0.3432791013648385,
'num_leaves': 111, 'feature_fraction': 0.6511348252707131, 'bagging_fraction':
0.8531587963972362, 'bagging_freq': 3, 'min_child_samples': 74, 'learning_rate':
0.026044179661967884, 'n_estimators': 900, 'max_depth': 9}. Best is trial 44 with val
0.07543999784683231.
[I 2025-11-04 03:40:49,041] Trial 52 finished with value: 0.07544940314266643 and
parameters: {'lambda_l1': 0.5946653116327807, 'lambda_l2': 0.05091934056261511,
'num_leaves': 67, 'feature_fraction': 0.657656391462361, 'bagging_fraction':
0.8625682090117257, 'bagging_freq': 3, 'min_child_samples': 89, 'learning_rate':
0.02569677038706598, 'n_estimators': 900, 'max_depth': 9}. Best is trial 44 with valu
0.07543999784683231.
[I 2025-11-04 03:41:28,805] Trial 53 finished with value: 0.07543643680598835 and
parameters: {'lambda_l1': 0.5733623164491394, 'lambda_l2': 0.05856433632758321,
'num_leaves': 89, 'feature_fraction': 0.6312369328979347, 'bagging_fraction':
0.8508020920082979, 'bagging_freq': 3, 'min_child_samples': 74, 'learning_rate':
0.02484059010511091, 'n_estimators': 800, 'max_depth': 9}. Best is trial 53 with valu
0.07543643680598835.
[I 2025-11-04 03:42:08,853] Trial 54 finished with value: 0.07546239302988954 and
parameters: {'lambda_l1': 0.6004574188090848, 'lambda_l2': 0.0621856898734006,
'num_leaves': 87, 'feature_fraction': 0.5394344024085703, 'bagging_fraction':
0.8139821309137772, 'bagging_freq': 3, 'min_child_samples': 96, 'learning_rate':

0.024346935523828505, 'n_estimators': 800, 'max_depth': 9}. Best is trial 53 with va]
0.07543643680598835.
[I 2025-11-04 03:42:43,586] Trial 55 finished with value: 0.07573113178852509 and
parameters: {'lambda_l1': 0.49784934429972727, 'lambda_l2': 0.02854998864937398,
'num_leaves': 43, 'feature_fraction': 0.6749971235463567, 'bagging_fraction':
0.8732711513477347, 'bagging_freq': 3, 'min_child_samples': 81, 'learning_rate':
0.010628681286599027, 'n_estimators': 800, 'max_depth': 9}. Best is trial 53 with va]
0.07543643680598835.
[I 2025-11-04 03:43:31,255] Trial 56 finished with value: 0.0754749822624878 and
parameters: {'lambda_l1': 0.9904180850460896, 'lambda_l2': 0.002976899128214485,
'num_leaves': 93, 'feature_fraction': 0.6199322821400655, 'bagging_fraction':
0.8936011832635518, 'bagging_freq': 2, 'min_child_samples': 71, 'learning_rate':
0.0149521254970201, 'n_estimators': 800, 'max_depth': 9}. Best is trial 53 with value
0.07543643680598835.
[I 2025-11-04 03:44:13,482] Trial 57 finished with value: 0.07549692628227861 and
parameters: {'lambda_l1': 0.11302821917759873, 'lambda_l2': 0.013714067082219478,
'num_leaves': 60, 'feature_fraction': 0.582757485329709, 'bagging_fraction':
0.8391704982488956, 'bagging_freq': 3, 'min_child_samples': 84, 'learning_rate':
0.028079375744761707, 'n_estimators': 1000, 'max_depth': 8}. Best is trial 53 with va]
0.07543643680598835.
[I 2025-11-04 03:45:03,824] Trial 58 finished with value: 0.07542831527272195 and
parameters: {'lambda_l1': 0.22597744798549818, 'lambda_l2': 0.006126597100935564,
'num_leaves': 101, 'feature_fraction': 0.6368260127015217, 'bagging_fraction':
0.7744773688746924, 'bagging_freq': 2, 'min_child_samples': 78, 'learning_rate':
0.02265720654517657, 'n_estimators': 900, 'max_depth': 9}. Best is trial 58 with valu
0.07542831527272195.
[I 2025-11-04 03:45:53,242] Trial 59 finished with value: 0.07543318385873586 and
parameters: {'lambda_l1': 0.686807715391366, 'lambda_l2': 0.00603888805690691,
'num_leaves': 101, 'feature_fraction': 0.8330817934730493, 'bagging_fraction':
0.7341772909008452, 'bagging_freq': 2, 'min_child_samples': 89, 'learning_rate':
0.023796463732830953, 'n_estimators': 900, 'max_depth': 10}. Best is trial 58 with va
0.07542831527272195.
[I 2025-11-04 03:46:31,825] Trial 60 finished with value: 0.07547975996036944 and
parameters: {'lambda_l1': 0.6536668729367977, 'lambda_l2': 0.061469923742063406,
'num_leaves': 118, 'feature_fraction': 0.6356657039716223, 'bagging_fraction':
0.6991967426033865, 'bagging_freq': 1, 'min_child_samples': 95, 'learning_rate':
0.023740850278960085, 'n_estimators': 900, 'max_depth': 10}. Best is trial 58 with va
0.07542831527272195.
[I 2025-11-04 03:47:29,033] Trial 61 finished with value: 0.07539158810789467 and
parameters: {'lambda_l1': 0.3918908882109293, 'lambda_l2': 0.006275512845376153,
'num_leaves': 97, 'feature_fraction': 0.8310705646284455, 'bagging_fraction':
0.7680921032964286, 'bagging_freq': 2, 'min_child_samples': 87, 'learning_rate':
0.012413316981231748, 'n_estimators': 1000, 'max_depth': 9}. Best is trial 61 with va
0.07539158810789467.
[I 2025-11-04 03:48:23,989] Trial 62 finished with value: 0.07540069796083583 and
parameters: {'lambda_l1': 0.38481553921957173, 'lambda_l2': 0.007299289506960488,
'num_leaves': 90, 'feature_fraction': 0.8271954446502908, 'bagging_fraction':
0.7311490470811207, 'bagging_freq': 2, 'min_child_samples': 88, 'learning_rate':
0.012104610686530659, 'n_estimators': 1000, 'max_depth': 10}. Best is trial 61 with v
0.07539158810789467.
[I 2025-11-04 03:49:18,437] Trial 63 finished with value: 0.07545131896240055 and
parameters: {'lambda_l1': 0.37736788460902954, 'lambda_l2': 0.024047719790979614,
'num_leaves': 75, 'feature_fraction': 0.8311922472058535, 'bagging_fraction':
0.7356092595846537, 'bagging_freq': 2, 'min_child_samples': 100, 'learning_rate':
0.008139530531936704, 'n_estimators': 1000, 'max_depth': 11}. Best is trial 61 with v
0.07539158810789467.
[I 2025-11-04 03:50:12,441] Trial 64 finished with value: 0.07547556734494051 and
parameters: {'lambda_l1': 0.22804238324966294, 'lambda_l2': 0.00455573548329088,
'num_leaves': 91, 'feature_fraction': 0.5578403122815387, 'bagging_fraction':
0.6759305150969729, 'bagging_freq': 2, 'min_child_samples': 88, 'learning_rate':

0.011544551695766094, 'n_estimators': 1000, 'max_depth': 11}. Best is trial 61 with v
0.07539158810789467.
[I 2025-11-04 03:50:47,766] Trial 65 finished with value: 0.07541789301469146 and
parameters: {'lambda_l1': 0.6519525646446862, 'lambda_l2': 0.010832096080397586,
'num_leaves': 96, 'feature_fraction': 0.7958594149785337, 'bagging_fraction':
0.7761555401199818, 'bagging_freq': 1, 'min_child_samples': 93, 'learning_rate':
0.01346200612502319, 'n_estimators': 900, 'max_depth': 12}. Best is trial 61 with val
0.07539158810789467.
[I 2025-11-04 03:51:28,087] Trial 66 finished with value: 0.07540717283186757 and
parameters: {'lambda_l1': 0.43031898207877456, 'lambda_l2': 0.014226497350489536,
'num_leaves': 102, 'feature_fraction': 0.8154331089704588, 'bagging_fraction':
0.7655580907506936, 'bagging_freq': 1, 'min_child_samples': 94, 'learning_rate':
0.012709087061995928, 'n_estimators': 1000, 'max_depth': 11}. Best is trial 61 with v
0.07539158810789467.
[I 2025-11-04 03:52:04,338] Trial 67 finished with value: 0.07554355309107344 and
parameters: {'lambda_l1': 1.0971665526153692e-05, 'lambda_l2': 0.011915095964929873,
'num_leaves': 101, 'feature_fraction': 0.8212418543108486, 'bagging_fraction':
0.7626585662377628, 'bagging_freq': 1, 'min_child_samples': 94, 'learning_rate':
0.006683617390342744, 'n_estimators': 900, 'max_depth': 12}. Best is trial 61 with va
0.07539158810789467.
[I 2025-11-04 03:52:40,193] Trial 68 finished with value: 0.07542188341065532 and
parameters: {'lambda_l1': 0.42206788678452295, 'lambda_l2': 0.017319071469787294,
'num_leaves': 82, 'feature_fraction': 0.8829019191719825, 'bagging_fraction':
0.7653842296868458, 'bagging_freq': 1, 'min_child_samples': 98, 'learning_rate':
0.010212875352483632, 'n_estimators': 1000, 'max_depth': 12}. Best is trial 61 with v
0.07539158810789467.
[I 2025-11-04 03:53:19,407] Trial 69 finished with value: 0.07540791784810988 and
parameters: {'lambda_l1': 0.3470468709601976, 'lambda_l2': 0.015792868037037396,
'num_leaves': 82, 'feature_fraction': 0.8990653708935529, 'bagging_fraction':
0.6195351328164407, 'bagging_freq': 1, 'min_child_samples': 98, 'learning_rate':
0.009818629586224585, 'n_estimators': 1000, 'max_depth': 12}. Best is trial 61 with v
0.07539158810789467.
[I 2025-11-04 03:53:58,259] Trial 70 finished with value: 0.07544296085513241 and
parameters: {'lambda_l1': 0.3854214847924509, 'lambda_l2': 0.010956909971003584,
'num_leaves': 79, 'feature_fraction': 0.880809677416372, 'bagging_fraction':
0.6306295447166641, 'bagging_freq': 1, 'min_child_samples': 98, 'learning_rate':
0.00945255346116074, 'n_estimators': 1000, 'max_depth': 12}. Best is trial 61 with va
0.07539158810789467.
[I 2025-11-04 03:54:39,772] Trial 71 finished with value: 0.0754186140869604 and
parameters: {'lambda_l1': 0.7280045143841554, 'lambda_l2': 0.01658811614652269,
'num_leaves': 101, 'feature_fraction': 0.8914250674824347, 'bagging_fraction':
0.7656482392772493, 'bagging_freq': 1, 'min_child_samples': 93, 'learning_rate':
0.00907431885026634, 'n_estimators': 1000, 'max_depth': 12}. Best is trial 61 with va
0.07539158810789467.
[I 2025-11-04 03:55:19,664] Trial 72 finished with value: 0.07557397795129799 and
parameters: {'lambda_l1': 0.17161819978083706, 'lambda_l2': 0.015757532416011515,
'num_leaves': 83, 'feature_fraction': 0.9070917788441961, 'bagging_fraction':
0.7630669596349402, 'bagging_freq': 1, 'min_child_samples': 93, 'learning_rate':
0.0050311156069168675, 'n_estimators': 1000, 'max_depth': 12}. Best is trial 61 with
0.07539158810789467.
[I 2025-11-04 03:55:56,387] Trial 73 finished with value: 0.07550147023045076 and
parameters: {'lambda_l1': 0.42003499296452934, 'lambda_l2': 0.017467563000571656,
'num_leaves': 70, 'feature_fraction': 0.8845984970609869, 'bagging_fraction':
0.7774704660541419, 'bagging_freq': 1, 'min_child_samples': 97, 'learning_rate':
0.00717639038717586, 'n_estimators': 1000, 'max_depth': 12}. Best is trial 61 with va
0.07539158810789467.
[I 2025-11-04 03:56:42,080] Trial 74 finished with value: 0.07542930486648368 and
parameters: {'lambda_l1': 0.28929766353889885, 'lambda_l2': 0.0081014118978329,
'num_leaves': 119, 'feature_fraction': 0.86458707542735, 'bagging_fraction':
0.5981141486895222, 'bagging_freq': 1, 'min_child_samples': 95, 'learning_rate':

0.009065297049782064, 'n_estimators': 1000, 'max_depth': 12}. Best is trial 61 with v
0.07539158810789467.
[I 2025-11-04 03:57:15,852] Trial 75 finished with value: 0.07541715536908741 and
parameters: {'lambda_l1': 0.7427128226070999, 'lambda_l2': 0.031614208273190184,
'num_leaves': 60, 'feature_fraction': 0.9354628619382457, 'bagging_fraction':
0.7071386427202676, 'bagging_freq': 1, 'min_child_samples': 100, 'learning_rate':
0.011478437164658944, 'n_estimators': 1000, 'max_depth': 12}. Best is trial 61 with v
0.07539158810789467.
[I 2025-11-04 03:57:49,734] Trial 76 finished with value: 0.07540481804265703 and
parameters: {'lambda_l1': 0.8553849026981072, 'lambda_l2': 0.04333796306049007,
'num_leaves': 61, 'feature_fraction': 0.9774503713273701, 'bagging_fraction':
0.7013697889113204, 'bagging_freq': 1, 'min_child_samples': 100, 'learning_rate':
0.01181854844913939, 'n_estimators': 1000, 'max_depth': 12}. Best is trial 61 with va
0.07539158810789467.
[I 2025-11-04 03:58:23,758] Trial 77 finished with value: 0.07541899235707732 and
parameters: {'lambda_l1': 0.8141034985498182, 'lambda_l2': 0.0423158458508908,
'num_leaves': 59, 'feature_fraction': 0.9663554497864467, 'bagging_fraction':
0.6925086799313332, 'bagging_freq': 1, 'min_child_samples': 99, 'learning_rate':
0.011704170863259717, 'n_estimators': 1000, 'max_depth': 11}. Best is trial 61 with v
0.07539158810789467.
[I 2025-11-04 03:58:56,609] Trial 78 finished with value: 0.0755518393878246 and
parameters: {'lambda_l1': 0.7805013101291668, 'lambda_l2': 0.032298545520046906,
'num_leaves': 44, 'feature_fraction': 0.9211338178267408, 'bagging_fraction':
0.6068843166901344, 'bagging_freq': 1, 'min_child_samples': 100, 'learning_rate':
0.00835771928254937, 'n_estimators': 1000, 'max_depth': 12}. Best is trial 61 with va
0.07539158810789467.
[I 2025-11-04 03:59:20,747] Trial 79 finished with value: 0.07569861011872295 and
parameters: {'lambda_l1': 3.408307746759732e-05, 'lambda_l2': 0.09563095139488917,
'num_leaves': 22, 'feature_fraction': 0.9422453294290399, 'bagging_fraction':
0.7151151094198431, 'bagging_freq': 1, 'min_child_samples': 92, 'learning_rate':
0.012192987867822387, 'n_estimators': 1000, 'max_depth': 11}. Best is trial 61 with v
0.07539158810789467.
[I 2025-11-04 03:59:46,490] Trial 80 finished with value: 0.0758219802264099 and
parameters: {'lambda_l1': 0.0006056335129824816, 'lambda_l2': 0.003168999098232778,
'num_leaves': 31, 'feature_fraction': 0.9752176365949019, 'bagging_fraction':
0.7490656381434146, 'bagging_freq': 1, 'min_child_samples': 85, 'learning_rate':
0.006279794260787825, 'n_estimators': 900, 'max_depth': 12}. Best is trial 61 with va
0.07539158810789467.
[I 2025-11-04 04:00:20,167] Trial 81 finished with value: 0.075432217494406 and param
{'lambda_l1': 0.9784687349505432, 'lambda_l2': 0.032811120820989574, 'num_leaves': 5
'feature_fraction': 0.9872359240080677, 'bagging_fraction': 0.6882945844246767,
'bagging_freq': 1, 'min_child_samples': 97, 'learning_rate': 0.011392998653015239,
'n_estimators': 1000, 'max_depth': 11}. Best is trial 61 with value: 0.0753915881078
[I 2025-11-04 04:00:53,354] Trial 82 finished with value: 0.0754204445789859 and
parameters: {'lambda_l1': 0.7472657898904487, 'lambda_l2': 0.024610796892565578,
'num_leaves': 61, 'feature_fraction': 0.9618727746393447, 'bagging_fraction':
0.6718424829004938, 'bagging_freq': 1, 'min_child_samples': 100, 'learning_rate':
0.015024138566450632, 'n_estimators': 1000, 'max_depth': 11}. Best is trial 61 with v
0.07539158810789467.
[I 2025-11-04 04:01:22,868] Trial 83 finished with value: 0.07545933882434729 and
parameters: {'lambda_l1': 0.46935251772952546, 'lambda_l2': 0.04275182385903591,
'num_leaves': 46, 'feature_fraction': 0.8979200849443567, 'bagging_fraction':
0.715650609490122, 'bagging_freq': 1, 'min_child_samples': 94, 'learning_rate':
0.013578596408917062, 'n_estimators': 1000, 'max_depth': 12}. Best is trial 61 with v
0.07539158810789467.
[I 2025-11-04 04:02:00,245] Trial 84 finished with value: 0.07543646892896279 and
parameters: {'lambda_l1': 0.7028551129672866, 'lambda_l2': 0.0782297177780828,
'num_leaves': 75, 'feature_fraction': 0.9324567482799944, 'bagging_fraction':
0.744591158569559, 'bagging_freq': 1, 'min_child_samples': 90, 'learning_rate':
0.008835541571569117, 'n_estimators': 1000, 'max_depth': 11}. Best is trial 61 with v

0.07539158810789467.
[I 2025-11-04 04:02:30,599] Trial 85 finished with value: 0.07548021792422861 and
parameters: {'lambda_l1': 0.36139373699758237, 'lambda_l2': 0.010142334743565984,
'num_leaves': 53, 'feature_fraction': 0.9849799713149195, 'bagging_fraction':
0.6500879789148093, 'bagging_freq': 1, 'min_child_samples': 97, 'learning_rate':
0.01047579879602003, 'n_estimators': 900, 'max_depth': 12}. Best is trial 61 with val
0.07539158810789467.
[I 2025-11-04 04:03:03,829] Trial 86 finished with value: 0.07539186901531429 and
parameters: {'lambda_l1': 0.2740286969147352, 'lambda_l2': 0.022893346888709986,
'num_leaves': 73, 'feature_fraction': 0.9516826054909617, 'bagging_fraction':
0.7077022820239883, 'bagging_freq': 1, 'min_child_samples': 93, 'learning_rate':
0.017391653434296824, 'n_estimators': 1000, 'max_depth': 12}. Best is trial 61 with v
0.07539158810789467.
[I 2025-11-04 04:03:36,401] Trial 87 finished with value: 0.07539023602815771 and
parameters: {'lambda_l1': 0.1523473534339557, 'lambda_l2': 0.020424562605245902,
'num_leaves': 71, 'feature_fraction': 0.9471708476565738, 'bagging_fraction':
0.7255316641970853, 'bagging_freq': 1, 'min_child_samples': 82, 'learning_rate':
0.016708908910841598, 'n_estimators': 1000, 'max_depth': 12}. Best is trial 87 with v
0.07539023602815771.
[I 2025-11-04 04:04:01,220] Trial 88 finished with value: 0.07548872677747165 and
parameters: {'lambda_l1': 0.2815658564349547, 'lambda_l2': 0.13363859510212228,
'num_leaves': 37, 'feature_fraction': 0.9566811821209463, 'bagging_fraction':
0.5547671434793444, 'bagging_freq': 1, 'min_child_samples': 80, 'learning_rate':
0.01741565588482422, 'n_estimators': 900, 'max_depth': 12}. Best is trial 87 with val
0.07539023602815771.
[I 2025-11-04 04:04:32,293] Trial 89 finished with value: 0.07539787355057978 and
parameters: {'lambda_l1': 0.14052818119690944, 'lambda_l2': 0.023420689388795605,
'num_leaves': 65, 'feature_fraction': 0.9408176808960365, 'bagging_fraction':
0.7239856691930802, 'bagging_freq': 1, 'min_child_samples': 83, 'learning_rate':
0.01862922254329422, 'n_estimators': 1000, 'max_depth': 11}. Best is trial 87 with va
0.07539023602815771.
[I 2025-11-04 04:05:05,044] Trial 90 finished with value: 0.07539744919314721 and
parameters: {'lambda_l1': 0.05106541035452425, 'lambda_l2': 0.007825144900788892,
'num_leaves': 71, 'feature_fraction': 0.9480425526187815, 'bagging_fraction':
0.7098758569569336, 'bagging_freq': 1, 'min_child_samples': 87, 'learning_rate':
0.018037737499371903, 'n_estimators': 1000, 'max_depth': 11}. Best is trial 87 with v
0.07539023602815771.
[I 2025-11-04 04:05:37,383] Trial 91 finished with value: 0.07542289578202192 and
parameters: {'lambda_l1': 0.057338455265942674, 'lambda_l2': 0.02231385278927957,
'num_leaves': 72, 'feature_fraction': 0.9392527242149059, 'bagging_fraction':
0.7099964187814736, 'bagging_freq': 1, 'min_child_samples': 82, 'learning_rate':
0.019414101569810754, 'n_estimators': 1000, 'max_depth': 11}. Best is trial 87 with v
0.07539023602815771.
[I 2025-11-04 04:06:07,635] Trial 92 finished with value: 0.07539251223689648 and
parameters: {'lambda_l1': 0.1389282088787708, 'lambda_l2': 0.007995402563234853,
'num_leaves': 61, 'feature_fraction': 0.9198472432122786, 'bagging_fraction':
0.7267022691639237, 'bagging_freq': 1, 'min_child_samples': 85, 'learning_rate':
0.015649201536813404, 'n_estimators': 1000, 'max_depth': 11}. Best is trial 87 with v
0.07539023602815771.
[I 2025-11-04 04:06:46,484] Trial 93 finished with value: 0.07545147202335156 and
parameters: {'lambda_l1': 0.13288159926948684, 'lambda_l2': 0.007574253081131231,
'num_leaves': 73, 'feature_fraction': 0.919875971796558, 'bagging_fraction':
0.725470811166432, 'bagging_freq': 7, 'min_child_samples': 86, 'learning_rate':
0.015335293725936158, 'n_estimators': 1000, 'max_depth': 11}. Best is trial 87 with v
0.07539023602815771.
[I 2025-11-04 04:07:22,415] Trial 94 finished with value: 0.07539884304578824 and
parameters: {'lambda_l1': 0.1667182116943747, 'lambda_l2': 0.004575242835588497,
'num_leaves': 86, 'feature_fraction': 0.947868245917898, 'bagging_fraction':
0.678879641291945, 'bagging_freq': 1, 'min_child_samples': 84, 'learning_rate':
0.01728946309095625, 'n_estimators': 1000, 'max_depth': 11}. Best is trial 87 with va

0.07539023602815771.
[I 2025-11-04 04:07:58,896] Trial 95 finished with value: 0.0754614671920878 and
parameters: {'lambda_l1': 0.18046760140845367, 'lambda_l2': 0.003993909263048272,
'num_leaves': 63, 'feature_fraction': 0.976824567660149, 'bagging_fraction':
0.6825168709260013, 'bagging_freq': 6, 'min_child_samples': 83, 'learning_rate':
0.017936554195357057, 'n_estimators': 1000, 'max_depth': 11}. Best is trial 87 with v
0.07539023602815771.
[I 2025-11-04 04:08:29,119] Trial 96 finished with value: 0.07571159995254939 and
parameters: {'lambda_l1': 0.09432949010543046, 'lambda_l2': 0.004774119966880728,
'num_leaves': 16, 'feature_fraction': 0.9480871059058233, 'bagging_fraction':
0.6631800777610714, 'bagging_freq': 2, 'min_child_samples': 86, 'learning_rate':
0.02141055189023391, 'n_estimators': 1000, 'max_depth': 11}. Best is trial 87 with va
0.07539023602815771.
[I 2025-11-04 04:09:08,430] Trial 97 finished with value: 0.0754458451306202 and
parameters: {'lambda_l1': 0.07575610126902531, 'lambda_l2': 0.0023460071813734412,
'num_leaves': 51, 'feature_fraction': 0.9746527026176888, 'bagging_fraction':
0.741207335564284, 'bagging_freq': 2, 'min_child_samples': 90, 'learning_rate':
0.016058732694235568, 'n_estimators': 900, 'max_depth': 10}. Best is trial 87 with va
0.07539023602815771.
[I 2025-11-04 04:09:39,511] Trial 98 finished with value: 0.07539386717625453 and
parameters: {'lambda_l1': 0.047999329032483294, 'lambda_l2': 0.009102498945187323,
'num_leaves': 65, 'feature_fraction': 0.9984320770370162, 'bagging_fraction':
0.7254522508677761, 'bagging_freq': 1, 'min_child_samples': 84, 'learning_rate':
0.01914308357822491, 'n_estimators': 1000, 'max_depth': 10}. Best is trial 87 with va
0.07539023602815771.
[I 2025-11-04 04:10:11,160] Trial 99 finished with value: 0.0754107706362513 and
parameters: {'lambda_l1': 0.15890857152250087, 'lambda_l2': 0.007076575723380586,
'num_leaves': 65, 'feature_fraction': 0.9908500459232705, 'bagging_fraction':
0.696783845436233, 'bagging_freq': 1, 'min_child_samples': 83, 'learning_rate':
0.019467048871863322, 'n_estimators': 1000, 'max_depth': 10}. Best is trial 87 with v
0.07539023602815771.
[I 2025-11-04 04:10:47,764] Trial 100 finished with value: 0.0754593792116727 and
parameters: {'lambda_l1': 0.02565934491064004, 'lambda_l2': 0.00187676871277715382,
'num_leaves': 47, 'feature_fraction': 0.9967455713144424, 'bagging_fraction':
0.7224934895634909, 'bagging_freq': 2, 'min_child_samples': 79, 'learning_rate':
0.017922591155111734, 'n_estimators': 900, 'max_depth': 10}. Best is trial 87 with va
0.07539023602815771.
[I 2025-11-04 04:11:24,658] Trial 101 finished with value: 0.07538848598269772 and
parameters: {'lambda_l1': 0.04402378270331905, 'lambda_l2': 0.005412844912960319,
'num_leaves': 85, 'feature_fraction': 0.9515048182701239, 'bagging_fraction':
0.7293754733699007, 'bagging_freq': 1, 'min_child_samples': 87, 'learning_rate':
0.012631566400158136, 'n_estimators': 1000, 'max_depth': 11}. Best is trial 101 with
0.07538848598269772.
[I 2025-11-04 04:12:01,005] Trial 102 finished with value: 0.07539142129198476 and
parameters: {'lambda_l1': 0.04603841521520742, 'lambda_l2': 0.0030512516882324585,
'num_leaves': 87, 'feature_fraction': 0.9552061403507448, 'bagging_fraction':
0.750430790627467, 'bagging_freq': 1, 'min_child_samples': 87, 'learning_rate':
0.014673643261756679, 'n_estimators': 1000, 'max_depth': 11}. Best is trial 101 with
0.07538848598269772.
[I 2025-11-04 04:12:38,669] Trial 103 finished with value: 0.07538717766286997 and
parameters: {'lambda_l1': 0.037613825933599306, 'lambda_l2': 0.00282346160230619,
'num_leaves': 88, 'feature_fraction': 0.953811093367665, 'bagging_fraction':
0.7504138523239731, 'bagging_freq': 1, 'min_child_samples': 87, 'learning_rate':
0.014286272084015408, 'n_estimators': 1000, 'max_depth': 10}. Best is trial 103 with
0.07538717766286997.
[I 2025-11-04 04:13:13,962] Trial 104 finished with value: 0.07538461334316687 and
parameters: {'lambda_l1': 0.04250842813595568, 'lambda_l2': 0.0035476647714680794,
'num_leaves': 86, 'feature_fraction': 0.9495929430282423, 'bagging_fraction':
0.7916705187181706, 'bagging_freq': 1, 'min_child_samples': 76, 'learning_rate':
0.014875295717776751, 'n_estimators': 1000, 'max_depth': 11}. Best is trial 104 with

0.07538461334316687.
[I 2025-11-04 04:13:45,603] Trial 105 finished with value: 0.07539161523829968 and
parameters: {'lambda_l1': 0.03970862060470346, 'lambda_l2': 0.0009695111629008203,
'num_leaves': 79, 'feature_fraction': 0.956995722213848, 'bagging_fraction':
0.7995864093296888, 'bagging_freq': 1, 'min_child_samples': 82, 'learning_rate':
0.014492656424285662, 'n_estimators': 900, 'max_depth': 10}. Best is trial 104 with v
0.07538461334316687.
[I 2025-11-04 04:14:16,868] Trial 106 finished with value: 0.07540131355424179 and
parameters: {'lambda_l1': 0.0462026130245327, 'lambda_l2': 0.0008003012040617578,
'num_leaves': 78, 'feature_fraction': 0.9589154970355083, 'bagging_fraction':
0.794757502840716, 'bagging_freq': 1, 'min_child_samples': 76, 'learning_rate':
0.015183373359002486, 'n_estimators': 900, 'max_depth': 10}. Best is trial 104 with v
0.07538461334316687.
[I 2025-11-04 04:14:46,570] Trial 107 finished with value: 0.07540030137545616 and
parameters: {'lambda_l1': 0.012224711849292429, 'lambda_l2': 0.001145174277138034,
'num_leaves': 71, 'feature_fraction': 0.9143646417897775, 'bagging_fraction':
0.8213419111893059, 'bagging_freq': 1, 'min_child_samples': 81, 'learning_rate':
0.01480443110295563, 'n_estimators': 900, 'max_depth': 10}. Best is trial 104 with va
0.07538461334316687.
[I 2025-11-04 04:15:22,121] Trial 108 finished with value: 0.07540655025324387 and
parameters: {'lambda_l1': 0.0363272333330468, 'lambda_l2': 0.0032953013878449016,
'num_leaves': 93, 'feature_fraction': 0.9251327656950046, 'bagging_fraction':
0.7544270227603667, 'bagging_freq': 1, 'min_child_samples': 87, 'learning_rate':
0.02123758559931043, 'n_estimators': 1000, 'max_depth': 11}. Best is trial 104 with v
0.07538461334316687.
[I 2025-11-04 04:15:57,178] Trial 109 finished with value: 0.07536391841304065 and
parameters: {'lambda_l1': 0.019611617921035825, 'lambda_l2': 0.002881158246866287,
'num_leaves': 86, 'feature_fraction': 0.9546359388526771, 'bagging_fraction':
0.7910754286868847, 'bagging_freq': 1, 'min_child_samples': 79, 'learning_rate':
0.016725852822244005, 'n_estimators': 1000, 'max_depth': 10}. Best is trial 109 with
0.07536391841304065.
[I 2025-11-04 04:16:12,940] Trial 110 finished with value: 0.07697126361044049 and
parameters: {'lambda_l1': 0.02148907707370342, 'lambda_l2': 0.0027110338705025566,
'num_leaves': 86, 'feature_fraction': 0.9680657221234527, 'bagging_fraction':
0.7904975647233519, 'bagging_freq': 1, 'min_child_samples': 75, 'learning_rate':
0.014069846256951398, 'n_estimators': 1000, 'max_depth': 3}. Best is trial 109 with v
0.07536391841304065.
[I 2025-11-04 04:16:47,053] Trial 111 finished with value: 0.07537871435627513 and
parameters: {'lambda_l1': 0.03259695694069636, 'lambda_l2': 0.004869254283218398,
'num_leaves': 78, 'feature_fraction': 0.9532676054839716, 'bagging_fraction':
0.7401289353004252, 'bagging_freq': 1, 'min_child_samples': 78, 'learning_rate':
0.016459853367721287, 'n_estimators': 1000, 'max_depth': 10}. Best is trial 109 with
0.07536391841304065.
[I 2025-11-04 04:17:20,844] Trial 112 finished with value: 0.0753792962010322 and
parameters: {'lambda_l1': 0.030474847888020584, 'lambda_l2': 0.0018537392864126341,
'num_leaves': 78, 'feature_fraction': 0.9983878642514268, 'bagging_fraction':
0.8053759199045818, 'bagging_freq': 1, 'min_child_samples': 78, 'learning_rate':
0.016081931150572274, 'n_estimators': 1000, 'max_depth': 10}. Best is trial 109 with
0.07536391841304065.
[I 2025-11-04 04:17:55,472] Trial 113 finished with value: 0.0753902178343546 and
parameters: {'lambda_l1': 0.029880737586177344, 'lambda_l2': 0.0010032164517769734,
'num_leaves': 79, 'feature_fraction': 0.9549935058228746, 'bagging_fraction':
0.8021592599016574, 'bagging_freq': 1, 'min_child_samples': 69, 'learning_rate':
0.01418153115244848, 'n_estimators': 1000, 'max_depth': 10}. Best is trial 109 with v
0.07536391841304065.
[I 2025-11-04 04:18:27,529] Trial 114 finished with value: 0.07539586181506135 and
parameters: {'lambda_l1': 0.01503723012740675, 'lambda_l2': 0.0005583755032636489,
'num_leaves': 78, 'feature_fraction': 0.9595355429079138, 'bagging_fraction':
0.8089147634712527, 'bagging_freq': 1, 'min_child_samples': 72, 'learning_rate':
0.013850312809359463, 'n_estimators': 900, 'max_depth': 10}. Best is trial 109 with

0.07536391841304065.
[I 2025-11-04 04:19:04,150] Trial 115 finished with value: 0.07536933372732663 and
parameters: {'lambda_l1': 0.034831710591776754, 'lambda_l2': 0.001714057695790166,
'num_leaves': 95, 'feature_fraction': 0.9302121980240224, 'bagging_fraction':
0.8012700371609526, 'bagging_freq': 1, 'min_child_samples': 70, 'learning_rate':
0.01629852906446995, 'n_estimators': 1000, 'max_depth': 10}. Best is trial 109 with v
0.07536391841304065.
[I 2025-11-04 04:19:43,810] Trial 116 finished with value: 0.0753829744387742 and
parameters: {'lambda_l1': 0.026953745748838034, 'lambda_l2': 0.0016388755162601587,
'num_leaves': 97, 'feature_fraction': 0.9317388961198485, 'bagging_fraction':
0.7874174634570157, 'bagging_freq': 1, 'min_child_samples': 78, 'learning_rate':
0.010620248272692081, 'n_estimators': 1000, 'max_depth': 10}. Best is trial 109 with
0.07536391841304065.
[I 2025-11-04 04:20:41,495] Trial 117 finished with value: 0.07539166537413737 and
parameters: {'lambda_l1': 0.02905893211862063, 'lambda_l2': 0.001663829409199567,
'num_leaves': 114, 'feature_fraction': 0.9302797843054814, 'bagging_fraction':
0.8204534868246566, 'bagging_freq': 2, 'min_child_samples': 69, 'learning_rate':
0.012881169173936061, 'n_estimators': 1000, 'max_depth': 10}. Best is trial 109 with
0.07536391841304065.
[I 2025-11-04 04:21:17,726] Trial 118 finished with value: 0.07538755614332064 and
parameters: {'lambda_l1': 0.009539875222057825, 'lambda_l2': 0.001930209981724871,
'num_leaves': 89, 'feature_fraction': 0.904612009310589, 'bagging_fraction':
0.7861411301146058, 'bagging_freq': 1, 'min_child_samples': 78, 'learning_rate':
0.010958886150724639, 'n_estimators': 1000, 'max_depth': 10}. Best is trial 109 with
0.07536391841304065.
[I 2025-11-04 04:21:57,782] Trial 119 finished with value: 0.07538106599795814 and
parameters: {'lambda_l1': 0.008353835468785755, 'lambda_l2': 0.001987617816497172,
'num_leaves': 106, 'feature_fraction': 0.9054020686150114, 'bagging_fraction':
0.7871399687401291, 'bagging_freq': 1, 'min_child_samples': 66, 'learning_rate':
0.011084498523676283, 'n_estimators': 1000, 'max_depth': 10}. Best is trial 109 with
0.07536391841304065.
[I 2025-11-04 04:22:38,205] Trial 120 finished with value: 0.07539932095132353 and
parameters: {'lambda_l1': 0.004698442464562401, 'lambda_l2': 0.0012674082139148425,
'num_leaves': 107, 'feature_fraction': 0.9049823092645172, 'bagging_fraction':
0.7833659552823954, 'bagging_freq': 1, 'min_child_samples': 64, 'learning_rate':
0.0109067844622027, 'n_estimators': 1000, 'max_depth': 10}. Best is trial 109 with va
0.07536391841304065.
[I 2025-11-04 04:23:20,001] Trial 121 finished with value: 0.0754194073077581 and
parameters: {'lambda_l1': 0.009146531255403259, 'lambda_l2': 0.0020681208752675252,
'num_leaves': 93, 'feature_fraction': 0.9094542878014492, 'bagging_fraction':
0.8027172929330516, 'bagging_freq': 1, 'min_child_samples': 70, 'learning_rate':
0.007591455218682009, 'n_estimators': 1000, 'max_depth': 10}. Best is trial 109 with
0.07536391841304065.
[I 2025-11-04 04:23:55,533] Trial 122 finished with value: 0.0753833912961038 and
parameters: {'lambda_l1': 0.02077558594714596, 'lambda_l2': 0.0006424410363385105,
'num_leaves': 88, 'feature_fraction': 0.9323280759426026, 'bagging_fraction':
0.7921475540785731, 'bagging_freq': 1, 'min_child_samples': 78, 'learning_rate':
0.016767099097307003, 'n_estimators': 1000, 'max_depth': 10}. Best is trial 109 with
0.07536391841304065.
[I 2025-11-04 04:24:15,465] Trial 123 finished with value: 0.07606308825185429 and
parameters: {'lambda_l1': 0.020832314905818654, 'lambda_l2': 0.0002741988894723542,
'num_leaves': 97, 'feature_fraction': 0.9284371743631878, 'bagging_fraction':
0.7887525135898075, 'bagging_freq': 1, 'min_child_samples': 65, 'learning_rate':
0.016679559075812464, 'n_estimators': 1000, 'max_depth': 4}. Best is trial 109 with v
0.07536391841304065.
[I 2025-11-04 04:25:10,270] Trial 124 finished with value: 0.07544247883195569 and
parameters: {'lambda_l1': 0.03044101039500883, 'lambda_l2': 0.0006465339282196886,
'num_leaves': 237, 'feature_fraction': 0.9829860312697611, 'bagging_fraction':
0.8292767029461268, 'bagging_freq': 1, 'min_child_samples': 73, 'learning_rate':
0.01064592230198292, 'n_estimators': 1000, 'max_depth': 10}. Best is trial 109 with v

0.07536391841304065.
[I 2025-11-04 04:25:49,817] Trial 125 finished with value: 0.07536040856488692 and
parameters: {'lambda_l1': 0.010943932196833511, 'lambda_l2': 0.0004165392315636587,
'num_leaves': 106, 'feature_fraction': 0.9358362676966043, 'bagging_fraction':
0.8046802637476063, 'bagging_freq': 1, 'min_child_samples': 77, 'learning_rate':
0.013383277279881848, 'n_estimators': 1000, 'max_depth': 10}. Best is trial 125 with
0.07536040856488692.
[I 2025-11-04 04:26:29,371] Trial 126 finished with value: 0.07537670360970132 and
parameters: {'lambda_l1': 0.011511778446826802, 'lambda_l2': 0.0003727836509819009,
'num_leaves': 106, 'feature_fraction': 0.9366284831687002, 'bagging_fraction':
0.808001139897492, 'bagging_freq': 1, 'min_child_samples': 78, 'learning_rate':
0.01338482595381944, 'n_estimators': 1000, 'max_depth': 10}. Best is trial 125 with v
0.07536040856488692.
[I 2025-11-04 04:27:09,643] Trial 127 finished with value: 0.07536341685238647 and
parameters: {'lambda_l1': 0.009778806052818051, 'lambda_l2': 0.0003948154760112393,
'num_leaves': 111, 'feature_fraction': 0.9378511891802918, 'bagging_fraction':
0.8155496227598255, 'bagging_freq': 1, 'min_child_samples': 78, 'learning_rate':
0.012634645035273713, 'n_estimators': 1000, 'max_depth': 10}. Best is trial 125 with
0.07536040856488692.
[I 2025-11-04 04:27:50,421] Trial 128 finished with value: 0.07540649870176333 and
parameters: {'lambda_l1': 0.005288682746841539, 'lambda_l2': 0.0004249939191238545,
'num_leaves': 106, 'feature_fraction': 0.9361744530005168, 'bagging_fraction':
0.8431555073356789, 'bagging_freq': 1, 'min_child_samples': 78, 'learning_rate':
0.009786708863648418, 'n_estimators': 1000, 'max_depth': 10}. Best is trial 125 with
0.07536040856488692.
[I 2025-11-04 04:28:32,405] Trial 129 finished with value: 0.07536576262759541 and
parameters: {'lambda_l1': 0.009920374710633456, 'lambda_l2': 0.00015932138749657124,
'num_leaves': 123, 'feature_fraction': 0.9141883700675609, 'bagging_fraction':
0.8154570773762606, 'bagging_freq': 1, 'min_child_samples': 76, 'learning_rate':
0.01330767731945045, 'n_estimators': 1000, 'max_depth': 10}. Best is trial 125 with v
0.07536040856488692.
[I 2025-11-04 04:29:14,385] Trial 130 finished with value: 0.07537661400237314 and
parameters: {'lambda_l1': 0.006921233762827666, 'lambda_l2': 0.00014382623039497976,
'num_leaves': 123, 'feature_fraction': 0.9688868766745051, 'bagging_fraction':
0.8165342067439302, 'bagging_freq': 1, 'min_child_samples': 75, 'learning_rate':
0.012655338456907849, 'n_estimators': 1000, 'max_depth': 9}. Best is trial 125 with v
0.07536040856488692.
[I 2025-11-04 04:29:52,454] Trial 131 finished with value: 0.07954224993240962 and
parameters: {'lambda_l1': 0.006593458758505075, 'lambda_l2': 0.00014753847094281476,
'num_leaves': 125, 'feature_fraction': 0.9687154993604837, 'bagging_fraction':
0.8130931372004553, 'bagging_freq': 1, 'min_child_samples': 75, 'learning_rate':
0.1563735641562418, 'n_estimators': 1000, 'max_depth': 10}. Best is trial 125 with va
0.07536040856488692.
[I 2025-11-04 04:30:33,213] Trial 132 finished with value: 0.0753759497681449 and
parameters: {'lambda_l1': 0.01250921920675702, 'lambda_l2': 0.00010062433289058718,
'num_leaves': 114, 'feature_fraction': 0.9278588729786615, 'bagging_fraction':
0.819168307889315, 'bagging_freq': 1, 'min_child_samples': 72, 'learning_rate':
0.013445129129378916, 'n_estimators': 1000, 'max_depth': 9}. Best is trial 125 with v
0.07536040856488692.
[I 2025-11-04 04:31:13,915] Trial 133 finished with value: 0.07535915279801235 and
parameters: {'lambda_l1': 0.013189590187514973, 'lambda_l2': 8.376202734991248e-05,
'num_leaves': 113, 'feature_fraction': 0.9204440932862002, 'bagging_fraction':
0.8191694716025599, 'bagging_freq': 1, 'min_child_samples': 72, 'learning_rate':
0.01224530396895683, 'n_estimators': 1000, 'max_depth': 9}. Best is trial 133 with va
0.07535915279801235.
[I 2025-11-04 04:31:53,982] Trial 134 finished with value: 0.07537834295941964 and
parameters: {'lambda_l1': 0.004287468095817986, 'lambda_l2': 8.981378519522491e-05,
'num_leaves': 111, 'feature_fraction': 0.9207766907101941, 'bagging_fraction':
0.8249272365120979, 'bagging_freq': 1, 'min_child_samples': 72, 'learning_rate':
0.012839452693832836, 'n_estimators': 1000, 'max_depth': 9}. Best is trial 133 with v

0.07535915279801235.
[I 2025-11-04 04:32:35,211] Trial 135 finished with value: 0.07540204035465023 and
parameters: {'lambda_l1': 0.0036464822091350326, 'lambda_l2': 8.156984819885102e-05,
'num_leaves': 113, 'feature_fraction': 0.9140175261280775, 'bagging_fraction':
0.820866171297998, 'bagging_freq': 1, 'min_child_samples': 72, 'learning_rate':
0.010233243847940145, 'n_estimators': 1000, 'max_depth': 9}. Best is trial 133 with v
0.07535915279801235.
[I 2025-11-04 04:33:12,729] Trial 136 finished with value: 0.07537797851776838 and
parameters: {'lambda_l1': 0.0018577178453593704, 'lambda_l2': 9.913457318537424e-05,
'num_leaves': 120, 'feature_fraction': 0.8764773543097549, 'bagging_fraction':
0.8315576928003866, 'bagging_freq': 1, 'min_child_samples': 67, 'learning_rate':
0.013033016915731234, 'n_estimators': 900, 'max_depth': 9}. Best is trial 133 with va
0.07535915279801235.
[I 2025-11-04 04:33:50,019] Trial 137 finished with value: 0.07539133012859714 and
parameters: {'lambda_l1': 0.0018271015233242989, 'lambda_l2': 9.875467640715267e-05,
'num_leaves': 121, 'feature_fraction': 0.8955874285426704, 'bagging_fraction':
0.8398591363867212, 'bagging_freq': 1, 'min_child_samples': 66, 'learning_rate':
0.013124554144529302, 'n_estimators': 900, 'max_depth': 9}. Best is trial 133 with va
0.07535915279801235.
[I 2025-11-04 04:34:15,990] Trial 138 finished with value: 0.07542717933373509 and
parameters: {'lambda_l1': 0.011730754914754652, 'lambda_l2': 5.292624646341719e-05,
'num_leaves': 131, 'feature_fraction': 0.87662778416891, 'bagging_fraction':
0.8302121311804087, 'bagging_freq': 1, 'min_child_samples': 60, 'learning_rate':
0.0132077727561492, 'n_estimators': 600, 'max_depth': 9}. Best is trial 133 with valu
0.07535915279801235.
[I 2025-11-04 04:35:03,446] Trial 139 finished with value: 0.07540760187783864 and
parameters: {'lambda_l1': 0.002551859106376807, 'lambda_l2': 0.00018531469006217267,
'num_leaves': 122, 'feature_fraction': 0.9167334473967822, 'bagging_fraction':
0.8143410774108174, 'bagging_freq': 6, 'min_child_samples': 74, 'learning_rate':
0.011999709763727613, 'n_estimators': 900, 'max_depth': 9}. Best is trial 133 with va
0.07535915279801235.
[I 2025-11-04 04:35:45,673] Trial 140 finished with value: 0.07538196078777618 and
parameters: {'lambda_l1': 0.004117421991871511, 'lambda_l2': 4.988646560277336e-05,
'num_leaves': 139, 'feature_fraction': 0.890280120323113, 'bagging_fraction':
0.8538604891658387, 'bagging_freq': 1, 'min_child_samples': 70, 'learning_rate':
0.012241511046511729, 'n_estimators': 1000, 'max_depth': 9}. Best is trial 133 with v
0.07535915279801235.
[I 2025-11-04 04:36:28,733] Trial 141 finished with value: 0.07538047696057312 and
parameters: {'lambda_l1': 0.003715446964258348, 'lambda_l2': 4.5607632999479173e-05,
'num_leaves': 136, 'feature_fraction': 0.8872895801718594, 'bagging_fraction':
0.8707280603436445, 'bagging_freq': 1, 'min_child_samples': 71, 'learning_rate':
0.012118116556804507, 'n_estimators': 1000, 'max_depth': 9}. Best is trial 133 with v
0.07535915279801235.
[I 2025-11-04 04:37:11,033] Trial 142 finished with value: 0.07536812400242258 and
parameters: {'lambda_l1': 0.008937993299389439, 'lambda_l2': 0.00011767201514673037,
'num_leaves': 128, 'feature_fraction': 0.9233312811980942, 'bagging_fraction':
0.8254179522493056, 'bagging_freq': 1, 'min_child_samples': 67, 'learning_rate':
0.013210085057922679, 'n_estimators': 1000, 'max_depth': 9}. Best is trial 133 with v
0.07535915279801235.
[I 2025-11-04 04:37:52,983] Trial 143 finished with value: 0.07537522302075311 and
parameters: {'lambda_l1': 0.015494353325771239, 'lambda_l2': 0.00010789559689302837,
'num_leaves': 128, 'feature_fraction': 0.9239825631468898, 'bagging_fraction':
0.831426428678679, 'bagging_freq': 1, 'min_child_samples': 72, 'learning_rate':
0.01604094252290925, 'n_estimators': 1000, 'max_depth': 9}. Best is trial 133 with va
0.07535915279801235.
[I 2025-11-04 04:38:32,905] Trial 144 finished with value: 0.07537310499380724 and
parameters: {'lambda_l1': 0.015069090634094003, 'lambda_l2': 0.0002031689380615089494,
'num_leaves': 128, 'feature_fraction': 0.9198597819987436, 'bagging_fraction':
0.8325786476835574, 'bagging_freq': 1, 'min_child_samples': 73, 'learning_rate':
0.015685085984533914, 'n_estimators': 1000, 'max_depth': 8}. Best is trial 133 with v

0.07535915279801235.
[I 2025-11-04 04:39:12,485] Trial 145 finished with value: 0.0753660037391162 and
parameters: {'lambda_l1': 0.01601402192189441, 'lambda_l2': 0.00012322448486800803,
'num_leaves': 116, 'feature_fraction': 0.9239140139739289, 'bagging_fraction':
0.8337979840266223, 'bagging_freq': 1, 'min_child_samples': 73, 'learning_rate':
0.01338917239101999, 'n_estimators': 1000, 'max_depth': 8}. Best is trial 133 with va
0.07535915279801235.
[I 2025-11-04 04:39:52,658] Trial 146 finished with value: 0.07536574560356185 and
parameters: {'lambda_l1': 0.00650006607941277, 'lambda_l2': 0.00010323694125334447,
'num_leaves': 128, 'feature_fraction': 0.9233599505936823, 'bagging_fraction':
0.8354852377924046, 'bagging_freq': 1, 'min_child_samples': 68, 'learning_rate':
0.013367496277575365, 'n_estimators': 1000, 'max_depth': 8}. Best is trial 133 with v
0.07535915279801235.
[I 2025-11-04 04:40:33,117] Trial 147 finished with value: 0.07537369754734666 and
parameters: {'lambda_l1': 0.015200425792251528, 'lambda_l2': 0.00010941686103331008,
'num_leaves': 129, 'feature_fraction': 0.9411946699853785, 'bagging_fraction':
0.8354118081792682, 'bagging_freq': 1, 'min_child_samples': 68, 'learning_rate':
0.013302893856299241, 'n_estimators': 1000, 'max_depth': 8}. Best is trial 133 with v
0.07535915279801235.
[I 2025-11-04 04:41:14,820] Trial 148 finished with value: 0.07536057576604091 and
parameters: {'lambda_l1': 0.014404074764329852, 'lambda_l2': 0.00022077787090420177,
'num_leaves': 148, 'feature_fraction': 0.939200173906457, 'bagging_fraction':
0.8486397332020588, 'bagging_freq': 1, 'min_child_samples': 62, 'learning_rate':
0.01385391532881615, 'n_estimators': 1000, 'max_depth': 8}. Best is trial 133 with va
0.07535915279801235.
[I 2025-11-04 04:41:55,761] Trial 149 finished with value: 0.0753782584607524 and
parameters: {'lambda_l1': 0.01677980134146817, 'lambda_l2': 0.00019513864697687724,
'num_leaves': 148, 'feature_fraction': 0.9252919370144417, 'bagging_fraction':
0.8468617628291267, 'bagging_freq': 1, 'min_child_samples': 60, 'learning_rate':
0.015363730720759685, 'n_estimators': 1000, 'max_depth': 8}. Best is trial 133 with v
0.07535915279801235.
✅ Best LGBMRegressor parameters: {'lambda_l1': 0.013189590187514973, 'lambda_l2':
8.376202734991248e-05, 'num_leaves': 113, 'feature_fraction': 0.9204440932862002,
'bagging_fraction': 0.8191694716025599, 'bagging_freq': 1, 'min_child_samples': 72,
'learning_rate': 0.01224530396895683, 'n_estimators': 1000, 'max_depth': 9}

⚡ Evaluating Tuned Models on GPU...

XGBRegressor (GPU) | MSE: 0.07543 | MAE: 0.15272 | R²: 0.53203
LGBMRegressor (GPU) | MSE: 0.07538 | MAE: 0.15207 | R²: 0.53238

In [8]:
```python
# Select best model
best_idx = np.argmin(mse_scores)
best_model_name = model_names[best_idx]
best_model = models[best_idx][1]
print(f"\n✅ Best Model Based on MSE: {best_model_name}")

# Evaluate final model
y_pred = best_model.predict(X_test_scaled)
mse_default = mean_squared_error(y_test, y_pred)
mae_default = mean_absolute_error(y_test, y_pred)
r2_default = r2_score(y_test, y_pred)

print("\n✅ Final Model Evaluation:")
print(f"Mean Squared Error : {mse_default:.5f}")
print(f"Mean Absolute Error: {mae_default:.5f}")
print(f"R² Score : {r2_default:.5f}")
```

✅ Best Model Based on MSE: LGBMRegressor (GPU)

✅ Final Model Evaluation:
Mean Squared Error : 0.07538
Mean Absolute Error: 0.15207
R² Score : 0.53238

9.Selecting best model and Generating Submission

```
In [9]:  # --- 9. Final Training on Full Data ---
         print("\n🚀 Retraining the best model on full training data...")
         X_full = train_processed.drop(columns=['loan_paid_back'], errors='ignore')
         y_full = train_processed['loan_paid_back']
         X_full = X_full.select_dtypes(include=[np.number])

         # Re-fit the scaler on the FULL training data
         if scaler is not None:
             X_full_scaled = scaler.fit_transform(X_full)
         else:
             X_full_scaled = X_full

         # Retrain best model on the full scaled dataset
         best_model.fit(X_full_scaled, y_full)
         print(f"✅ Model retrained successfully: {best_model_name} ({best_model.__class_


         # --- 10. Generate Submission (Single Best Model) ---
         print("🔮 Generating predictions using the best model...")

         X_submission = test_processed.select_dtypes(include=[np.number])
         X_submission = X_submission[X_full.columns] # Align column order

         # Scale using the scaler that was just re-fit on X_full
         if scaler is not None:
             X_submission_scaled = scaler.transform(X_submission)
         else:
             X_submission_scaled = X_submission

         # Generate the final predictions
         submission_preds_raw = best_model.predict(X_submission_scaled)

         # Clip the predictions
         submission_preds = np.clip(submission_preds_raw, 0, 1)

         # --- Create Submission File ---
         submission = pd.DataFrame({
             'id': test_ids,
             'loan_paid_back': submission_preds
         })
         submission.to_csv('submission_v5.csv', index=False)
         print("\n✅ Submission file 'submission_v5.csv' generated successfully!")
         display(submission.head())
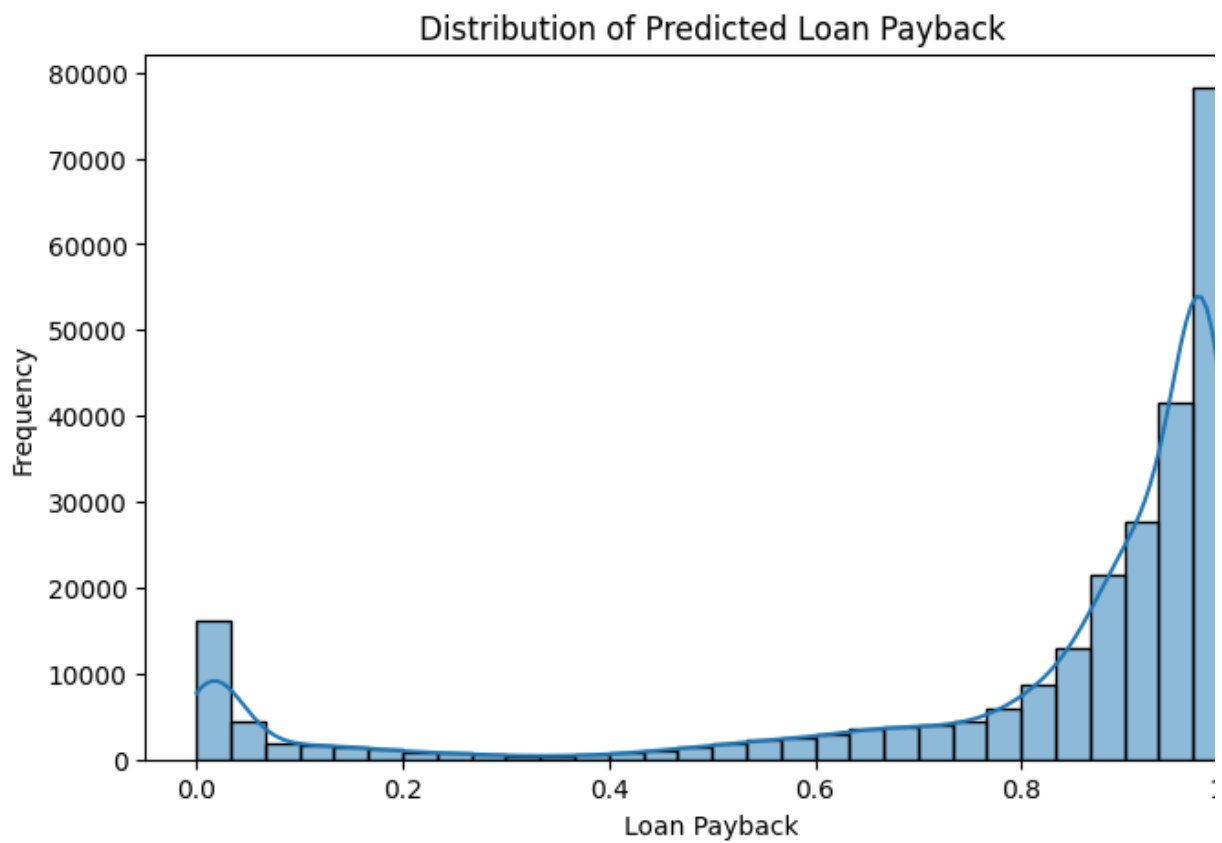```

🚀 Retraining the best model on full training data...
✅ Model retrained successfully: LGBMRegressor (GPU) (LGBMRegressor)

🔮 Generating predictions using the best model...

✅ Submission file 'submission_v5.csv' generated successfully!

|   | id | loan_paid_back |
|---|---|---|
| 0 | 593994 | 0.946568 |
| 1 | 593995 | 0.959703 |
| 2 | 593996 | 0.526704 |
| 3 | 593997 | 0.967088 |
| 4 | 593998 | 0.984655 |

In [10]:
```python
# --- 11. Final Plot ---
plt.figure(figsize=(8, 5))
sns.histplot(submission['loan_paid_back'], bins=30, kde=True)
plt.title('Distribution of Predicted Loan Payback')
plt.xlabel('Loan Payback')
plt.ylabel('Frequency')
plt.show()
```


Distribution of Predicted Loan Payback

In [ ]: