Kaggle Playground

Problem Statement / Real World Implementations

1. Importing Libraries

In [1]:
```
# Core Data Science Libraries
import numpy as np
import pandas as pd
import warnings

# Visualization Libraries
import plotly.express as px
import matplotlib.pyplot as plt
import seaborn as sns
import plotly.graph_objects as go
from plotly.subplots import make_subplots

# Scikit-learn for Preprocessing and Modeling
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

# Machine Learning Models
from xgboost import XGBRegressor
from lightgbm import LGBMRegressor

# Hyperparameter Tuning
import optuna

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

2. Loading Dataset

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)
```

In [3]:
```
print("Train shape:", train_df.shape)
print("Test shape:", test_df.shape)
```

```
Train shape: (593994, 13)
Test shape: (254569, 12)
```

In [4]:
```
df=train_df
df.head(5)
```

Out[4]:

	id	annual_income	debt_to_income_ratio	credit_score	loan_amount	interest_rate	gend
0	0	29367.99	0.084	736	2528.42	13.67	Fema
1	1	22108.02	0.166	636	4593.10	12.92	Ma
2	2	49566.20	0.097	694	17005.15	9.76	Ma
3	3	46858.25	0.065	533	4682.48	16.10	Fema
4	4	25496.70	0.053	665	12184.43	10.21	Ma

In [5]:
```
print(df["gender"].unique())
print(df["marital_status"].unique())
print(df["education_level"].unique())
print(df["employment_status"].unique())
print(df["loan_purpose"].unique())
print(df["grade_subgrade"].unique())
```

```
['Female' 'Male' 'Other']
['Single' 'Married' 'Divorced' 'Widowed']
['High School' "Master's" "Bachelor's" 'PhD' 'Other']
['Self-employed' 'Employed' 'Unemployed' 'Retired' 'Student']
['Other' 'Debt consolidation' 'Home' 'Education' 'Vacation' 'Car'
 'Medical' 'Business']
['C3' 'D3' 'C5' 'F1' 'D1' 'D5' 'C2' 'C1' 'F5' 'D4' 'C4' 'D2' 'E5' 'B1'
 'B2' 'F4' 'A4' 'E1' 'F2' 'B4' 'E4' 'B3' 'E3' 'B5' 'E2' 'F3' 'A5' 'A3'
 'A1' 'A2']
```

In [6]:
```
df.isna().sum()
```

Out[6]:
```
id                     0
annual_income          0
debt_to_income_ratio   0
credit_score           0
loan_amount            0
interest_rate          0
gender                 0
marital_status         0
education_level        0
employment_status      0
loan_purpose           0
grade_subgrade         0
loan_paid_back         0
dtype: int64
```

In [7]:
```
df.head()
```

Out[7]:

	id	annual_income	debt_to_income_ratio	credit_score	loan_amount	interest_rate	gend
0	0	29367.99	0.084	736	2528.42	13.67	Fema
1	1	22108.02	0.166	636	4593.10	12.92	Ma
2	2	49566.20	0.097	694	17005.15	9.76	Ma
3	3	46858.25	0.065	533	4682.48	16.10	Fema
4	4	25496.70	0.053	665	12184.43	10.21	Ma

4. EDA

In [8]:

```
# Select only numeric columns for correlation matrix
numerical_cols = train_df.select_dtypes(include=np.number).columns.tolist()
numerical_cols.remove('id')
numerical_cols.remove('loan_paid_back')

numeric_df = train_df[numerical_cols + ['loan_paid_back']]
corr_matrix = numeric_df.corr()

# Create the interactive heatmap
fig = go.Figure(data=go.Heatmap(
                    z=corr_matrix.values,
                    x=corr_matrix.columns,
                    y=corr_matrix.columns,
                    colorscale='RdBu_r',
                    zmin=-1, zmax=1,
                    text=corr_matrix.round(2).values,
                    texttemplate="%{text}",
                    hoverongaps=False))

fig.update_layout(
    title='Correlation Heatmap of Numerical Features',
    width=800, height=800
)
fig.show()
```

3. Normalization of data

In [9]:
```
def encode_features(df):
    df_encoded = df.copy()

    # Boolean to integer
    for col in df_encoded.select_dtypes(include='bool').columns:
        df_encoded[col] = df_encoded[col].astype(int)

    # Categorical to integer
    categorical_cols = df_encoded.select_dtypes(include='object').columns
    if len(categorical_cols) > 0:
```

```
        encoder = OrdinalEncoder()
        df_encoded[categorical_cols] = encoder.fit_transform(df_encoded[categori

    return df_encoded

train_ids = train_df['id']
test_ids = test_df['id']

train_processed = encode_features(train_df.drop('id', axis=1))
test_processed = encode_features(test_df.drop('id', axis=1))
```

In [10]:
```
df.head(5)
```

Out[10]:

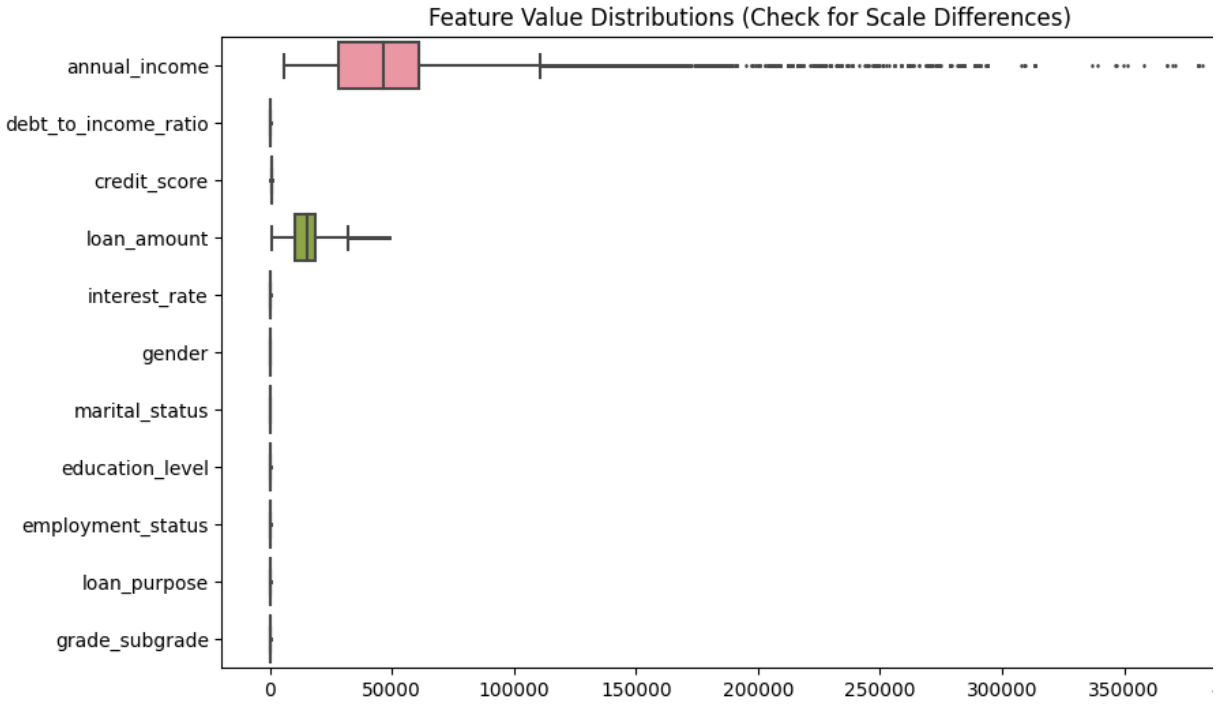
	id	annual_income	debt_to_income_ratio	credit_score	loan_amount	interest_rate	gend
0	0	29367.99	0.084	736	2528.42	13.67	Fema
1	1	22108.02	0.166	636	4593.10	12.92	Ma
2	2	49566.20	0.097	694	17005.15	9.76	Ma
3	3	46858.25	0.065	533	4682.48	16.10	Fema
4	4	25496.70	0.053	665	12184.43	10.21	Ma

In [11]:
```
# Exclude target column if present
features = train_processed.drop(columns=['loan_paid_back'], errors='ignore')

# 1. Check summary statistics
print("Summary Statistics:\n")
display(features.describe())

# 2. Check for large differences in scale
range_df = features.max() - features.min()
print("\nFeature Ranges:\n")
print(range_df.sort_values(ascending=False))

# 3. Visualize distribution of feature scales
plt.figure(figsize=(10, 6))
sns.boxplot(data=features, orient='h', fliersize=1)
plt.title("Feature Value Distributions (Check for Scale Differences)")
plt.show()

# 4. Correlation check
corr_matrix = features.corr()
high_range_features = range_df[range_df > range_df.mean()].index.tolist()
print(f"\nFeatures with significantly higher ranges: {high_range_features}")

# 5. Quick rule-based decision
if range_df.max() / range_df.min() > 10:
    print("\n✅ Feature scaling is likely necessary (large scale differences det
else:
    print("\n❌ Feature scaling might not be strictly necessary (features on sim
```

```
Summary Statistics:
```

	annual_income	debt_to_income_ratio	credit_score	loan_amount	interest_rate	
count	593994.000000	593994.000000	593994.000000	593994.000000	593994.000000	5
mean	48212.202976	0.120696	680.916009	15020.297629	12.356345	
std	26711.942078	0.068573	55.424956	6926.530568	2.008959	
min	6002.430000	0.011000	395.000000	500.090000	3.200000	
25%	27934.400000	0.072000	646.000000	10279.620000	10.990000	
50%	46557.680000	0.096000	682.000000	15000.220000	12.370000	
75%	60981.320000	0.156000	719.000000	18858.580000	13.680000	
max	393381.740000	0.627000	849.000000	48959.950000	20.990000	

```
Feature Ranges:

annual_income           387379.310
loan_amount              48459.860
credit_score               454.000
grade_subgrade              29.000
interest_rate               17.790
loan_purpose                 7.000
employment_status            4.000
education_level              4.000
marital_status               3.000
gender                       2.000
debt_to_income_ratio         0.616
dtype: float64
```




```
Features with significantly higher ranges: ['annual_income', 'loan_amount']

✅ Feature scaling is likely necessary (large scale differences detected).
```

Train test split

In [12]:
```
from sklearn.model_selection import train_test_split
from sklearn.preprocessing import MinMaxScaler, StandardScaler, RobustScaler, Pc
```

```
import numpy as np

# Use encoded data for model training
X = train_processed.drop("loan_paid_back", axis=1)
y = train_processed["loan_paid_back"]

# Ensure all columns are numeric
X = X.select_dtypes(include=[np.number])

# Train-test split
X_train, X_test, y_train, y_test = train_test_split(
    X, y, test_size=0.2, random_state=42
)

# Choose scaling method
selected_method = 'Standard Scaling'

# Apply the best scaling method
if selected_method == 'Min-Max Scaling':
    scaler = MinMaxScaler()
elif selected_method == 'Standard Scaling':
    scaler = StandardScaler()
elif selected_method == 'Robust Scaling':
    scaler = RobustScaler()
elif selected_method == 'Power Transformation':
    scaler = PowerTransformer(method='yeo-johnson')
else:
    scaler = None  # Log or Decimal handled separately

# Perform scaling
if scaler is not None:
    X_train_scaled = scaler.fit_transform(X_train)
    X_test_scaled = scaler.transform(X_test)
elif selected_method == 'Log Transformation':
    X_train_scaled = np.log1p(X_train.clip(lower=1e-6))
    X_test_scaled = np.log1p(X_test.clip(lower=1e-6))
elif selected_method == 'Decimal Scaling':
    X_train_scaled = X_train / 100.0
    X_test_scaled = X_test / 100.0
else:
    X_train_scaled = X_train
    X_test_scaled = X_test
```

In [13]:

```
import optuna
from sklearn.metrics import mean_squared_error, mean_absolute_error, r2_score
from xgboost import XGBRegressor
from lightgbm import LGBMRegressor

# ✅ Enable GPU for both XGBoost and LightGBM

# --- Hyperparameter tuning for XGBRegressor ---
def objective_xgb(trial):
    param = {
        'tree_method': 'gpu_hist',     # Use GPU histogram algorithm
        'predictor': 'gpu_predictor',  # GPU prediction
        'gpu_id': 0,
        'lambda': trial.suggest_loguniform('lambda', 1e-3, 10.0),
        '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 acceleration
        'gpu_platform_id': 0,
        'gpu_device_id': 0,
        'boosting_type': 'gbdt',
        'objective': 'regression',
        'metric': 'mse',

        # Regularization (not too extreme)
        '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),

        # Tree and data sampling
        '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 control
        '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 ---
print("🚀 Tuning XGBRegressor (GPU)...")
study_xgb = optuna.create_study(direction='minimize')
study_xgb.optimize(objective_xgb, n_trials=150, timeout=7200)
best_params_xgb = study_xgb.best_params
print(f"✅ Best XGBRegressor parameters: {best_params_xgb}")

print("\n🚀 Tuning LGBMRegressor (GPU)...")
```

```python
study_lgbm = optuna.create_study(direction='minimize')
study_lgbm.optimize(objective_lgbm, n_trials=150, timeout=7200)
best_params_lgbm = study_lgbm.best_params
print(f"✅ Best LGBMRegressor parameters: {best_params_lgbm}")


# --- Initialize models with tuned GPU parameters ---
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 = []

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 2025-11-03 16:52:32,366] A new study created in memory with name: no-name-
cf330d3d-09eb-4b42-bbd6-fc3e55d62873
🚀 Tuning XGBRegressor (GPU)...
```

```
[I 2025-11-03 16:52:35,118] Trial 0 finished with value: 0.08419142065411396 and
parameters: {'lambda': 0.11555702022521114, 'alpha': 0.778913402872795, 'colsample_by
0.7, 'subsample': 0.7, 'learning_rate': 0.005383065206050055, 'n_estimators': 300,
'max_depth': 6, 'min_child_weight': 105}. Best is trial 0 with value: 0.0841914206541
[I 2025-11-03 16:52:42,300] Trial 1 finished with value: 0.07354228601559487 and
parameters: {'lambda': 0.24156442332585457, 'alpha': 0.01649244621593166,
'colsample_bytree': 0.3, 'subsample': 1.0, 'learning_rate': 0.022223151054268007,
'n_estimators': 900, 'max_depth': 8, 'min_child_weight': 102}. Best is trial 1 with v
0.07354228601559487.
[I 2025-11-03 16:52:50,985] Trial 2 finished with value: 0.07611580779397609 and
parameters: {'lambda': 0.007966831669650202, 'alpha': 0.0022049605128884138,
'colsample_bytree': 0.9, 'subsample': 0.7, 'learning_rate': 0.0066519046519809,
'n_estimators': 300, 'max_depth': 12, 'min_child_weight': 47}. Best is trial 1 with v
0.07354228601559487.
[I 2025-11-03 16:53:00,110] Trial 3 finished with value: 0.07270575087289911 and
parameters: {'lambda': 0.5545016425999088, 'alpha': 0.001006441788573443,
'colsample_bytree': 1.0, 'subsample': 0.6, 'learning_rate': 0.022289316176370526,
'n_estimators': 800, 'max_depth': 10, 'min_child_weight': 41}. Best is trial 3 with v
0.07270575087289911.
[I 2025-11-03 16:53:02,431] Trial 4 finished with value: 0.07563701773734724 and
parameters: {'lambda': 6.021295271383328, 'alpha': 0.23534042822706586, 'colsample_by
0.7, 'subsample': 0.8, 'learning_rate': 0.007512472876557314, 'n_estimators': 500,
'max_depth': 4, 'min_child_weight': 229}. Best is trial 3 with value: 0.0727057508728
[I 2025-11-03 16:53:05,559] Trial 5 finished with value: 0.07714827138836476 and
parameters: {'lambda': 3.8448098554853853, 'alpha': 0.7481777135412523, 'colsample_by
0.3, 'subsample': 0.7, 'learning_rate': 0.010366369337965527, 'n_estimators': 700,
'max_depth': 4, 'min_child_weight': 237}. Best is trial 3 with value: 0.0727057508728
[I 2025-11-03 16:53:07,241] Trial 6 finished with value: 0.0735151107771938 and paran
{'lambda': 5.798902063644184, 'alpha': 0.009833141177417425, 'colsample_bytree': 0.7,
'subsample': 0.5, 'learning_rate': 0.025254415468846738, 'n_estimators': 300, 'max_de
5, 'min_child_weight': 96}. Best is trial 3 with value: 0.07270575087289911.
[I 2025-11-03 16:53:13,711] Trial 7 finished with value: 0.07273799794863287 and
parameters: {'lambda': 0.5899705663805322, 'alpha': 1.5601338088337444, 'colsample_by
0.7, 'subsample': 0.5, 'learning_rate': 0.04993405355908046, 'n_estimators': 500,
'max_depth': 12, 'min_child_weight': 262}. Best is trial 3 with value: 0.072705750872
[I 2025-11-03 16:53:17,608] Trial 8 finished with value: 0.07943011639726501 and
parameters: {'lambda': 0.0222393302563763, 'alpha': 0.0029473246037491317,
'colsample_bytree': 0.7, 'subsample': 0.5, 'learning_rate': 0.010302767190214465,
'n_estimators': 200, 'max_depth': 12, 'min_child_weight': 274}. Best is trial 3 with
0.07270575087289911.
[I 2025-11-03 16:53:24,956] Trial 9 finished with value: 0.07248868002762324 and
parameters: {'lambda': 0.0017649240511327193, 'alpha': 0.016953107506157274,
'colsample_bytree': 0.7, 'subsample': 0.7, 'learning_rate': 0.03785994807214365,
'n_estimators': 900, 'max_depth': 9, 'min_child_weight': 295}. Best is trial 9 with v
0.07248868002762324.
[I 2025-11-03 16:53:32,412] Trial 10 finished with value: 0.07249613289793355 and
parameters: {'lambda': 0.0010821393181869772, 'alpha': 8.883667665274077,
'colsample_bytree': 0.5, 'subsample': 0.6, 'learning_rate': 0.045186373662112804,
'n_estimators': 1000, 'max_depth': 8, 'min_child_weight': 184}. Best is trial 9 with
0.07248868002762324.
[I 2025-11-03 16:53:39,869] Trial 11 finished with value: 0.07250206881771852 and
parameters: {'lambda': 0.0010994564860331766, 'alpha': 9.682770936403992,
'colsample_bytree': 0.5, 'subsample': 0.6, 'learning_rate': 0.04901310913202877,
'n_estimators': 1000, 'max_depth': 8, 'min_child_weight': 188}. Best is trial 9 with
0.07248868002762324.
[I 2025-11-03 16:53:48,128] Trial 12 finished with value: 0.07246546133968954 and
parameters: {'lambda': 0.0010748716476718782, 'alpha': 0.039122926577494575,
'colsample_bytree': 0.5, 'subsample': 0.6, 'learning_rate': 0.03350687660013078,
'n_estimators': 1000, 'max_depth': 9, 'min_child_weight': 299}. Best is trial 12 with
value: 0.07246546133968954.
```

```
[I 2025-11-03 16:53:56,026] Trial 13 finished with value: 0.07235554608758409 and
parameters: {'lambda': 0.0047913655561121656, 'alpha': 0.04987634314617129,
'colsample_bytree': 0.5, 'subsample': 1.0, 'learning_rate': 0.029805773107804596,
'n_estimators': 800, 'max_depth': 10, 'min_child_weight': 300}. Best is trial 13 with
value: 0.07235554608758409.
[I 2025-11-03 16:54:03,334] Trial 14 finished with value: 0.07238228279058875 and
parameters: {'lambda': 0.0076072147462619335, 'alpha': 0.07297658651235533,
'colsample_bytree': 0.5, 'subsample': 1.0, 'learning_rate': 0.030942660226104403,
'n_estimators': 700, 'max_depth': 10, 'min_child_weight': 210}. Best is trial 13 with
value: 0.07235554608758409.
[I 2025-11-03 16:54:10,632] Trial 15 finished with value: 0.0726536146031576 and
parameters: {'lambda': 0.014124960546581316, 'alpha': 0.11050809170943263,
'colsample_bytree': 0.5, 'subsample': 1.0, 'learning_rate': 0.0156962284042595,
'n_estimators': 600, 'max_depth': 10, 'min_child_weight': 195}. Best is trial 13 with
value: 0.07235554608758409.
[I 2025-11-03 16:54:18,141] Trial 16 finished with value: 0.07240102652935639 and
parameters: {'lambda': 0.005275497839579425, 'alpha': 0.07566724559014558,
'colsample_bytree': 0.5, 'subsample': 1.0, 'learning_rate': 0.030682755059824172,
'n_estimators': 700, 'max_depth': 10, 'min_child_weight': 145}. Best is trial 13 with
value: 0.07235554608758409.
[I 2025-11-03 16:54:26,702] Trial 17 finished with value: 0.0725128799897757 and
parameters: {'lambda': 0.032945306411631514, 'alpha': 0.21955771078433492,
'colsample_bytree': 1.0, 'subsample': 1.0, 'learning_rate': 0.017185693050465602,
'n_estimators': 700, 'max_depth': 11, 'min_child_weight': 235}. Best is trial 13 with
value: 0.07235554608758409.
[I 2025-11-03 16:54:31,063] Trial 18 finished with value: 0.07276650450867744 and
parameters: {'lambda': 0.004499145652391778, 'alpha': 0.03870271945304967,
'colsample_bytree': 0.9, 'subsample': 1.0, 'learning_rate': 0.01796755785447154,
'n_estimators': 800, 'max_depth': 6, 'min_child_weight': 160}. Best is trial 13 with
0.07235554608758409.
[I 2025-11-03 16:54:38,578] Trial 19 finished with value: 0.07244466981868974 and
parameters: {'lambda': 0.05430593018200632, 'alpha': 0.006851099557605277,
'colsample_bytree': 0.5, 'subsample': 0.8, 'learning_rate': 0.028884474289167166,
'n_estimators': 600, 'max_depth': 11, 'min_child_weight': 257}. Best is trial 13 with
value: 0.07235554608758409.
[I 2025-11-03 16:54:42,140] Trial 20 finished with value: 0.07346790897601167 and
parameters: {'lambda': 0.0026672533572354574, 'alpha': 0.2739812862986913,
'colsample_bytree': 0.5, 'subsample': 1.0, 'learning_rate': 0.013228973504732618,
'n_estimators': 500, 'max_depth': 7, 'min_child_weight': 6}. Best is trial 13 with va
0.07235554608758409.
[I 2025-11-03 16:54:49,680] Trial 21 finished with value: 0.07242101826766055 and
parameters: {'lambda': 0.00847457010678389, 'alpha': 0.05668167068129422,
'colsample_bytree': 0.5, 'subsample': 1.0, 'learning_rate': 0.03252680827051698,
'n_estimators': 700, 'max_depth': 10, 'min_child_weight': 133}. Best is trial 13 with
value: 0.07235554608758409.
[I 2025-11-03 16:54:56,532] Trial 22 finished with value: 0.07239941586645009 and
parameters: {'lambda': 0.0038393876514660904, 'alpha': 0.09863259119164022,
'colsample_bytree': 0.5, 'subsample': 1.0, 'learning_rate': 0.03651808817222073,
'n_estimators': 800, 'max_depth': 9, 'min_child_weight': 158}. Best is trial 13 with
0.07235554608758409.
[I 2025-11-03 16:55:03,255] Trial 23 finished with value: 0.07238574349554104 and
parameters: {'lambda': 0.0036055390979086587, 'alpha': 0.12365677851654992,
'colsample_bytree': 0.5, 'subsample': 1.0, 'learning_rate': 0.04118996988581433,
'n_estimators': 800, 'max_depth': 9, 'min_child_weight': 205}. Best is trial 13 with
0.07235554608758409.
[I 2025-11-03 16:55:13,907] Trial 24 finished with value: 0.07240599242510784 and
parameters: {'lambda': 0.014786856779379125, 'alpha': 0.02573108399086984,
'colsample_bytree': 0.5, 'subsample': 1.0, 'learning_rate': 0.02658183492226147,
'n_estimators': 900, 'max_depth': 11, 'min_child_weight': 211}. Best is trial 13 with
value: 0.07235554608758409.
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[I 2025-11-03 16:55:20,585] Trial 25 finished with value: 0.0724750808680709 and
parameters: {'lambda': 0.03503872058776769, 'alpha': 0.42543763568809534,
'colsample_bytree': 1.0, 'subsample': 1.0, 'learning_rate': 0.03826627927033575,
'n_estimators': 800, 'max_depth': 9, 'min_child_weight': 216}. Best is trial 13 with
0.07235554608758409.
[I 2025-11-03 16:55:24,542] Trial 26 finished with value: 0.07275278830997393 and
parameters: {'lambda': 0.0022680195393758526, 'alpha': 0.12479373098175871,
'colsample_bytree': 0.5, 'subsample': 1.0, 'learning_rate': 0.021406905924476652,
'n_estimators': 600, 'max_depth': 7, 'min_child_weight': 270}. Best is trial 13 with
0.07235554608758409.
[I 2025-11-03 16:55:35,218] Trial 27 finished with value: 0.07341066876415438 and
parameters: {'lambda': 0.010009770073761852, 'alpha': 0.0069697478557312915,
'colsample_bytree': 0.3, 'subsample': 0.8, 'learning_rate': 0.04235568886946276,
'n_estimators': 900, 'max_depth': 11, 'min_child_weight': 178}. Best is trial 13 with
value: 0.07235554608758409.
[I 2025-11-03 16:55:42,417] Trial 28 finished with value: 0.07239026283464109 and
parameters: {'lambda': 0.06078183416622126, 'alpha': 2.9138103417670638,
'colsample_bytree': 0.9, 'subsample': 1.0, 'learning_rate': 0.026436581873517207,
'n_estimators': 800, 'max_depth': 9, 'min_child_weight': 125}. Best is trial 13 with
0.07235554608758409.
[I 2025-11-03 16:55:44,091] Trial 29 finished with value: 0.07490009633749896 and
parameters: {'lambda': 0.1602651983859032, 'alpha': 0.4534563855106746, 'colsample_by
0.5, 'subsample': 1.0, 'learning_rate': 0.040977528417348516, 'n_estimators': 400,
'max_depth': 3, 'min_child_weight': 209}. Best is trial 13 with value: 0.072355546087
[I 2025-11-03 16:55:48,729] Trial 30 finished with value: 0.07274966070894547 and
parameters: {'lambda': 0.005600437505257673, 'alpha': 0.1828442821861591,
'colsample_bytree': 0.5, 'subsample': 1.0, 'learning_rate': 0.019570046138655147,
'n_estimators': 700, 'max_depth': 7, 'min_child_weight': 247}. Best is trial 13 with
0.07235554608758409.
[I 2025-11-03 16:55:55,937] Trial 31 finished with value: 0.07240955369812953 and
parameters: {'lambda': 0.07727758911558429, 'alpha': 2.5529860625204224,
'colsample_bytree': 0.9, 'subsample': 1.0, 'learning_rate': 0.026037206546284924,
'n_estimators': 800, 'max_depth': 9, 'min_child_weight': 121}. Best is trial 13 with
0.07235554608758409.
[I 2025-11-03 16:56:02,826] Trial 32 finished with value: 0.07238209707720528 and
parameters: {'lambda': 0.022732546803678616, 'alpha': 2.5356828487955294,
'colsample_bytree': 0.9, 'subsample': 1.0, 'learning_rate': 0.0292059076986868,
'n_estimators': 900, 'max_depth': 8, 'min_child_weight': 85}. Best is trial 13 with v
0.07235554608758409.
[I 2025-11-03 16:56:09,667] Trial 33 finished with value: 0.0724801728891991 and
parameters: {'lambda': 0.026432537626872334, 'alpha': 0.8893971745350594,
'colsample_bytree': 0.9, 'subsample': 1.0, 'learning_rate': 0.03365122943610863,
'n_estimators': 900, 'max_depth': 8, 'min_child_weight': 40}. Best is trial 13 with v
0.07235554608758409.
[I 2025-11-03 16:56:19,270] Trial 34 finished with value: 0.0725310280092723 and
parameters: {'lambda': 0.013117509266592936, 'alpha': 0.021040421376199228,
'colsample_bytree': 0.9, 'subsample': 0.7, 'learning_rate': 0.02376877454262272,
'n_estimators': 900, 'max_depth': 10, 'min_child_weight': 93}. Best is trial 13 with
0.07235554608758409.
[I 2025-11-03 16:56:23,632] Trial 35 finished with value: 0.0738279449581884 and
parameters: {'lambda': 0.007068720564404659, 'alpha': 0.04613841394864533,
'colsample_bytree': 0.3, 'subsample': 1.0, 'learning_rate': 0.029474629749381722,
'n_estimators': 800, 'max_depth': 6, 'min_child_weight': 80}. Best is trial 13 with v
0.07235554608758409.
[I 2025-11-03 16:56:29,194] Trial 36 finished with value: 0.07241580389468591 and
parameters: {'lambda': 0.0031148589192306637, 'alpha': 5.307007384585382,
'colsample_bytree': 0.9, 'subsample': 0.8, 'learning_rate': 0.021801788024946995,
'n_estimators': 700, 'max_depth': 8, 'min_child_weight': 66}. Best is trial 13 with v
0.07235554608758409.
[I 2025-11-03 16:56:38,098] Trial 37 finished with value: 0.07291599787871089 and
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parameters: {'lambda': 0.3631695127438334, 'alpha': 1.1679220358114406, 'colsample_by
1.0, 'subsample': 0.5, 'learning_rate': 0.005873668992761264, 'n_estimators': 900,
'max_depth': 10, 'min_child_weight': 286}. Best is trial 13 with value:
0.07235554608758409.
[I 2025-11-03 16:56:44,347] Trial 38 finished with value: 0.07328052335418557 and
parameters: {'lambda': 0.00210972267547701, 'alpha': 0.48703234230469644,
'colsample_bytree': 0.3, 'subsample': 1.0, 'learning_rate': 0.0349591083980384,
'n_estimators': 1000, 'max_depth': 7, 'min_child_weight': 19}. Best is trial 13 with
0.07235554608758409.
[I 2025-11-03 16:56:55,811] Trial 39 finished with value: 0.07248224642543738 and
parameters: {'lambda': 0.020935148265629262, 'alpha': 0.010979379318464991,
'colsample_bytree': 0.9, 'subsample': 0.7, 'learning_rate': 0.01308260358986568,
'n_estimators': 800, 'max_depth': 11, 'min_child_weight': 70}. Best is trial 13 with
0.07235554608758409.
[I 2025-11-03 16:57:04,264] Trial 40 finished with value: 0.07283142980627147 and
parameters: {'lambda': 2.911322105472414, 'alpha': 0.0013555891230982618,
'colsample_bytree': 0.5, 'subsample': 0.5, 'learning_rate': 0.04575001365362291,
'n_estimators': 600, 'max_depth': 12, 'min_child_weight': 167}. Best is trial 13 with
value: 0.07235554608758409.
[I 2025-11-03 16:57:11,529] Trial 41 finished with value: 0.07240246530357212 and
parameters: {'lambda': 0.05062694771713391, 'alpha': 2.7046373383641455,
'colsample_bytree': 0.9, 'subsample': 1.0, 'learning_rate': 0.026913535415095897,
'n_estimators': 800, 'max_depth': 9, 'min_child_weight': 118}. Best is trial 13 with
0.07235554608758409.
[I 2025-11-03 16:57:17,933] Trial 42 finished with value: 0.07238702594588432 and
parameters: {'lambda': 0.10553848255999441, 'alpha': 2.6882081409982153,
'colsample_bytree': 0.9, 'subsample': 1.0, 'learning_rate': 0.029391035764792486,
'n_estimators': 700, 'max_depth': 9, 'min_child_weight': 113}. Best is trial 13 with
0.07235554608758409.
[I 2025-11-03 16:57:23,226] Trial 43 finished with value: 0.07237740933019472 and
parameters: {'lambda': 0.1347690903703487, 'alpha': 1.5004943722590667, 'colsample_by
0.9, 'subsample': 1.0, 'learning_rate': 0.04069262876302503, 'n_estimators': 700,
'max_depth': 8, 'min_child_weight': 103}. Best is trial 13 with value: 0.072355546087
[I 2025-11-03 16:57:27,880] Trial 44 finished with value: 0.07244546035496649 and
parameters: {'lambda': 0.21088575029200599, 'alpha': 4.906656923144687, 'colsample_by
0.7, 'subsample': 0.6, 'learning_rate': 0.04022964065965215, 'n_estimators': 600,
'max_depth': 8, 'min_child_weight': 144}. Best is trial 13 with value: 0.072355546087
[I 2025-11-03 16:57:35,037] Trial 45 finished with value: 0.07267078760708857 and
parameters: {'lambda': 0.001641370942684563, 'alpha': 0.6900700531731427,
'colsample_bytree': 0.9, 'subsample': 1.0, 'learning_rate': 0.008251932995184912,
'n_estimators': 900, 'max_depth': 8, 'min_child_weight': 98}. Best is trial 13 with v
0.07235554608758409.
[I 2025-11-03 16:57:42,853] Trial 46 finished with value: 0.0724993353163241 and
parameters: {'lambda': 1.9614280521888598, 'alpha': 1.6075128234197587, 'colsample_by
0.5, 'subsample': 1.0, 'learning_rate': 0.045809011283367486, 'n_estimators': 700,
'max_depth': 10, 'min_child_weight': 55}. Best is trial 13 with value: 0.072355546087
[I 2025-11-03 16:57:46,712] Trial 47 finished with value: 0.07251907905206052 and
parameters: {'lambda': 1.0153175936993104, 'alpha': 0.02612830019316137,
'colsample_bytree': 0.9, 'subsample': 0.7, 'learning_rate': 0.03643932383446426,
'n_estimators': 800, 'max_depth': 5, 'min_child_weight': 88}. Best is trial 13 with v
0.07235554608758409.
[I 2025-11-03 16:57:49,110] Trial 48 finished with value: 0.07298562581457797 and
parameters: {'lambda': 0.01736388328897856, 'alpha': 0.1432897152682489,
'colsample_bytree': 1.0, 'subsample': 0.6, 'learning_rate': 0.023520172412851533,
'n_estimators': 400, 'max_depth': 6, 'min_child_weight': 200}. Best is trial 13 with
0.07235554608758409.
[I 2025-11-03 16:57:51,753] Trial 49 finished with value: 0.07246503159358583 and
parameters: {'lambda': 0.009284681718673823, 'alpha': 0.07139788409862906,
'colsample_bytree': 0.7, 'subsample': 1.0, 'learning_rate': 0.04949016428133776,
'n_estimators': 200, 'max_depth': 10, 'min_child_weight': 173}. Best is trial 13 with
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value: 0.07235554608758409.
[I 2025-11-03 16:57:59,083] Trial 50 finished with value: 0.0723930369677385 and
parameters: {'lambda': 0.00572356760483571, 'alpha': 5.263457480404366, 'colsample_by
0.5, 'subsample': 0.8, 'learning_rate': 0.03239990338551571, 'n_estimators': 1000,
'max_depth': 8, 'min_child_weight': 223}. Best is trial 13 with value: 0.072355546087
[I 2025-11-03 16:58:05,381] Trial 51 finished with value: 0.07242837348711209 and
parameters: {'lambda': 0.13034772626930288, 'alpha': 1.5187164001511944,
'colsample_bytree': 0.9, 'subsample': 1.0, 'learning_rate': 0.030379867216659074,
'n_estimators': 700, 'max_depth': 9, 'min_child_weight': 135}. Best is trial 13 with
0.07235554608758409.
[I 2025-11-03 16:58:11,716] Trial 52 finished with value: 0.07245340213811063 and
parameters: {'lambda': 0.3578350921843693, 'alpha': 3.611703448356833, 'colsample_byt
0.9, 'subsample': 1.0, 'learning_rate': 0.043010310784520306, 'n_estimators': 700,
'max_depth': 9, 'min_child_weight': 112}. Best is trial 13 with value: 0.072355546087
[I 2025-11-03 16:58:18,967] Trial 53 finished with value: 0.07263890364676465 and
parameters: {'lambda': 0.0845870255292665, 'alpha': 0.2892383276843181, 'colsample_by
0.9, 'subsample': 1.0, 'learning_rate': 0.038761609478978144, 'n_estimators': 700,
'max_depth': 10, 'min_child_weight': 110}. Best is trial 13 with value:
0.07235554608758409.
[I 2025-11-03 16:58:26,261] Trial 54 finished with value: 0.07244768040036594 and
parameters: {'lambda': 0.037884611687709346, 'alpha': 1.664722012147593,
'colsample_bytree': 0.9, 'subsample': 1.0, 'learning_rate': 0.029332683784980582,
'n_estimators': 800, 'max_depth': 9, 'min_child_weight': 79}. Best is trial 13 with v
0.07235554608758409.
[I 2025-11-03 16:58:30,238] Trial 55 finished with value: 0.07270633220604936 and
parameters: {'lambda': 0.11332393097607033, 'alpha': 7.714771237128111, 'colsample_by
0.5, 'subsample': 0.5, 'learning_rate': 0.03214184400419395, 'n_estimators': 600,
'max_depth': 7, 'min_child_weight': 101}. Best is trial 13 with value: 0.072355546087
[I 2025-11-03 16:58:35,060] Trial 56 finished with value: 0.07263963004903803 and
parameters: {'lambda': 0.0034948410057998192, 'alpha': 0.07388718089607937,
'colsample_bytree': 0.5, 'subsample': 1.0, 'learning_rate': 0.01943767106216171,
'n_estimators': 600, 'max_depth': 8, 'min_child_weight': 242}. Best is trial 13 with
0.07235554608758409.
[I 2025-11-03 16:58:46,118] Trial 57 finished with value: 0.07343080203295496 and
parameters: {'lambda': 0.0014296475781080534, 'alpha': 2.0545076611326265,
'colsample_bytree': 0.3, 'subsample': 1.0, 'learning_rate': 0.027856031516222048,
'n_estimators': 900, 'max_depth': 11, 'min_child_weight': 152}. Best is trial 13 with
value: 0.07235554608758409.
[I 2025-11-03 16:58:52,179] Trial 58 finished with value: 0.0724258301883433 and
parameters: {'lambda': 0.012194889550106558, 'alpha': 0.8075356033678319,
'colsample_bytree': 0.9, 'subsample': 1.0, 'learning_rate': 0.024580550344374886,
'n_estimators': 700, 'max_depth': 9, 'min_child_weight': 285}. Best is trial 13 with
0.07235554608758409.
[I 2025-11-03 16:59:00,481] Trial 59 finished with value: 0.0724497610355502 and
parameters: {'lambda': 0.20360419062876875, 'alpha': 0.0327739786206484,
'colsample_bytree': 0.5, 'subsample': 1.0, 'learning_rate': 0.035209828058348366,
'n_estimators': 800, 'max_depth': 10, 'min_child_weight': 135}. Best is trial 13 with
value: 0.07235554608758409.
[I 2025-11-03 16:59:04,629] Trial 60 finished with value: 0.07281547808129957 and
parameters: {'lambda': 0.006534190536039525, 'alpha': 0.004123341005936996,
'colsample_bytree': 0.7, 'subsample': 0.6, 'learning_rate': 0.01464551164464442,
'n_estimators': 500, 'max_depth': 8, 'min_child_weight': 257}. Best is trial 13 with
0.07235554608758409.
[I 2025-11-03 16:59:11,783] Trial 61 finished with value: 0.07241049486565442 and
parameters: {'lambda': 0.05594752071259256, 'alpha': 2.851615597360039, 'colsample_by
0.9, 'subsample': 1.0, 'learning_rate': 0.030943410402862234, 'n_estimators': 800,
'max_depth': 9, 'min_child_weight': 124}. Best is trial 13 with value: 0.072355546087
[I 2025-11-03 16:59:18,258] Trial 62 finished with value: 0.07240762495146569 and
parameters: {'lambda': 0.08375611403437867, 'alpha': 3.6213798189564637,
'colsample_bytree': 0.9, 'subsample': 1.0, 'learning_rate': 0.025919022219441774,
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'n_estimators': 700, 'max_depth': 9, 'min_child_weight': 106}. Best is trial 13 with
0.07235554608758409.
[I 2025-11-03 16:59:26,553] Trial 63 finished with value: 0.0724237970757171 and
parameters: {'lambda': 9.774446224167377, 'alpha': 6.994135583626227, 'colsample_bytr
0.9, 'subsample': 1.0, 'learning_rate': 0.037553077056660826, 'n_estimators': 800,
'max_depth': 10, 'min_child_weight': 146}. Best is trial 13 with value:
0.07235554608758409.
[I 2025-11-03 16:59:33,247] Trial 64 finished with value: 0.07245886495809399 and
parameters: {'lambda': 0.026361189602549864, 'alpha': 3.495424295984148,
'colsample_bytree': 0.9, 'subsample': 1.0, 'learning_rate': 0.020698644530868587,
'n_estimators': 700, 'max_depth': 9, 'min_child_weight': 54}. Best is trial 13 with v
0.07235554608758409.
[I 2025-11-03 16:59:39,036] Trial 65 finished with value: 0.07236868392017144 and
parameters: {'lambda': 0.06206386601904837, 'alpha': 0.015669839473042402,
'colsample_bytree': 0.5, 'subsample': 1.0, 'learning_rate': 0.04322504933364215,
'n_estimators': 800, 'max_depth': 8, 'min_child_weight': 127}. Best is trial 13 with
0.07235554608758409.
[I 2025-11-03 16:59:44,501] Trial 66 finished with value: 0.0723862024607767 and
parameters: {'lambda': 0.2980528466646136, 'alpha': 0.011623914126188213,
'colsample_bytree': 0.5, 'subsample': 1.0, 'learning_rate': 0.04426674668896332,
'n_estimators': 900, 'max_depth': 7, 'min_child_weight': 187}. Best is trial 13 with
0.07235554608758409.
[I 2025-11-03 16:59:49,328] Trial 67 finished with value: 0.07250171447203334 and
parameters: {'lambda': 0.3924665462199697, 'alpha': 0.01473516383322538,
'colsample_bytree': 0.5, 'subsample': 0.8, 'learning_rate': 0.042833109770770185,
'n_estimators': 900, 'max_depth': 6, 'min_child_weight': 189}. Best is trial 13 with
0.07235554608758409.
[I 2025-11-03 16:59:55,266] Trial 68 finished with value: 0.07235994649421193 and
parameters: {'lambda': 0.9025992000080776, 'alpha': 0.006311008149478605,
'colsample_bytree': 0.5, 'subsample': 1.0, 'learning_rate': 0.04684579401141004,
'n_estimators': 1000, 'max_depth': 7, 'min_child_weight': 230}. Best is trial 13 with
value: 0.07235554608758409.
[I 2025-11-03 17:00:01,410] Trial 69 finished with value: 0.07246694064324112 and
parameters: {'lambda': 0.8929067508162223, 'alpha': 0.00654722518915266,
'colsample_bytree': 0.5, 'subsample': 0.7, 'learning_rate': 0.04687271265773095,
'n_estimators': 1000, 'max_depth': 7, 'min_child_weight': 228}. Best is trial 13 with
value: 0.07235554608758409.
[I 2025-11-03 17:00:08,379] Trial 70 finished with value: 0.07235816311732148 and
parameters: {'lambda': 0.040637076605332965, 'alpha': 0.002824077104774139,
'colsample_bytree': 0.5, 'subsample': 1.0, 'learning_rate': 0.040281350743610486,
'n_estimators': 1000, 'max_depth': 8, 'min_child_weight': 204}. Best is trial 13 with
value: 0.07235554608758409.
[I 2025-11-03 17:00:15,296] Trial 71 finished with value: 0.07237437336214295 and
parameters: {'lambda': 0.03809842808585468, 'alpha': 0.002680850476341561,
'colsample_bytree': 0.5, 'subsample': 1.0, 'learning_rate': 0.04095236821909959,
'n_estimators': 1000, 'max_depth': 8, 'min_child_weight': 211}. Best is trial 13 with
value: 0.07235554608758409.
[I 2025-11-03 17:00:21,278] Trial 72 finished with value: 0.07237378387507033 and
parameters: {'lambda': 0.041661181643656606, 'alpha': 0.0021739780404839617,
'colsample_bytree': 0.5, 'subsample': 1.0, 'learning_rate': 0.04027804430241345,
'n_estimators': 1000, 'max_depth': 7, 'min_child_weight': 216}. Best is trial 13 with
value: 0.07235554608758409.
[I 2025-11-03 17:00:27,198] Trial 73 finished with value: 0.07239268910273475 and
parameters: {'lambda': 0.04323504829306103, 'alpha': 0.0034658477672272186,
'colsample_bytree': 0.5, 'subsample': 1.0, 'learning_rate': 0.049688253640199395,
'n_estimators': 1000, 'max_depth': 7, 'min_child_weight': 220}. Best is trial 13 with
value: 0.07235554608758409.
[I 2025-11-03 17:00:32,368] Trial 74 finished with value: 0.0724362830407506 and
parameters: {'lambda': 0.029000999974363437, 'alpha': 0.0017970923454219102,
'colsample_bytree': 0.5, 'subsample': 1.0, 'learning_rate': 0.04024856844109556,
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'n_estimators': 1000, 'max_depth': 6, 'min_child_weight': 235}. Best is trial 13 with
value: 0.07235554608758409.
[I 2025-11-03 17:00:39,378] Trial 75 finished with value: 0.07237293856399032 and
parameters: {'lambda': 0.020624405889911785, 'alpha': 0.0024250064120513114,
'colsample_bytree': 0.5, 'subsample': 1.0, 'learning_rate': 0.0353107491475313,
'n_estimators': 1000, 'max_depth': 8, 'min_child_weight': 248}. Best is trial 13 with
value: 0.07235554608758409.
[I 2025-11-03 17:00:45,516] Trial 76 finished with value: 0.07251753637022647 and
parameters: {'lambda': 0.06965392847819028, 'alpha': 0.0010107969402476133,
'colsample_bytree': 0.5, 'subsample': 0.5, 'learning_rate': 0.039090812686741645,
'n_estimators': 1000, 'max_depth': 7, 'min_child_weight': 272}. Best is trial 13 with
value: 0.07235554608758409.
[I 2025-11-03 17:00:52,546] Trial 77 finished with value: 0.07237344634535303 and
parameters: {'lambda': 0.017567655831794447, 'alpha': 0.002777667856232968,
'colsample_bytree': 0.5, 'subsample': 1.0, 'learning_rate': 0.035447997157439855,
'n_estimators': 1000, 'max_depth': 8, 'min_child_weight': 253}. Best is trial 13 with
value: 0.07235554608758409.
[I 2025-11-03 17:00:59,531] Trial 78 finished with value: 0.07234576905096671 and
parameters: {'lambda': 0.03752508715892622, 'alpha': 0.0020252243657209913,
'colsample_bytree': 0.5, 'subsample': 1.0, 'learning_rate': 0.035124315422718363,
'n_estimators': 1000, 'max_depth': 8, 'min_child_weight': 262}. Best is trial 78 with
value: 0.07234576905096671.
[I 2025-11-03 17:01:04,132] Trial 79 finished with value: 0.0727068706224872 and
parameters: {'lambda': 0.018433043209171534, 'alpha': 0.0019295269762305992,
'colsample_bytree': 0.5, 'subsample': 1.0, 'learning_rate': 0.03476589860066694,
'n_estimators': 1000, 'max_depth': 5, 'min_child_weight': 250}. Best is trial 78 with
value: 0.07234576905096671.
[I 2025-11-03 17:01:10,168] Trial 80 finished with value: 0.07240190620628387 and
parameters: {'lambda': 0.045397150118229194, 'alpha': 0.004811702614151508,
'colsample_bytree': 0.5, 'subsample': 1.0, 'learning_rate': 0.036215747931066314,
'n_estimators': 1000, 'max_depth': 7, 'min_child_weight': 261}. Best is trial 78 with
value: 0.07234576905096671.
[I 2025-11-03 17:01:17,023] Trial 81 finished with value: 0.07238450166324009 and
parameters: {'lambda': 0.036006484027979804, 'alpha': 0.0024605306558028945,
'colsample_bytree': 0.5, 'subsample': 1.0, 'learning_rate': 0.04775936776647987,
'n_estimators': 1000, 'max_depth': 8, 'min_child_weight': 291}. Best is trial 78 with
value: 0.07234576905096671.
[I 2025-11-03 17:01:23,933] Trial 82 finished with value: 0.07237877025905161 and
parameters: {'lambda': 0.011304839547714525, 'alpha': 0.0030662952733230392,
'colsample_bytree': 0.5, 'subsample': 1.0, 'learning_rate': 0.04358458260016995,
'n_estimators': 1000, 'max_depth': 8, 'min_child_weight': 278}. Best is trial 78 with
value: 0.07234576905096671.
[I 2025-11-03 17:01:30,919] Trial 83 finished with value: 0.0723798044095927 and
parameters: {'lambda': 0.016826714652089975, 'alpha': 0.005259655086838196,
'colsample_bytree': 0.5, 'subsample': 1.0, 'learning_rate': 0.03386238674543022,
'n_estimators': 1000, 'max_depth': 8, 'min_child_weight': 300}. Best is trial 78 with
value: 0.07234576905096671.
[I 2025-11-03 17:01:36,940] Trial 84 finished with value: 0.07239063916148163 and
parameters: {'lambda': 0.022509660648659377, 'alpha': 0.0015616714132822742,
'colsample_bytree': 0.5, 'subsample': 1.0, 'learning_rate': 0.0373189756941851,
'n_estimators': 1000, 'max_depth': 7, 'min_child_weight': 250}. Best is trial 78 with
value: 0.07234576905096671.
[I 2025-11-03 17:01:43,615] Trial 85 finished with value: 0.07235218848354197 and
parameters: {'lambda': 0.06728766632577303, 'alpha': 0.002415553432371493,
'colsample_bytree': 0.5, 'subsample': 1.0, 'learning_rate': 0.045066067687963625,
'n_estimators': 1000, 'max_depth': 8, 'min_child_weight': 242}. Best is trial 78 with
value: 0.07234576905096671.
[I 2025-11-03 17:01:50,055] Trial 86 finished with value: 0.07247117168019972 and
parameters: {'lambda': 0.07160600788011205, 'alpha': 0.008628903599831879,
'colsample_bytree': 0.5, 'subsample': 0.6, 'learning_rate': 0.04481727368615668,
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'n_estimators': 900, 'max_depth': 8, 'min_child_weight': 266}. Best is trial 78 with
0.07234576905096671.
[I 2025-11-03 17:01:56,014] Trial 87 finished with value: 0.07237369184541921 and
parameters: {'lambda': 0.06227099767605044, 'alpha': 0.003691854480077125,
'colsample_bytree': 0.5, 'subsample': 1.0, 'learning_rate': 0.046849223955045746,
'n_estimators': 1000, 'max_depth': 7, 'min_child_weight': 240}. Best is trial 78 with
value: 0.07234576905096671.
[I 2025-11-03 17:02:02,538] Trial 88 finished with value: 0.07245885541401514 and
parameters: {'lambda': 0.05567766439897642, 'alpha': 0.0012247040512716988,
'colsample_bytree': 0.5, 'subsample': 0.8, 'learning_rate': 0.04732005602472595,
'n_estimators': 900, 'max_depth': 8, 'min_child_weight': 240}. Best is trial 78 with
0.07234576905096671.
[I 2025-11-03 17:02:07,766] Trial 89 finished with value: 0.07227737892886735 and
parameters: {'lambda': 0.1567773260584922, 'alpha': 0.0037167786229560886,
'colsample_bytree': 1.0, 'subsample': 1.0, 'learning_rate': 0.04224944689512175,
'n_estimators': 1000, 'max_depth': 6, 'min_child_weight': 229}. Best is trial 89 with
value: 0.07227737892886735.
[I 2025-11-03 17:02:12,608] Trial 90 finished with value: 0.0724189129482492 and
parameters: {'lambda': 1.5547281643579334, 'alpha': 0.005619418228369378,
'colsample_bytree': 1.0, 'subsample': 0.7, 'learning_rate': 0.0322680665798934,
'n_estimators': 900, 'max_depth': 6, 'min_child_weight': 281}. Best is trial 89 with
0.07227737892886735.
[I 2025-11-03 17:02:17,841] Trial 91 finished with value: 0.07227741102914093 and
parameters: {'lambda': 0.17175760094991482, 'alpha': 0.003268225408012527,
'colsample_bytree': 1.0, 'subsample': 1.0, 'learning_rate': 0.04205822660421885,
'n_estimators': 1000, 'max_depth': 6, 'min_child_weight': 231}. Best is trial 89 with
value: 0.07227737892886735.
[I 2025-11-03 17:02:22,433] Trial 92 finished with value: 0.07239182473449951 and
parameters: {'lambda': 0.15739255757130843, 'alpha': 0.008417802427677477,
'colsample_bytree': 1.0, 'subsample': 1.0, 'learning_rate': 0.038233976898198845,
'n_estimators': 1000, 'max_depth': 5, 'min_child_weight': 230}. Best is trial 89 with
value: 0.07227737892886735.
[I 2025-11-03 17:02:27,054] Trial 93 finished with value: 0.07234851890121996 and
parameters: {'lambda': 0.5316804639299253, 'alpha': 0.004314731451524876,
'colsample_bytree': 1.0, 'subsample': 1.0, 'learning_rate': 0.04257697354509302,
'n_estimators': 1000, 'max_depth': 5, 'min_child_weight': 255}. Best is trial 89 with
value: 0.07227737892886735.
[I 2025-11-03 17:02:31,611] Trial 94 finished with value: 0.07237095558842695 and
parameters: {'lambda': 0.6979754702342619, 'alpha': 0.004192575774648756,
'colsample_bytree': 1.0, 'subsample': 1.0, 'learning_rate': 0.04230967194358187,
'n_estimators': 1000, 'max_depth': 5, 'min_child_weight': 228}. Best is trial 89 with
value: 0.07227737892886735.
[I 2025-11-03 17:02:35,297] Trial 95 finished with value: 0.07267088749253137 and
parameters: {'lambda': 0.5374504203569619, 'alpha': 0.014612783464370798,
'colsample_bytree': 1.0, 'subsample': 1.0, 'learning_rate': 0.042431092400476524,
'n_estimators': 900, 'max_depth': 4, 'min_child_weight': 202}. Best is trial 89 with
0.07227737892886735.
[I 2025-11-03 17:02:39,895] Trial 96 finished with value: 0.07234589265054531 and
parameters: {'lambda': 0.5750889111077148, 'alpha': 0.004159772726406092,
'colsample_bytree': 1.0, 'subsample': 1.0, 'learning_rate': 0.04468847244513011,
'n_estimators': 1000, 'max_depth': 5, 'min_child_weight': 224}. Best is trial 89 with
value: 0.07227737892886735.
[I 2025-11-03 17:02:43,599] Trial 97 finished with value: 0.07266682354895693 and
parameters: {'lambda': 1.3290725190691945, 'alpha': 0.006425414756742221,
'colsample_bytree': 1.0, 'subsample': 1.0, 'learning_rate': 0.04452829474943708,
'n_estimators': 900, 'max_depth': 4, 'min_child_weight': 264}. Best is trial 89 with
0.07227737892886735.
[I 2025-11-03 17:02:48,297] Trial 98 finished with value: 0.072455250120226 and paran
{'lambda': 0.4267097021239083, 'alpha': 0.0034006712534214683, 'colsample_bytree': 1.
'subsample': 0.5, 'learning_rate': 0.04919084887303782, 'n_estimators': 1000, 'max_de
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5, 'min_child_weight': 221}. Best is trial 89 with value: 0.07227737892886735.
[I 2025-11-03 17:02:52,409] Trial 99 finished with value: 0.07389777394669711 and
parameters: {'lambda': 0.23143639002975075, 'alpha': 0.00458664176809918,
'colsample_bytree': 1.0, 'subsample': 1.0, 'learning_rate': 0.010449410262577728,
'n_estimators': 1000, 'max_depth': 4, 'min_child_weight': 234}. Best is trial 89 with
value: 0.07227737892886735.
[I 2025-11-03 17:02:57,654] Trial 100 finished with value: 0.07228776727246482 and
parameters: {'lambda': 0.2845669540286754, 'alpha': 0.0015592871792660386,
'colsample_bytree': 1.0, 'subsample': 1.0, 'learning_rate': 0.03873715360024768,
'n_estimators': 1000, 'max_depth': 6, 'min_child_weight': 194}. Best is trial 89 with
value: 0.07227737892886735.
[I 2025-11-03 17:03:02,918] Trial 101 finished with value: 0.0722829740417369 and
parameters: {'lambda': 0.29711595084437564, 'alpha': 0.0015160961829518414,
'colsample_bytree': 1.0, 'subsample': 1.0, 'learning_rate': 0.04511664962529588,
'n_estimators': 1000, 'max_depth': 6, 'min_child_weight': 195}. Best is trial 89 with
value: 0.07227737892886735.
[I 2025-11-03 17:03:08,124] Trial 102 finished with value: 0.07229643879587891 and
parameters: {'lambda': 0.29908576892424726, 'alpha': 0.0013936524664790403,
'colsample_bytree': 1.0, 'subsample': 1.0, 'learning_rate': 0.04572310548192905,
'n_estimators': 1000, 'max_depth': 6, 'min_child_weight': 195}. Best is trial 89 with
value: 0.07227737892886735.
[I 2025-11-03 17:03:13,325] Trial 103 finished with value: 0.0722962570614238 and
parameters: {'lambda': 0.2799565352762282, 'alpha': 0.0014941898190830396,
'colsample_bytree': 1.0, 'subsample': 1.0, 'learning_rate': 0.03915408865678424,
'n_estimators': 1000, 'max_depth': 6, 'min_child_weight': 195}. Best is trial 89 with
value: 0.07227737892886735.
[I 2025-11-03 17:03:18,544] Trial 104 finished with value: 0.07230325757677632 and
parameters: {'lambda': 0.2822648887570019, 'alpha': 0.00147783979810597,
'colsample_bytree': 1.0, 'subsample': 1.0, 'learning_rate': 0.03864395564613093,
'n_estimators': 1000, 'max_depth': 6, 'min_child_weight': 195}. Best is trial 89 with
value: 0.07227737892886735.
[I 2025-11-03 17:03:23,715] Trial 105 finished with value: 0.07228189183865809 and
parameters: {'lambda': 0.28554113630586764, 'alpha': 0.0014591554563188832,
'colsample_bytree': 1.0, 'subsample': 1.0, 'learning_rate': 0.037525882049784125,
'n_estimators': 1000, 'max_depth': 6, 'min_child_weight': 194}. Best is trial 89 with
value: 0.07227737892886735.
[I 2025-11-03 17:03:28,933] Trial 106 finished with value: 0.07224814092816519 and
parameters: {'lambda': 0.28854575292869883, 'alpha': 0.0013875239625506489,
'colsample_bytree': 1.0, 'subsample': 1.0, 'learning_rate': 0.03836214525629626,
'n_estimators': 1000, 'max_depth': 6, 'min_child_weight': 173}. Best is trial 106 with
value: 0.07224814092816519.
[I 2025-11-03 17:03:33,669] Trial 107 finished with value: 0.07228645517413934 and
parameters: {'lambda': 0.32027131647276963, 'alpha': 0.0013033121204986367,
'colsample_bytree': 1.0, 'subsample': 1.0, 'learning_rate': 0.03916931717531111,
'n_estimators': 900, 'max_depth': 6, 'min_child_weight': 179}. Best is trial 106 with
value: 0.07224814092816519.
[I 2025-11-03 17:03:38,533] Trial 108 finished with value: 0.07238403782458297 and
parameters: {'lambda': 0.28214337065419837, 'alpha': 0.0013334107792401832,
'colsample_bytree': 1.0, 'subsample': 0.6, 'learning_rate': 0.03786384823246635,
'n_estimators': 900, 'max_depth': 6, 'min_child_weight': 194}. Best is trial 106 with
value: 0.07224814092816519.
[I 2025-11-03 17:03:43,794] Trial 109 finished with value: 0.07231591272539388 and
parameters: {'lambda': 0.16711836350900494, 'alpha': 0.0011180450312798555,
'colsample_bytree': 1.0, 'subsample': 1.0, 'learning_rate': 0.03371135284995694,
'n_estimators': 1000, 'max_depth': 6, 'min_child_weight': 180}. Best is trial 106 with
value: 0.07224814092816519.
[I 2025-11-03 17:03:49,030] Trial 110 finished with value: 0.07227730509646252 and
parameters: {'lambda': 0.1809805572018549, 'alpha': 0.0010061828541170386,
'colsample_bytree': 1.0, 'subsample': 1.0, 'learning_rate': 0.03871390069292084,
'n_estimators': 1000, 'max_depth': 6, 'min_child_weight': 178}. Best is trial 106 with
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value: 0.07224814092816519.
[I 2025-11-03 17:03:54,267] Trial 111 finished with value: 0.07226867339285678 and
parameters: {'lambda': 0.1795203061692103, 'alpha': 0.0011364867300482021,
'colsample_bytree': 1.0, 'subsample': 1.0, 'learning_rate': 0.039231585452556644,
'n_estimators': 1000, 'max_depth': 6, 'min_child_weight': 175}. Best is trial 106 wit
value: 0.07224814092816519.
[I 2025-11-03 17:03:59,528] Trial 112 finished with value: 0.07227697059705855 and
parameters: {'lambda': 0.29338684231817436, 'alpha': 0.0016784949830250442,
'colsample_bytree': 1.0, 'subsample': 1.0, 'learning_rate': 0.03874401274522242,
'n_estimators': 1000, 'max_depth': 6, 'min_child_weight': 172}. Best is trial 106 wit
value: 0.07224814092816519.
[I 2025-11-03 17:04:04,773] Trial 113 finished with value: 0.07226356952161533 and
parameters: {'lambda': 0.1735460150300006, 'alpha': 0.0017302555565711537,
'colsample_bytree': 1.0, 'subsample': 1.0, 'learning_rate': 0.03922451854854354,
'n_estimators': 1000, 'max_depth': 6, 'min_child_weight': 167}. Best is trial 106 wit
value: 0.07224814092816519.
[I 2025-11-03 17:04:09,444] Trial 114 finished with value: 0.07229476124646621 and
parameters: {'lambda': 0.17657357302147816, 'alpha': 0.0016503596554671032,
'colsample_bytree': 1.0, 'subsample': 1.0, 'learning_rate': 0.03681834811563725,
'n_estimators': 900, 'max_depth': 6, 'min_child_weight': 168}. Best is trial 106 with
value: 0.07224814092816519.
[I 2025-11-03 17:04:13,982] Trial 115 finished with value: 0.0723654662463167 and
parameters: {'lambda': 0.19661406688498034, 'alpha': 0.0011131481085492182,
'colsample_bytree': 1.0, 'subsample': 1.0, 'learning_rate': 0.03114952159216668,
'n_estimators': 900, 'max_depth': 6, 'min_child_weight': 166}. Best is trial 106 with
value: 0.07224814092816519.
[I 2025-11-03 17:04:18,637] Trial 116 finished with value: 0.07231431658956408 and
parameters: {'lambda': 0.13875927796367435, 'alpha': 0.0018047288095219202,
'colsample_bytree': 1.0, 'subsample': 0.8, 'learning_rate': 0.03680000942495861,
'n_estimators': 900, 'max_depth': 6, 'min_child_weight': 172}. Best is trial 106 with
value: 0.07224814092816519.
[I 2025-11-03 17:04:23,258] Trial 117 finished with value: 0.07232668762013336 and
parameters: {'lambda': 0.4508658791588465, 'alpha': 0.0018588944208900607,
'colsample_bytree': 1.0, 'subsample': 0.7, 'learning_rate': 0.041536679726660974,
'n_estimators': 900, 'max_depth': 6, 'min_child_weight': 159}. Best is trial 106 with
value: 0.07224814092816519.
[I 2025-11-03 17:04:28,283] Trial 118 finished with value: 0.07232287772050411 and
parameters: {'lambda': 0.09777220210745349, 'alpha': 0.0010223623901820188,
'colsample_bytree': 1.0, 'subsample': 1.0, 'learning_rate': 0.033216686692714444,
'n_estimators': 1000, 'max_depth': 6, 'min_child_weight': 182}. Best is trial 106 wit
value: 0.07224814092816519.
[I 2025-11-03 17:04:33,259] Trial 119 finished with value: 0.07229600512260459 and
parameters: {'lambda': 0.18010760107251964, 'alpha': 0.0015633713593737385,
'colsample_bytree': 1.0, 'subsample': 1.0, 'learning_rate': 0.036418892025206255,
'n_estimators': 1000, 'max_depth': 6, 'min_child_weight': 175}. Best is trial 106 wit
value: 0.07224814092816519.
[I 2025-11-03 17:04:35,486] Trial 120 finished with value: 0.07263527620114953 and
parameters: {'lambda': 0.22586232798977754, 'alpha': 0.0016343401574153904,
'colsample_bytree': 1.0, 'subsample': 1.0, 'learning_rate': 0.04061771966433365,
'n_estimators': 400, 'max_depth': 6, 'min_child_weight': 166}. Best is trial 106 with
value: 0.07224814092816519.
[I 2025-11-03 17:04:40,487] Trial 121 finished with value: 0.07228279721758897 and
parameters: {'lambda': 0.17747513816060298, 'alpha': 0.0012644275347647826,
'colsample_bytree': 1.0, 'subsample': 1.0, 'learning_rate': 0.03691802339172915,
'n_estimators': 1000, 'max_depth': 6, 'min_child_weight': 174}. Best is trial 106 wit
value: 0.07224814092816519.
[I 2025-11-03 17:04:45,456] Trial 122 finished with value: 0.07229197836980032 and
parameters: {'lambda': 0.33331225488463734, 'alpha': 0.0011940190538412153,
'colsample_bytree': 1.0, 'subsample': 1.0, 'learning_rate': 0.03721047238464456,
'n_estimators': 1000, 'max_depth': 6, 'min_child_weight': 156}. Best is trial 106 wit
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value: 0.07224814092816519.
[I 2025-11-03 17:04:50,459] Trial 123 finished with value: 0.07227703925747177 and
parameters: {'lambda': 0.3325612003579686, 'alpha': 0.0012242456874775947,
'colsample_bytree': 1.0, 'subsample': 1.0, 'learning_rate': 0.03936701186745315,
'n_estimators': 1000, 'max_depth': 6, 'min_child_weight': 152}. Best is trial 106 wit
value: 0.07224814092816519.
[I 2025-11-03 17:04:54,782] Trial 124 finished with value: 0.07236391213129205 and
parameters: {'lambda': 0.2447069255825512, 'alpha': 0.002154637550749489,
'colsample_bytree': 1.0, 'subsample': 1.0, 'learning_rate': 0.03924266388583419,
'n_estimators': 1000, 'max_depth': 5, 'min_child_weight': 186}. Best is trial 106 wit
value: 0.07224814092816519.
[I 2025-11-03 17:04:59,798] Trial 125 finished with value: 0.0722533922718147 and
parameters: {'lambda': 0.14155760339091567, 'alpha': 0.0012682269463102397,
'colsample_bytree': 1.0, 'subsample': 1.0, 'learning_rate': 0.0416246653636563,
'n_estimators': 1000, 'max_depth': 6, 'min_child_weight': 147}. Best is trial 106 wit
value: 0.07224814092816519.
[I 2025-11-03 17:05:04,472] Trial 126 finished with value: 0.07247017747669583 and
parameters: {'lambda': 0.12465571274840144, 'alpha': 0.001240230371359992,
'colsample_bytree': 1.0, 'subsample': 0.5, 'learning_rate': 0.04176535051864565,
'n_estimators': 1000, 'max_depth': 5, 'min_child_weight': 142}. Best is trial 106 wit
value: 0.07224814092816519.
[I 2025-11-03 17:05:09,710] Trial 127 finished with value: 0.07227803955035061 and
parameters: {'lambda': 0.103664416450724, 'alpha': 0.0010023799806891717,
'colsample_bytree': 1.0, 'subsample': 1.0, 'learning_rate': 0.04077745493639131,
'n_estimators': 1000, 'max_depth': 6, 'min_child_weight': 178}. Best is trial 106 wit
value: 0.07224814092816519.
[I 2025-11-03 17:05:14,917] Trial 128 finished with value: 0.07230771506518013 and
parameters: {'lambda': 0.0983202905197468, 'alpha': 0.0010569566447646715,
'colsample_bytree': 1.0, 'subsample': 1.0, 'learning_rate': 0.03378816015165828,
'n_estimators': 1000, 'max_depth': 6, 'min_child_weight': 149}. Best is trial 106 wit
value: 0.07224814092816519.
[I 2025-11-03 17:05:19,472] Trial 129 finished with value: 0.07231617657722753 and
parameters: {'lambda': 0.14898722839815265, 'alpha': 0.0017994117589986327,
'colsample_bytree': 1.0, 'subsample': 1.0, 'learning_rate': 0.043437613443632436,
'n_estimators': 1000, 'max_depth': 5, 'min_child_weight': 162}. Best is trial 106 wit
value: 0.07224814092816519.
[I 2025-11-03 17:05:24,962] Trial 130 finished with value: 0.07322601222810304 and
parameters: {'lambda': 0.2272005641573892, 'alpha': 0.002180834308581126,
'colsample_bytree': 1.0, 'subsample': 1.0, 'learning_rate': 0.007693508949881316,
'n_estimators': 1000, 'max_depth': 6, 'min_child_weight': 154}. Best is trial 106 wit
value: 0.07224814092816519.
[I 2025-11-03 17:05:30,185] Trial 131 finished with value: 0.07228272035606771 and
parameters: {'lambda': 0.11428201718332781, 'alpha': 0.0010004216296578303,
'colsample_bytree': 1.0, 'subsample': 1.0, 'learning_rate': 0.03888172704499009,
'n_estimators': 1000, 'max_depth': 6, 'min_child_weight': 182}. Best is trial 106 wit
value: 0.07224814092816519.
[I 2025-11-03 17:05:35,404] Trial 132 finished with value: 0.07227814107926991 and
parameters: {'lambda': 0.106652410057991, 'alpha': 0.001333585565494796,
'colsample_bytree': 1.0, 'subsample': 1.0, 'learning_rate': 0.04072124603612524,
'n_estimators': 1000, 'max_depth': 6, 'min_child_weight': 173}. Best is trial 106 wit
value: 0.07224814092816519.
[I 2025-11-03 17:05:40,621] Trial 133 finished with value: 0.07225661613948764 and
parameters: {'lambda': 0.1040432476798747, 'alpha': 0.0012176958376451507,
'colsample_bytree': 1.0, 'subsample': 1.0, 'learning_rate': 0.04082687574517349,
'n_estimators': 1000, 'max_depth': 6, 'min_child_weight': 173}. Best is trial 106 wit
value: 0.07224814092816519.
[I 2025-11-03 17:05:45,877] Trial 134 finished with value: 0.07337904649552177 and
parameters: {'lambda': 0.10974398974605225, 'alpha': 0.001023659536372004,
'colsample_bytree': 0.3, 'subsample': 1.0, 'learning_rate': 0.04013688775545927,
'n_estimators': 1000, 'max_depth': 6, 'min_child_weight': 160}. Best is trial 106 wit
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value: 0.07224814092816519.
[I 2025-11-03 17:05:50,889] Trial 135 finished with value: 0.07224633469259703 and
parameters: {'lambda': 0.08957845996095434, 'alpha': 0.0021939053559678445,
'colsample_bytree': 1.0, 'subsample': 1.0, 'learning_rate': 0.04134354589157865,
'n_estimators': 1000, 'max_depth': 6, 'min_child_weight': 170}. Best is trial 135 wit
value: 0.07224633469259703.
[I 2025-11-03 17:05:55,244] Trial 136 finished with value: 0.0723158033560133 and
parameters: {'lambda': 0.13154384829491758, 'alpha': 0.0020239777515485414,
'colsample_bytree': 1.0, 'subsample': 1.0, 'learning_rate': 0.04210727260193577,
'n_estimators': 1000, 'max_depth': 5, 'min_child_weight': 138}. Best is trial 135 wit
value: 0.07224633469259703.
[I 2025-11-03 17:06:00,241] Trial 137 finished with value: 0.07228477266490706 and
parameters: {'lambda': 0.09442771190396232, 'alpha': 0.0029251255853511415,
'colsample_bytree': 1.0, 'subsample': 1.0, 'learning_rate': 0.03444805020791721,
'n_estimators': 1000, 'max_depth': 6, 'min_child_weight': 168}. Best is trial 135 wit
value: 0.07224633469259703.
[I 2025-11-03 17:06:06,199] Trial 138 finished with value: 0.07255800639596971 and
parameters: {'lambda': 0.08132286198030146, 'alpha': 0.002650473730379124,
'colsample_bytree': 1.0, 'subsample': 0.6, 'learning_rate': 0.04825071107133272,
'n_estimators': 1000, 'max_depth': 7, 'min_child_weight': 173}. Best is trial 135 wit
value: 0.07224633469259703.
[I 2025-11-03 17:06:11,468] Trial 139 finished with value: 0.07233442514333815 and
parameters: {'lambda': 0.14933819680519306, 'alpha': 0.0023130684633101478,
'colsample_bytree': 0.7, 'subsample': 1.0, 'learning_rate': 0.04143661711583915,
'n_estimators': 1000, 'max_depth': 6, 'min_child_weight': 150}. Best is trial 135 wit
value: 0.07224633469259703.
[I 2025-11-03 17:06:16,010] Trial 140 finished with value: 0.07234457469976097 and
parameters: {'lambda': 0.38607920302774107, 'alpha': 0.0012979194529578531,
'colsample_bytree': 1.0, 'subsample': 1.0, 'learning_rate': 0.0436694828956369,
'n_estimators': 1000, 'max_depth': 5, 'min_child_weight': 163}. Best is trial 135 wit
value: 0.07224633469259703.
[I 2025-11-03 17:06:21,253] Trial 141 finished with value: 0.07228052073007699 and
parameters: {'lambda': 0.11696972367464516, 'alpha': 0.0010082614311254096,
'colsample_bytree': 1.0, 'subsample': 1.0, 'learning_rate': 0.040229846268719095,
'n_estimators': 1000, 'max_depth': 6, 'min_child_weight': 186}. Best is trial 135 wit
value: 0.07224633469259703.
[I 2025-11-03 17:06:26,489] Trial 142 finished with value: 0.0722857767188785 and
parameters: {'lambda': 0.12534138315537943, 'alpha': 0.0018359537033973757,
'colsample_bytree': 1.0, 'subsample': 1.0, 'learning_rate': 0.040783324139063895,
'n_estimators': 1000, 'max_depth': 6, 'min_child_weight': 187}. Best is trial 135 wit
value: 0.07224633469259703.
[I 2025-11-03 17:06:31,964] Trial 143 finished with value: 0.07345039218493542 and
parameters: {'lambda': 0.20536797636482593, 'alpha': 0.001229889879518049,
'colsample_bytree': 1.0, 'subsample': 1.0, 'learning_rate': 0.005334999162642656,
'n_estimators': 1000, 'max_depth': 6, 'min_child_weight': 170}. Best is trial 135 wit
value: 0.07224633469259703.
[I 2025-11-03 17:06:37,986] Trial 144 finished with value: 0.07231195658000829 and
parameters: {'lambda': 0.08556958667510531, 'alpha': 0.0014227434221919417,
'colsample_bytree': 1.0, 'subsample': 1.0, 'learning_rate': 0.035241630877829215,
'n_estimators': 1000, 'max_depth': 7, 'min_child_weight': 177}. Best is trial 135 wit
value: 0.07224633469259703.
[I 2025-11-03 17:06:43,212] Trial 145 finished with value: 0.07228132489341221 and
parameters: {'lambda': 0.24869397772501134, 'alpha': 0.0018197909033446005,
'colsample_bytree': 1.0, 'subsample': 1.0, 'learning_rate': 0.0376044244612787,
'n_estimators': 1000, 'max_depth': 6, 'min_child_weight': 155}. Best is trial 135 wit
value: 0.07224633469259703.
[I 2025-11-03 17:06:48,561] Trial 146 finished with value: 0.07228458661109365 and
parameters: {'lambda': 0.1533638893142842, 'alpha': 0.0034223810440382934,
'colsample_bytree': 1.0, 'subsample': 0.8, 'learning_rate': 0.04629148634154177,
'n_estimators': 1000, 'max_depth': 6, 'min_child_weight': 155}. Best is trial 135 wit
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value: 0.07224633469259703.
[I 2025-11-03 17:06:50,408] Trial 147 finished with value: 0.07290014717409678 and
parameters: {'lambda': 0.24370177800636336, 'alpha': 0.0019775033820313183,
'colsample_bytree': 1.0, 'subsample': 1.0, 'learning_rate': 0.04056039924344746,
'n_estimators': 300, 'max_depth': 6, 'min_child_weight': 162}. Best is trial 135 with
value: 0.07224633469259703.
[I 2025-11-03 17:06:56,591] Trial 148 finished with value: 0.07248051887823725 and
parameters: {'lambda': 0.10925785069083456, 'alpha': 0.001017629127241109,
'colsample_bytree': 1.0, 'subsample': 0.7, 'learning_rate': 0.043082823549099945,
'n_estimators': 1000, 'max_depth': 7, 'min_child_weight': 144}. Best is trial 135 wit
value: 0.07224633469259703.
[I 2025-11-03 17:07:02,071] Trial 149 finished with value: 0.07338953715466853 and
parameters: {'lambda': 0.18145410704491036, 'alpha': 0.0017018577240896587,
'colsample_bytree': 1.0, 'subsample': 1.0, 'learning_rate': 0.005806417180077815,
'n_estimators': 1000, 'max_depth': 6, 'min_child_weight': 150}. Best is trial 135 wit
value: 0.07224633469259703.
[I 2025-11-03 17:07:02,073] A new study created in memory with name: no-name-
e75ac834-7815-4019-80c7-0970b963207e
✅ Best XGBRegressor parameters: {'lambda': 0.08957845996095434, 'alpha':
0.0021939053559678445, 'colsample_bytree': 1.0, 'subsample': 1.0, 'learning_rate':
0.04134354589157865, 'n_estimators': 1000, 'max_depth': 6, 'min_child_weight': 170}

🚀 Tuning LGBMRegressor (GPU)...
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[I 2025-11-03 17:07:17,760] Trial 0 finished with value: 0.0722084849234186 and paran
{'lambda_l1': 0.03971925550168432, 'lambda_l2': 0.2807925776819964, 'num_leaves': 68,
'feature_fraction': 0.8337911810284746, 'bagging_fraction': 0.776050002183273,
'bagging_freq': 6, 'min_child_samples': 68, 'learning_rate': 0.046057270917085995,
'n_estimators': 300, 'max_depth': 11}. Best is trial 0 with value: 0.0722084849234186
[I 2025-11-03 17:07:40,143] Trial 1 finished with value: 0.07215422502187056 and
parameters: {'lambda_l1': 0.011532372812333332, 'lambda_l2': 0.12239091514058868,
'num_leaves': 183, 'feature_fraction': 0.950732111584848, 'bagging_fraction':
0.6442376896291517, 'bagging_freq': 3, 'min_child_samples': 70, 'learning_rate':
0.04945609201482753, 'n_estimators': 500, 'max_depth': 8}. Best is trial 1 with value
0.07215422502187056.
[I 2025-11-03 17:07:49,080] Trial 2 finished with value: 0.07287927195016675 and
parameters: {'lambda_l1': 0.005120803202712731, 'lambda_l2': 0.007969817839367475,
'num_leaves': 163, 'feature_fraction': 0.7007736474370645, 'bagging_fraction':
0.7619644133085373, 'bagging_freq': 3, 'min_child_samples': 15, 'learning_rate':
0.15315794379235378, 'n_estimators': 200, 'max_depth': 10}. Best is trial 1 with valu
0.07215422502187056.
[I 2025-11-03 17:07:57,956] Trial 3 finished with value: 0.07550577306274968 and
parameters: {'lambda_l1': 0.2500684582090518, 'lambda_l2': 7.04474595317864e-05,
'num_leaves': 39, 'feature_fraction': 0.5793045107262615, 'bagging_fraction':
0.8844095019019388, 'bagging_freq': 3, 'min_child_samples': 78, 'learning_rate':
0.014784317200320304, 'n_estimators': 300, 'max_depth': 4}. Best is trial 1 with valu
0.07215422502187056.
[I 2025-11-03 17:08:07,313] Trial 4 finished with value: 0.0739156251175947 and paran
{'lambda_l1': 0.00011839997361897246, 'lambda_l2': 6.563374281963274e-05, 'num_leaves
139, 'feature_fraction': 0.8143213118137855, 'bagging_fraction': 0.6810807518487354,
'bagging_freq': 5, 'min_child_samples': 22, 'learning_rate': 0.0203398613574207,
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'n_estimators': 400, 'max_depth': 4}. Best is trial 1 with value: 0.0721542250218705
[I 2025-11-03 17:08:21,823] Trial 5 finished with value: 0.08134638122429315 and
parameters: {'lambda_l1': 0.046983681265616944, 'lambda_l2': 0.00015822761496167093,
'num_leaves': 227, 'feature_fraction': 0.8356597337262963, 'bagging_fraction':
0.9414050597526396, 'bagging_freq': 2, 'min_child_samples': 81, 'learning_rate':
0.00696562028880559, 'n_estimators': 200, 'max_depth': 10}. Best is trial 1 with valu
0.07215422502187056.
[I 2025-11-03 17:08:46,250] Trial 6 finished with value: 0.0720391924981732 and paran
{'lambda_l1': 0.019953268189921457, 'lambda_l2': 0.21278056916070445, 'num_leaves': 8
'feature_fraction': 0.6179120470564738, 'bagging_fraction': 0.664947410585544,
'bagging_freq': 3, 'min_child_samples': 84, 'learning_rate': 0.03130163236185464,
'n_estimators': 600, 'max_depth': 12}. Best is trial 6 with value: 0.072039192498173
[I 2025-11-03 17:09:09,331] Trial 7 finished with value: 0.0732348162854214 and paran
{'lambda_l1': 0.03934019225282483, 'lambda_l2': 3.8539796009200644e-05, 'num_leaves':
'feature_fraction': 0.5753378396496536, 'bagging_fraction': 0.8081443213189061,
'bagging_freq': 2, 'min_child_samples': 47, 'learning_rate': 0.026553427930377484,
'n_estimators': 800, 'max_depth': 4}. Best is trial 6 with value: 0.0720391924981732
[I 2025-11-03 17:09:25,626] Trial 8 finished with value: 0.07440189777642627 and
parameters: {'lambda_l1': 0.8591321445171409, 'lambda_l2': 5.0917329436710286e-05,
'num_leaves': 221, 'feature_fraction': 0.9371726282395303, 'bagging_fraction':
0.8002203171665494, 'bagging_freq': 6, 'min_child_samples': 47, 'learning_rate':
0.007230002826269747, 'n_estimators': 700, 'max_depth': 4}. Best is trial 6 with valu
0.0720391924981732.
[I 2025-11-03 17:09:44,079] Trial 9 finished with value: 0.07243161523186135 and
parameters: {'lambda_l1': 0.4072797810830503, 'lambda_l2': 0.0016648058345764423,
'num_leaves': 225, 'feature_fraction': 0.7810629003474694, 'bagging_fraction':
0.6178926330303688, 'bagging_freq': 4, 'min_child_samples': 31, 'learning_rate':
0.034247838182912764, 'n_estimators': 700, 'max_depth': 5}. Best is trial 6 with valu
0.0720391924981732.
[I 2025-11-03 17:10:19,908] Trial 10 finished with value: 0.07463980726855841 and
parameters: {'lambda_l1': 0.00036848439987477975, 'lambda_l2': 0.8569587277741176,
'num_leaves': 95, 'feature_fraction': 0.510423869777331, 'bagging_fraction':
0.5027583826272187, 'bagging_freq': 1, 'min_child_samples': 99, 'learning_rate':
0.12838707053218357, 'n_estimators': 1000, 'max_depth': 12}. Best is trial 6 with val
0.0720391924981732.
[I 2025-11-03 17:10:37,971] Trial 11 finished with value: 0.07221606479822833 and
parameters: {'lambda_l1': 0.0021523251431738956, 'lambda_l2': 0.0541873342570142,
'num_leaves': 181, 'feature_fraction': 0.9960813382580843, 'bagging_fraction':
0.6302694715603127, 'bagging_freq': 4, 'min_child_samples': 100, 'learning_rate':
0.07009951558130828, 'n_estimators': 500, 'max_depth': 7}. Best is trial 6 with value
0.0720391924981732.
[I 2025-11-03 17:10:59,270] Trial 12 finished with value: 0.0721841348515131 and
parameters: {'lambda_l1': 0.005430577746360318, 'lambda_l2': 0.04222457378084937,
'num_leaves': 99, 'feature_fraction': 0.6885726450376614, 'bagging_fraction':
0.5729887521834909, 'bagging_freq': 3, 'min_child_samples': 62, 'learning_rate':
0.07178777685994542, 'n_estimators': 500, 'max_depth': 8}. Best is trial 6 with value
0.0720391924981732.
[I 2025-11-03 17:11:20,852] Trial 13 finished with value: 0.07536908596935665 and
parameters: {'lambda_l1': 0.0010834879526214235, 'lambda_l2': 0.07685345646735894,
'num_leaves': 106, 'feature_fraction': 0.6361670562576307, 'bagging_fraction':
0.6920504518081401, 'bagging_freq': 1, 'min_child_samples': 83, 'learning_rate':
0.24883135451041472, 'n_estimators': 600, 'max_depth': 8}. Best is trial 6 with value
0.0720391924981732.
[I 2025-11-03 17:11:43,527] Trial 14 finished with value: 0.07301357320832642 and
parameters: {'lambda_l1': 2.2456022845025974e-05, 'lambda_l2': 0.006957392571262016,
'num_leaves': 22, 'feature_fraction': 0.9118471351776126, 'bagging_fraction':
0.694811151214555, 'bagging_freq': 4, 'min_child_samples': 89, 'learning_rate':
0.013311222767679787, 'n_estimators': 800, 'max_depth': 6}. Best is trial 6 with valu
0.0720391924981732.
[I 2025-11-03 17:12:08,023] Trial 15 finished with value: 0.07229303888944115 and
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parameters: {'lambda_l1': 0.016157598460596025, 'lambda_l2': 0.996831570085536,
'num_leaves': 184, 'feature_fraction': 0.7262857845076683, 'bagging_fraction':
0.5460781023268081, 'bagging_freq': 7, 'min_child_samples': 68, 'learning_rate':
0.05644125135133726, 'n_estimators': 500, 'max_depth': 9}. Best is trial 6 with value
0.0720391924981732.
[I 2025-11-03 17:13:15,132] Trial 16 finished with value: 0.07550589694931564 and
parameters: {'lambda_l1': 0.1363348660892489, 'lambda_l2': 0.0009138490571451007,
'num_leaves': 253, 'feature_fraction': 0.6473899163209781, 'bagging_fraction':
0.6285253282900293, 'bagging_freq': 2, 'min_child_samples': 56, 'learning_rate':
0.09154169263278981, 'n_estimators': 1000, 'max_depth': 12}. Best is trial 6 with val
0.0720391924981732.
[I 2025-11-03 17:13:34,303] Trial 17 finished with value: 0.07226684923672966 and
parameters: {'lambda_l1': 0.009307073863270 57, 'lambda_l2': 0.18742645800267094,
'num_leaves': 66, 'feature_fraction': 0.8935109807758993, 'bagging_fraction':
0.7193744898304384, 'bagging_freq': 5, 'min_child_samples': 71, 'learning_rate':
0.03212082174231134, 'n_estimators': 600, 'max_depth': 6}. Best is trial 6 with value
0.0720391924981732.
[I 2025-11-03 17:13:53,259] Trial 18 finished with value: 0.07276560003839908 and
parameters: {'lambda_l1': 0.0010858896406497952, 'lambda_l2': 0.021922486094724216,
'num_leaves': 116, 'feature_fraction': 0.9782982822976297, 'bagging_fraction':
0.5794228357958787, 'bagging_freq': 3, 'min_child_samples': 89, 'learning_rate':
0.011178589243422228, 'n_estimators': 400, 'max_depth': 10}. Best is trial 6 with val
0.0720391924981732.
[I 2025-11-03 17:14:26,449] Trial 19 finished with value: 0.07214707031778039 and
parameters: {'lambda_l1': 0.00021394568536297476, 'lambda_l2': 1.1112507634637592e-05,
'num_leaves': 73, 'feature_fraction': 0.5314283960739427, 'bagging_fraction':
0.8381775370505364, 'bagging_freq': 5, 'min_child_samples': 43, 'learning_rate':
0.020801875412397124, 'n_estimators': 800, 'max_depth': 9}. Best is trial 6 with valu
0.0720391924981732.
[I 2025-11-03 17:14:58,210] Trial 20 finished with value: 0.07223395302907511 and
parameters: {'lambda_l1': 1.1389082852262246e-05, 'lambda_l2': 1.2088462057342996e-05,
'num_leaves': 54, 'feature_fraction': 0.5164778361752664, 'bagging_fraction':
0.8515244247907591, 'bagging_freq': 5, 'min_child_samples': 36, 'learning_rate':
0.021057871020225456, 'n_estimators': 900, 'max_depth': 11}. Best is trial 6 with val
0.0720391924981732.
[I 2025-11-03 17:15:25,795] Trial 21 finished with value: 0.0719972864899319 and
parameters: {'lambda_l1': 0.00014201187346968126, 'lambda_l2': 0.20859085323381102,
'num_leaves': 82, 'feature_fraction': 0.5793626247591757, 'bagging_fraction':
0.912726674876856, 'bagging_freq': 5, 'min_child_samples': 48, 'learning_rate':
0.04131923994089322, 'n_estimators': 700, 'max_depth': 9}. Best is trial 21 with valu
0.0719972864899319.
[I 2025-11-03 17:15:57,075] Trial 22 finished with value: 0.0721982856333714 and
parameters: {'lambda_l1': 0.00011899829471229549, 'lambda_l2': 0.0003609934285512023,
'num_leaves': 81, 'feature_fraction': 0.5710412474543058, 'bagging_fraction':
0.9993443856424566, 'bagging_freq': 6, 'min_child_samples': 43, 'learning_rate':
0.02080033520148727, 'n_estimators': 700, 'max_depth': 9}. Best is trial 21 with valu
0.0719972864899319.
[I 2025-11-03 17:16:36,015] Trial 23 finished with value: 0.07190818959222457 and
parameters: {'lambda_l1': 8.076418755200248e-05, 'lambda_l2': 0.021156698306564636,
'num_leaves': 122, 'feature_fraction': 0.6172426016009831, 'bagging_fraction':
0.8993006680859825, 'bagging_freq': 5, 'min_child_samples': 57, 'learning_rate':
0.032934124587307066, 'n_estimators': 800, 'max_depth': 9}. Best is trial 23 with val
0.07190818959222457.
[I 2025-11-03 17:17:13,811] Trial 24 finished with value: 0.07205001867358177 and
parameters: {'lambda_l1': 4.57520085683549e-05, 'lambda_l2': 0.014675715916982933,
'num_leaves': 114, 'feature_fraction': 0.6316374587192007, 'bagging_fraction':
0.9165666627917333, 'bagging_freq': 4, 'min_child_samples': 53, 'learning_rate':
0.043440783153639584, 'n_estimators': 900, 'max_depth': 11}. Best is trial 23 with va
0.07190818959222457.
[I 2025-11-03 17:17:43,029] Trial 25 finished with value: 0.07207499805303161 and
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parameters: {'lambda_l1': 0.0005627919120935644, 'lambda_l2': 0.38010769497993857,
'num_leaves': 127, 'feature_fraction': 0.6073614971189897, 'bagging_fraction':
0.9930604977613613, 'bagging_freq': 7, 'min_child_samples': 59, 'learning_rate':
0.03468984482836303, 'n_estimators': 700, 'max_depth': 7}. Best is trial 23 with valu
0.07190818959222457.
[I 2025-11-03 17:18:03,335] Trial 26 finished with value: 0.0722895890526001 and
parameters: {'lambda_l1': 0.00010533199709704333, 'lambda_l2': 0.03344954922443865,
'num_leaves': 45, 'feature_fraction': 0.6829796468463895, 'bagging_fraction':
0.9454487724206176, 'bagging_freq': 6, 'min_child_samples': 26, 'learning_rate':
0.09417110501661559, 'n_estimators': 900, 'max_depth': 12}. Best is trial 23 with val
0.07190818959222457.
[I 2025-11-03 17:18:30,422] Trial 27 finished with value: 0.07207037987660152 and
parameters: {'lambda_l1': 2.794880751109884e-05, 'lambda_l2': 0.4457333858764629,
'num_leaves': 96, 'feature_fraction': 0.5488556868108498, 'bagging_fraction':
0.8810241969426736, 'bagging_freq': 5, 'min_child_samples': 36, 'learning_rate':
0.02592868794760932, 'n_estimators': 600, 'max_depth': 9}. Best is trial 23 with valu
0.07190818959222457.
[I 2025-11-03 17:19:11,536] Trial 28 finished with value: 0.07265282510603667 and
parameters: {'lambda_l1': 6.020179837976126e-05, 'lambda_l2': 0.12381817805896472,
'num_leaves': 156, 'feature_fraction': 0.6040462230541015, 'bagging_fraction':
0.7369753040371307, 'bagging_freq': 4, 'min_child_samples': 52, 'learning_rate':
0.06374044503005256, 'n_estimators': 800, 'max_depth': 10}. Best is trial 23 with val
0.07190818959222457.
[I 2025-11-03 17:19:37,305] Trial 29 finished with value: 0.07203377971484179 and
parameters: {'lambda_l1': 0.0022827814860200005, 'lambda_l2': 0.007957870270993761,
'num_leaves': 84, 'feature_fraction': 0.7532829060228826, 'bagging_fraction':
0.7975191459406628, 'bagging_freq': 6, 'min_child_samples': 64, 'learning_rate':
0.0462664701426762, 'n_estimators': 700, 'max_depth': 11}. Best is trial 23 with valu
0.07190818959222457.
[I 2025-11-03 17:19:57,865] Trial 30 finished with value: 0.0722059894925288 and
parameters: {'lambda_l1': 0.00033117304236418517, 'lambda_l2': 0.0036045262678276384,
'num_leaves': 25, 'feature_fraction': 0.749460987621787, 'bagging_fraction':
0.8002766601660058, 'bagging_freq': 7, 'min_child_samples': 62, 'learning_rate':
0.04803973412527358, 'n_estimators': 900, 'max_depth': 11}. Best is trial 23 with val
0.07190818959222457.
[I 2025-11-03 17:20:25,000] Trial 31 finished with value: 0.0719932752234854 and
parameters: {'lambda_l1': 0.03129718727260414, 'lambda_l2': 0.017595828871915672,
'num_leaves': 84, 'feature_fraction': 0.6591107793947687, 'bagging_fraction':
0.8491563643341913, 'bagging_freq': 6, 'min_child_samples': 77, 'learning_rate':
0.03596179985711496, 'n_estimators': 700, 'max_depth': 11}. Best is trial 23 with val
0.07190818959222457.
[I 2025-11-03 17:20:46,716] Trial 32 finished with value: 0.07207171825370733 and
parameters: {'lambda_l1': 0.0012337664689639992, 'lambda_l2': 0.006639935978088207,
'num_leaves': 58, 'feature_fraction': 0.7825159150341301, 'bagging_fraction':
0.8560064699449557, 'bagging_freq': 6, 'min_child_samples': 67, 'learning_rate':
0.04286589819893889, 'n_estimators': 700, 'max_depth': 11}. Best is trial 23 with val
0.07190818959222457.
[I 2025-11-03 17:21:22,744] Trial 33 finished with value: 0.07290319577246387 and
parameters: {'lambda_l1': 0.09788457309313413, 'lambda_l2': 0.0016195689686748053,
'num_leaves': 127, 'feature_fraction': 0.6547567459494363, 'bagging_fraction':
0.9085259109876939, 'bagging_freq': 6, 'min_child_samples': 72, 'learning_rate':
0.0963326078467701, 'n_estimators': 800, 'max_depth': 10}. Best is trial 23 with valu
0.07190818959222457.
[I 2025-11-03 17:21:51,768] Trial 34 finished with value: 0.07208089551677646 and
parameters: {'lambda_l1': 0.00211217451921291, 'lambda_l2': 0.012727323561720318,
'num_leaves': 85, 'feature_fraction': 0.7138158817837951, 'bagging_fraction':
0.7645222517594021, 'bagging_freq': 5, 'min_child_samples': 76, 'learning_rate':
0.05258917980660251, 'n_estimators': 700, 'max_depth': 8}. Best is trial 23 with valu
0.07190818959222457.
[I 2025-11-03 17:22:21,749] Trial 35 finished with value: 0.07207160733090505 and
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parameters: {'lambda_l1': 0.006487884390247299, 'lambda_l2': 0.003058514220104663,
'num_leaves': 117, 'feature_fraction': 0.6627088591980174, 'bagging_fraction':
0.8230791671110171, 'bagging_freq': 7, 'min_child_samples': 64, 'learning_rate':
0.016975787658604503, 'n_estimators': 600, 'max_depth': 10}. Best is trial 23 with va
0.07190818959222457.
[I 2025-11-03 17:22:47,834] Trial 36 finished with value: 0.07223913122628572 and
parameters: {'lambda_l1': 0.0005486361430259459, 'lambda_l2': 0.09587193264981278,
'num_leaves': 39, 'feature_fraction': 0.7354821159656066, 'bagging_fraction':
0.9618111173908772, 'bagging_freq': 6, 'min_child_samples': 75, 'learning_rate':
0.025854363752193923, 'n_estimators': 800, 'max_depth': 9}. Best is trial 23 with val
0.07190818959222457.
[I 2025-11-03 17:23:22,637] Trial 37 finished with value: 0.07241845828082769 and
parameters: {'lambda_l1': 0.02823533798566996, 'lambda_l2': 0.017974959872973165,
'num_leaves': 68, 'feature_fraction': 0.8469269265497109, 'bagging_fraction':
0.8883131839794906, 'bagging_freq': 5, 'min_child_samples': 56, 'learning_rate':
0.009999965308648578, 'n_estimators': 800, 'max_depth': 10}. Best is trial 23 with va
0.07190818959222457.
[I 2025-11-03 17:23:35,535] Trial 38 finished with value: 0.07350489861033593 and
parameters: {'lambda_l1': 1.0021363389464835e-05, 'lambda_l2': 0.035933149735581246,
'num_leaves': 145, 'feature_fraction': 0.7779202042869233, 'bagging_fraction':
0.8665373745583782, 'bagging_freq': 6, 'min_child_samples': 49, 'learning_rate':
0.03982758679778418, 'n_estimators': 700, 'max_depth': 3}. Best is trial 23 with valu
0.07190818959222457.
[I 2025-11-03 17:23:50,697] Trial 39 finished with value: 0.07274034533619475 and
parameters: {'lambda_l1': 0.00018492832187775004, 'lambda_l2': 0.003679723029706804,
'num_leaves': 86, 'feature_fraction': 0.5934425611535161, 'bagging_fraction':
0.9157288260327684, 'bagging_freq': 5, 'min_child_samples': 40, 'learning_rate':
0.14402160007333467, 'n_estimators': 500, 'max_depth': 11}. Best is trial 23 with val
0.07190818959222457.
[I 2025-11-03 17:24:09,116] Trial 40 finished with value: 0.07228344990142173 and
parameters: {'lambda_l1': 0.0032256179229556664, 'lambda_l2': 0.0005883262938865128,
'num_leaves': 127, 'feature_fraction': 0.548550019833762, 'bagging_fraction':
0.780233885136496, 'bagging_freq': 6, 'min_child_samples': 10, 'learning_rate':
0.025451916361577148, 'n_estimators': 400, 'max_depth': 8}. Best is trial 23 with val
0.07190818959222457.
[I 2025-11-03 17:24:34,555] Trial 41 finished with value: 0.07201285032794638 and
parameters: {'lambda_l1': 0.014877623435932914, 'lambda_l2': 0.2125581081188433,
'num_leaves': 87, 'feature_fraction': 0.6235528324911314, 'bagging_fraction':
0.6610624886244265, 'bagging_freq': 3, 'min_child_samples': 85, 'learning_rate':
0.031111762923499712, 'n_estimators': 600, 'max_depth': 12}. Best is trial 23 with va
0.07190818959222457.
[I 2025-11-03 17:24:57,584] Trial 42 finished with value: 0.07204114229088748 and
parameters: {'lambda_l1': 0.08588068305556905, 'lambda_l2': 0.1764646045540773,
'num_leaves': 75, 'feature_fraction': 0.6662419479977508, 'bagging_fraction':
0.8313796615450404, 'bagging_freq': 5, 'min_child_samples': 93, 'learning_rate':
0.0371480369050639, 'n_estimators': 600, 'max_depth': 12}. Best is trial 23 with valu
0.07190818959222457.
[I 2025-11-03 17:25:22,012] Trial 43 finished with value: 0.07217477205430847 and
parameters: {'lambda_l1': 0.05692512249923253, 'lambda_l2': 0.39262531529046013,
'num_leaves': 56, 'feature_fraction': 0.574491952883525, 'bagging_fraction':
0.8958665698900574, 'bagging_freq': 3, 'min_child_samples': 80, 'learning_rate':
0.02951294417491616, 'n_estimators': 600, 'max_depth': 11}. Best is trial 23 with val
0.07190818959222457.
[I 2025-11-03 17:25:50,295] Trial 44 finished with value: 0.07211970949449684 and
parameters: {'lambda_l1': 0.013616707034172396, 'lambda_l2': 0.0712237587889547,
'num_leaves': 100, 'feature_fraction': 0.6948610843584847, 'bagging_fraction':
0.9380527971456709, 'bagging_freq': 4, 'min_child_samples': 87, 'learning_rate':
0.05984628132862288, 'n_estimators': 700, 'max_depth': 12}. Best is trial 23 with val
0.07190818959222457.
[I 2025-11-03 17:26:20,559] Trial 45 finished with value: 0.07239905826409389 and
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parameters: {'lambda_l1': 0.024380527529776666, 'lambda_l2': 0.009953996250407984,
'num_leaves': 91, 'feature_fraction': 0.6152657103479384, 'bagging_fraction':
0.7875581632540277, 'bagging_freq': 2, 'min_child_samples': 93, 'learning_rate':
0.08234290303097398, 'n_estimators': 700, 'max_depth': 11}. Best is trial 23 with val
0.07190818959222457.
[I 2025-11-03 17:26:47,833] Trial 46 finished with value: 0.07208259058605727 and
parameters: {'lambda_l1': 0.2416833345711024, 'lambda_l2': 0.02067584644546121,
'num_leaves': 106, 'feature_fraction': 0.5555753354537044, 'bagging_fraction':
0.6583440693477154, 'bagging_freq': 6, 'min_child_samples': 65, 'learning_rate':
0.04996249420254471, 'n_estimators': 700, 'max_depth': 7}. Best is trial 23 with valu
0.07190818959222457.
[I 2025-11-03 17:27:21,428] Trial 47 finished with value: 0.07206430987676858 and
parameters: {'lambda_l1': 6.790653582583833e-05, 'lambda_l2': 0.028740399377895777,
'num_leaves': 172, 'feature_fraction': 0.6261339002569765, 'bagging_fraction':
0.7406562518688001, 'bagging_freq': 4, 'min_child_samples': 73, 'learning_rate':
0.03881884124474276, 'n_estimators': 600, 'max_depth': 12}. Best is trial 23 with val
0.07190818959222457.
[I 2025-11-03 17:27:31,438] Trial 48 finished with value: 0.07402313411728052 and
parameters: {'lambda_l1': 0.008462112743938053, 'lambda_l2': 0.053437131769306465,
'num_leaves': 109, 'feature_fraction': 0.6736126129582097, 'bagging_fraction':
0.9574923801658384, 'bagging_freq': 7, 'min_child_samples': 59, 'learning_rate':
0.016466042348837317, 'n_estimators': 200, 'max_depth': 10}. Best is trial 23 with va
0.07190818959222457.
[I 2025-11-03 17:27:56,647] Trial 49 finished with value: 0.07201192831795614 and
parameters: {'lambda_l1': 0.003211144372616342, 'lambda_l2': 0.6512536820758659,
'num_leaves': 136, 'feature_fraction': 0.815817359468367, 'bagging_fraction':
0.8146784057793015, 'bagging_freq': 5, 'min_child_samples': 79, 'learning_rate':
0.029752629512373594, 'n_estimators': 500, 'max_depth': 9}. Best is trial 23 with val
0.07190818959222457.
[I 2025-11-03 17:28:22,598] Trial 50 finished with value: 0.07201677136378339 and
parameters: {'lambda_l1': 0.030234568865668155, 'lambda_l2': 0.6500791347620871,
'num_leaves': 154, 'feature_fraction': 0.8341293455085245, 'bagging_fraction':
0.8179939948334636, 'bagging_freq': 5, 'min_child_samples': 84, 'learning_rate':
0.030145995052390743, 'n_estimators': 500, 'max_depth': 9}. Best is trial 23 with val
0.07190818959222457.
[I 2025-11-03 17:28:46,302] Trial 51 finished with value: 0.07210033899037266 and
parameters: {'lambda_l1': 0.00393572281581514, 'lambda_l2': 0.6138937163566451,
'num_leaves': 153, 'feature_fraction': 0.8115745344048091, 'bagging_fraction':
0.8163049623686451, 'bagging_freq': 5, 'min_child_samples': 85, 'learning_rate':
0.02975320268968945, 'n_estimators': 500, 'max_depth': 8}. Best is trial 23 with valu
0.07190818959222457.
[I 2025-11-03 17:29:12,425] Trial 52 finished with value: 0.07210216460817379 and
parameters: {'lambda_l1': 0.0365853521487524, 'lambda_l2': 0.2390744208663185,
'num_leaves': 133, 'feature_fraction': 0.8518419797568407, 'bagging_fraction':
0.8709787272654667, 'bagging_freq': 4, 'min_child_samples': 79, 'learning_rate':
0.023228810375063184, 'n_estimators': 500, 'max_depth': 9}. Best is trial 23 with val
0.07190818959222457.
[I 2025-11-03 17:29:35,118] Trial 53 finished with value: 0.07235785338619549 and
parameters: {'lambda_l1': 0.017022755074352868, 'lambda_l2': 0.6556926736032648,
'num_leaves': 194, 'feature_fraction': 0.8661623519338831, 'bagging_fraction':
0.844492183968555, 'bagging_freq': 5, 'min_child_samples': 94, 'learning_rate':
0.017445104637160997, 'n_estimators': 400, 'max_depth': 9}. Best is trial 23 with val
0.07190818959222457.
[I 2025-11-03 17:29:53,219] Trial 54 finished with value: 0.07213634935814925 and
parameters: {'lambda_l1': 0.058292378272474334, 'lambda_l2': 0.16065741757635332,
'num_leaves': 143, 'feature_fraction': 0.8223232942127536, 'bagging_fraction':
0.759024828124673, 'bagging_freq': 5, 'min_child_samples': 80, 'learning_rate':
0.033337027984467645, 'n_estimators': 400, 'max_depth': 8}. Best is trial 23 with val
0.07190818959222457.
[I 2025-11-03 17:30:04,856] Trial 55 finished with value: 0.07377634778775619 and
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parameters: {'lambda_l1': 0.010715252582215135, 'lambda_l2': 0.3390813472810079,
'num_leaves': 170, 'feature_fraction': 0.8910773645104041, 'bagging_fraction':
0.7119923455756435, 'bagging_freq': 3, 'min_child_samples': 97, 'learning_rate':
0.29835795072515553, 'n_estimators': 300, 'max_depth': 7}. Best is trial 23 with valu
0.07190818959222457.
[I 2025-11-03 17:30:24,630] Trial 56 finished with value: 0.07507420458916636 and
parameters: {'lambda_l1': 0.033311903069310006, 'lambda_l2': 0.6985689164000788,
'num_leaves': 155, 'feature_fraction': 0.7990456942599986, 'bagging_fraction':
0.861572587313135, 'bagging_freq': 4, 'min_child_samples': 84, 'learning_rate':
0.005246538800492106, 'n_estimators': 500, 'max_depth': 6}. Best is trial 23 with val
0.07190818959222457.
[I 2025-11-03 17:30:54,110] Trial 57 finished with value: 0.07232830039509398 and
parameters: {'lambda_l1': 0.006607721334131819, 'lambda_l2': 0.2712566135240239,
'num_leaves': 191, 'feature_fraction': 0.6356522395900942, 'bagging_fraction':
0.9045710290149072, 'bagging_freq': 5, 'min_child_samples': 89, 'learning_rate':
0.013314201544401702, 'n_estimators': 500, 'max_depth': 9}. Best is trial 23 with val
0.07190818959222457.
[I 2025-11-03 17:31:25,648] Trial 58 finished with value: 0.07204512883615379 and
parameters: {'lambda_l1': 0.23553945646382243, 'lambda_l2': 0.11008463053948986,
'num_leaves': 122, 'feature_fraction': 0.5813736589243734, 'bagging_fraction':
0.6014901787576568, 'bagging_freq': 2, 'min_child_samples': 69, 'learning_rate':
0.028185228669146464, 'n_estimators': 600, 'max_depth': 10}. Best is trial 23 with va
0.07190818959222457.
[I 2025-11-03 17:31:58,584] Trial 59 finished with value: 0.0720300199901677 and
parameters: {'lambda_l1': 2.978593440293941e-05, 'lambda_l2': 0.5169512961595311,
'num_leaves': 164, 'feature_fraction': 0.7111784663260519, 'bagging_fraction':
0.8306110871722336, 'bagging_freq': 5, 'min_child_samples': 77, 'learning_rate':
0.022916836754223336, 'n_estimators': 600, 'max_depth': 9}. Best is trial 23 with val
0.07190818959222457.
[I 2025-11-03 17:32:39,967] Trial 60 finished with value: 0.07196909507004942 and
parameters: {'lambda_l1': 0.0014378714662058424, 'lambda_l2': 0.8683427206512438,
'num_leaves': 215, 'feature_fraction': 0.594147762644438, 'bagging_fraction':
0.9362540686786502, 'bagging_freq': 4, 'min_child_samples': 82, 'learning_rate':
0.03579801050613415, 'n_estimators': 800, 'max_depth': 8}. Best is trial 23 with valu
0.07190818959222457.
[I 2025-11-03 17:33:21,414] Trial 61 finished with value: 0.07196398023544243 and
parameters: {'lambda_l1': 0.0006699865224076606, 'lambda_l2': 0.9227276491908363,
'num_leaves': 206, 'feature_fraction': 0.5991187999063357, 'bagging_fraction':
0.933584066909795, 'bagging_freq': 4, 'min_child_samples': 84, 'learning_rate':
0.033183989347808626, 'n_estimators': 800, 'max_depth': 8}. Best is trial 23 with val
0.07190818959222457.
[I 2025-11-03 17:34:02,469] Trial 62 finished with value: 0.07197525026711422 and
parameters: {'lambda_l1': 0.0007776094283194245, 'lambda_l2': 0.9961458299411323,
'num_leaves': 214, 'feature_fraction': 0.5957765481476076, 'bagging_fraction':
0.9325158062606667, 'bagging_freq': 4, 'min_child_samples': 90, 'learning_rate':
0.036819715328362264, 'n_estimators': 800, 'max_depth': 8}. Best is trial 23 with val
0.07190818959222457.
[I 2025-11-03 17:34:41,839] Trial 63 finished with value: 0.07196604643296874 and
parameters: {'lambda_l1': 0.0006387510271025481, 'lambda_l2': 0.9771291370485338,
'num_leaves': 215, 'feature_fraction': 0.5286643035771398, 'bagging_fraction':
0.9300704545799648, 'bagging_freq': 4, 'min_child_samples': 89, 'learning_rate':
0.0368598414028161, 'n_estimators': 900, 'max_depth': 7}. Best is trial 23 with value
0.07190818959222457.
[I 2025-11-03 17:35:21,304] Trial 64 finished with value: 0.07191012972589904 and
parameters: {'lambda_l1': 0.0007698104007576927, 'lambda_l2': 0.853635267219165,
'num_leaves': 213, 'feature_fraction': 0.5038670798635391, 'bagging_fraction':
0.9745309950866641, 'bagging_freq': 4, 'min_child_samples': 91, 'learning_rate':
0.041663911448929156, 'n_estimators': 900, 'max_depth': 7}. Best is trial 23 with val
0.07190818959222457.
[I 2025-11-03 17:36:01,218] Trial 65 finished with value: 0.07192887215264773 and
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parameters: {'lambda_l1': 0.0006793529645983905, 'lambda_l2': 0.9483434717802158,
'num_leaves': 211, 'feature_fraction': 0.5185138620150896, 'bagging_fraction':
0.9806385696908546, 'bagging_freq': 4, 'min_child_samples': 90, 'learning_rate':
0.03603174735372905, 'n_estimators': 900, 'max_depth': 7}. Best is trial 23 with valu
0.07190818959222457.
[I 2025-11-03 17:36:44,392] Trial 66 finished with value: 0.07201597258973612 and
parameters: {'lambda_l1': 0.0007057839891594004, 'lambda_l2': 0.9379731916772259,
'num_leaves': 210, 'feature_fraction': 0.5056707982995314, 'bagging_fraction':
0.9784057429612986, 'bagging_freq': 4, 'min_child_samples': 96, 'learning_rate':
0.06835524652541089, 'n_estimators': 1000, 'max_depth': 7}. Best is trial 23 with val
0.07190818959222457.
[I 2025-11-03 17:37:16,870] Trial 67 finished with value: 0.0720062817247805 and
parameters: {'lambda_l1': 0.00030882643006416055, 'lambda_l2': 0.9840753490467837,
'num_leaves': 241, 'feature_fraction': 0.5250349329269113, 'bagging_fraction':
0.9311324173342674, 'bagging_freq': 4, 'min_child_samples': 90, 'learning_rate':
0.0550382336080285, 'n_estimators': 900, 'max_depth': 6}. Best is trial 23 with value
0.07190818959222457.
[I 2025-11-03 17:37:44,978] Trial 68 finished with value: 0.07219345181896272 and
parameters: {'lambda_l1': 0.0014028144262992594, 'lambda_l2': 0.33042537286133605,
'num_leaves': 213, 'feature_fraction': 0.5334351614182844, 'bagging_fraction':
0.9652017879920635, 'bagging_freq': 4, 'min_child_samples': 99, 'learning_rate':
0.04347950101785986, 'n_estimators': 900, 'max_depth': 5}. Best is trial 23 with valu
0.07190818959222457.
[I 2025-11-03 17:38:27,299] Trial 69 finished with value: 0.07204575091071173 and
parameters: {'lambda_l1': 0.000561929921790432, 'lambda_l2': 0.00010373786550569934,
'num_leaves': 234, 'feature_fraction': 0.5592651810485237, 'bagging_fraction':
0.9813269463871231, 'bagging_freq': 4, 'min_child_samples': 90, 'learning_rate':
0.0764482151008002, 'n_estimators': 1000, 'max_depth': 7}. Best is trial 23 with valu
0.07190818959222457.
[I 2025-11-03 17:39:07,738] Trial 70 finished with value: 0.07196409224076854 and
parameters: {'lambda_l1': 0.0008325212175364322, 'lambda_l2': 0.4659846810470423,
'num_leaves': 204, 'feature_fraction': 0.5397641285759048, 'bagging_fraction':
0.9271761913280424, 'bagging_freq': 3, 'min_child_samples': 87, 'learning_rate':
0.03561119206102515, 'n_estimators': 900, 'max_depth': 7}. Best is trial 23 with valu
0.07190818959222457.
[I 2025-11-03 17:39:48,874] Trial 71 finished with value: 0.07196033486492594 and
parameters: {'lambda_l1': 0.0008961752176134614, 'lambda_l2': 0.4727578237008185,
'num_leaves': 205, 'feature_fraction': 0.5377297568291323, 'bagging_fraction':
0.9278996387943166, 'bagging_freq': 3, 'min_child_samples': 87, 'learning_rate':
0.03502454105313651, 'n_estimators': 900, 'max_depth': 7}. Best is trial 23 with valu
0.07190818959222457.
[I 2025-11-03 17:40:29,686] Trial 72 finished with value: 0.07190928914438893 and
parameters: {'lambda_l1': 0.001729847431525533, 'lambda_l2': 0.32343802013892087,
'num_leaves': 204, 'feature_fraction': 0.502605520273632, 'bagging_fraction':
0.9517985774521791, 'bagging_freq': 3, 'min_child_samples': 82, 'learning_rate':
0.04612316674118902, 'n_estimators': 900, 'max_depth': 7}. Best is trial 23 with valu
0.07190818959222457.
[I 2025-11-03 17:41:03,946] Trial 73 finished with value: 0.07197688357431878 and
parameters: {'lambda_l1': 0.0004212686152594802, 'lambda_l2': 0.420829084326216,
'num_leaves': 201, 'feature_fraction': 0.5020799110974525, 'bagging_fraction':
0.9526543837422053, 'bagging_freq': 3, 'min_child_samples': 87, 'learning_rate':
0.04722661203610771, 'n_estimators': 900, 'max_depth': 6}. Best is trial 23 with valu
0.07190818959222457.
[I 2025-11-03 17:41:44,068] Trial 74 finished with value: 0.07196422891048834 and
parameters: {'lambda_l1': 0.0002369933010084509, 'lambda_l2': 0.1416466761951742,
'num_leaves': 203, 'feature_fraction': 0.5383123563279057, 'bagging_fraction':
0.9777524454286174, 'bagging_freq': 3, 'min_child_samples': 95, 'learning_rate':
0.05684239517523853, 'n_estimators': 900, 'max_depth': 7}. Best is trial 23 with valu
0.07190818959222457.
[I 2025-11-03 17:42:29,312] Trial 75 finished with value: 0.07199042940195526 and
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parameters: {'lambda_l1': 0.00023575735507046873, 'lambda_l2': 0.14738380464873388,
'num_leaves': 203, 'feature_fraction': 0.5407147631957897, 'bagging_fraction':
0.9772258416642106, 'bagging_freq': 3, 'min_child_samples': 95, 'learning_rate':
0.0587800645454664, 'n_estimators': 1000, 'max_depth': 7}. Best is trial 23 with valu
0.07190818959222457.
[I 2025-11-03 17:43:00,967] Trial 76 finished with value: 0.07199645051623851 and
parameters: {'lambda_l1': 0.0009219112579057798, 'lambda_l2': 0.5038038334643679,
'num_leaves': 223, 'feature_fraction': 0.5189958778618291, 'bagging_fraction':
0.9703588032716811, 'bagging_freq': 2, 'min_child_samples': 100, 'learning_rate':
0.11309510909171243, 'n_estimators': 900, 'max_depth': 5}. Best is trial 23 with valu
0.07190818959222457.
[I 2025-11-03 17:43:35,344] Trial 77 finished with value: 0.07198543222117892 and
parameters: {'lambda_l1': 0.0019548156202571286, 'lambda_l2': 0.2678249300183991,
'num_leaves': 233, 'feature_fraction': 0.5627325807678729, 'bagging_fraction':
0.9980306280378802, 'bagging_freq': 3, 'min_child_samples': 92, 'learning_rate':
0.05137742165064046, 'n_estimators': 900, 'max_depth': 6}. Best is trial 23 with valu
0.07190818959222457.
[I 2025-11-03 17:44:19,298] Trial 78 finished with value: 0.07191649408123209 and
parameters: {'lambda_l1': 0.0004233117046075825, 'lambda_l2': 0.08503635039783851,
'num_leaves': 183, 'feature_fraction': 0.5123952340559509, 'bagging_fraction':
0.987939330676712, 'bagging_freq': 3, 'min_child_samples': 87, 'learning_rate':
0.042723305879559435, 'n_estimators': 1000, 'max_depth': 7}. Best is trial 23 with va
0.07190818959222457.
[I 2025-11-03 17:45:00,269] Trial 79 finished with value: 0.07200777712791913 and
parameters: {'lambda_l1': 0.0018139244488816746, 'lambda_l2': 0.08335862512141441,
'num_leaves': 181, 'feature_fraction': 0.5152740431130685, 'bagging_fraction':
0.9490674455395876, 'bagging_freq': 2, 'min_child_samples': 86, 'learning_rate':
0.04348005489858324, 'n_estimators': 1000, 'max_depth': 6}. Best is trial 23 with val
0.07190818959222457.
[I 2025-11-03 17:45:46,998] Trial 80 finished with value: 0.07205724640146709 and
parameters: {'lambda_l1': 0.00041117135533751386, 'lambda_l2': 0.47112151298172505,
'num_leaves': 191, 'feature_fraction': 0.5015600254902182, 'bagging_fraction':
0.9208257616205738, 'bagging_freq': 3, 'min_child_samples': 82, 'learning_rate':
0.02535125132459147, 'n_estimators': 1000, 'max_depth': 7}. Best is trial 23 with val
0.07190818959222457.
[I 2025-11-03 17:46:28,620] Trial 81 finished with value: 0.07200450720694565 and
parameters: {'lambda_l1': 0.00018125797040987503, 'lambda_l2': 0.059332220780662775,
'num_leaves': 204, 'feature_fraction': 0.5408579922029237, 'bagging_fraction':
0.987637549164129, 'bagging_freq': 3, 'min_child_samples': 96, 'learning_rate':
0.03336733035516936, 'n_estimators': 900, 'max_depth': 7}. Best is trial 23 with valu
0.07190818959222457.
[I 2025-11-03 17:47:20,108] Trial 82 finished with value: 0.07213697894036852 and
parameters: {'lambda_l1': 8.645834528525142e-05, 'lambda_l2': 0.3262783865905872,
'num_leaves': 199, 'feature_fraction': 0.5438938988431802, 'bagging_fraction':
0.9666430508141536, 'bagging_freq': 3, 'min_child_samples': 92, 'learning_rate':
0.06116990532412805, 'n_estimators': 1000, 'max_depth': 8}. Best is trial 23 with val
0.07190818959222457.
[I 2025-11-03 17:48:01,373] Trial 83 finished with value: 0.07192163095725702 and
parameters: {'lambda_l1': 0.0009284360357176488, 'lambda_l2': 0.13722267023977383,
'num_leaves': 185, 'feature_fraction': 0.5180431624096161, 'bagging_fraction':
0.9501078847190546, 'bagging_freq': 3, 'min_child_samples': 87, 'learning_rate':
0.04202100479862691, 'n_estimators': 900, 'max_depth': 7}. Best is trial 23 with valu
0.07190818959222457.
[I 2025-11-03 17:48:43,432] Trial 84 finished with value: 0.07194994938044148 and
parameters: {'lambda_l1': 0.0009853607586929858, 'lambda_l2': 0.21094395188522225,
'num_leaves': 246, 'feature_fraction': 0.5213893347332684, 'bagging_fraction':
0.8969819861012289, 'bagging_freq': 3, 'min_child_samples': 87, 'learning_rate':
0.04119815303322675, 'n_estimators': 800, 'max_depth': 8}. Best is trial 23 with valu
0.07190818959222457.
[I 2025-11-03 17:49:27,686] Trial 85 finished with value: 0.07195758086028638 and
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parameters: {'lambda_l1': 0.001127680575238973, 'lambda_l2': 0.11409788801461325,
'num_leaves': 255, 'feature_fraction': 0.5187849782128937, 'bagging_fraction':
0.8798148686513203, 'bagging_freq': 2, 'min_child_samples': 75, 'learning_rate':
0.04165029440107247, 'n_estimators': 800, 'max_depth': 8}. Best is trial 23 with valu
0.07190818959222457.
[I 2025-11-03 17:49:57,655] Trial 86 finished with value: 0.07192977642308622 and
parameters: {'lambda_l1': 0.002744392516149281, 'lambda_l2': 0.047292772786815665,
'num_leaves': 249, 'feature_fraction': 0.5173787570170724, 'bagging_fraction':
0.8814597463775502, 'bagging_freq': 1, 'min_child_samples': 74, 'learning_rate':
0.045036638487756464, 'n_estimators': 800, 'max_depth': 8}. Best is trial 23 with val
0.07190818959222457.
[I 2025-11-03 17:50:27,374] Trial 87 finished with value: 0.07197501011200633 and
parameters: {'lambda_l1': 0.002734762564719327, 'lambda_l2': 0.067301680310408,
'num_leaves': 256, 'feature_fraction': 0.5176322791338518, 'bagging_fraction':
0.8857844866586243, 'bagging_freq': 1, 'min_child_samples': 74, 'learning_rate':
0.0466853193358837, 'n_estimators': 800, 'max_depth': 8}. Best is trial 23 with value
0.07190818959222457.
[I 2025-11-03 17:50:57,387] Trial 88 finished with value: 0.07192726945029151 and
parameters: {'lambda_l1': 0.004279903637326575, 'lambda_l2': 0.050241221870915655,
'num_leaves': 247, 'feature_fraction': 0.5132735232464049, 'bagging_fraction':
0.8996318439659616, 'bagging_freq': 1, 'min_child_samples': 71, 'learning_rate':
0.040922396528806165, 'n_estimators': 800, 'max_depth': 8}. Best is trial 23 with val
0.07190818959222457.
[I 2025-11-03 17:51:26,278] Trial 89 finished with value: 0.07206274565431438 and
parameters: {'lambda_l1': 0.0028489192893973968, 'lambda_l2': 0.027884284392194945,
'num_leaves': 244, 'feature_fraction': 0.5100603627147 98, 'bagging_fraction':
0.9036199366958396, 'bagging_freq': 1, 'min_child_samples': 82, 'learning_rate':
0.06482247540136123, 'n_estimators': 800, 'max_depth': 8}. Best is trial 23 with valu
0.07190818959222457.
[I 2025-11-03 17:51:50,731] Trial 90 finished with value: 0.07200799952200669 and
parameters: {'lambda_l1': 0.004477033404370204, 'lambda_l2': 0.052647280141837456,
'num_leaves': 248, 'feature_fraction': 0.5614570012944908, 'bagging_fraction':
0.9493795148419658, 'bagging_freq': 1, 'min_child_samples': 71, 'learning_rate':
0.04072744714968739, 'n_estimators': 1000, 'max_depth': 6}. Best is trial 23 with val
0.07190818959222457.
[I 2025-11-03 17:52:20,419] Trial 91 finished with value: 0.07201040350295354 and
parameters: {'lambda_l1': 0.0012000904184268377, 'lambda_l2': 0.10811522796796047,
'num_leaves': 231, 'feature_fraction': 0.5001226998172458, 'bagging_fraction':
0.8952364200286351, 'bagging_freq': 1, 'min_child_samples': 75, 'learning_rate':
0.05193085403380064, 'n_estimators': 800, 'max_depth': 8}. Best is trial 23 with valu
0.07190818959222457.
[I 2025-11-03 17:53:04,902] Trial 92 finished with value: 0.07196826411006706 and
parameters: {'lambda_l1': 0.0017339147745885624, 'lambda_l2': 0.04106259877952328,
'num_leaves': 249, 'feature_fraction': 0.5227012844961183, 'bagging_fraction':
0.8752907888793946, 'bagging_freq': 2, 'min_child_samples': 78, 'learning_rate':
0.04126112918991123, 'n_estimators': 800, 'max_depth': 8}. Best is trial 23 with valu
0.07190818959222457.
[I 2025-11-03 17:53:28,746] Trial 93 finished with value: 0.07197357580087323 and
parameters: {'lambda_l1': 0.0011294703570015492, 'lambda_l2': 0.08171075175672775,
'num_leaves': 240, 'feature_fraction': 0.5133772250193019, 'bagging_fraction':
0.9905346525805447, 'bagging_freq': 1, 'min_child_samples': 71, 'learning_rate':
0.046189313060800825, 'n_estimators': 800, 'max_depth': 7}. Best is trial 23 with val
0.07190818959222457.
[I 2025-11-03 17:54:14,119] Trial 94 finished with value: 0.07197491977684456 and
parameters: {'lambda_l1': 0.00580203290633777, 'lambda_l2': 0.12570467446788292,
'num_leaves': 237, 'feature_fraction': 0.5266319791086405, 'bagging_fraction':
0.9156404875179104, 'bagging_freq': 2, 'min_child_samples': 66, 'learning_rate':
0.0408410621821008, 'n_estimators': 800, 'max_depth': 8}. Best is trial 23 with value
0.07190818959222457.
[I 2025-11-03 17:54:46,406] Trial 95 finished with value: 0.07202974556110471 and
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parameters: {'lambda_l1': 0.0015292651461136322, 'lambda_l2': 0.20408868986932116,
'num_leaves': 251, 'feature_fraction': 0.5550864674190954, 'bagging_fraction':
0.9582256664202529, 'bagging_freq': 1, 'min_child_samples': 60, 'learning_rate':
0.04958198761657658, 'n_estimators': 900, 'max_depth': 8}. Best is trial 23 with valu
0.07190818959222457.
[I 2025-11-03 17:55:30,625] Trial 96 finished with value: 0.07204609216908935 and
parameters: {'lambda_l1': 0.0004796173832416911, 'lambda_l2': 0.0478275321615379,
'num_leaves': 229, 'feature_fraction': 0.5689260344722304, 'bagging_fraction':
0.8990947780558274, 'bagging_freq': 2, 'min_child_samples': 76, 'learning_rate':
0.028029659096316002, 'n_estimators': 900, 'max_depth': 7}. Best is trial 23 with val
0.07190818959222457.
[I 2025-11-03 17:55:54,164] Trial 97 finished with value: 0.0720050832432372 and
parameters: {'lambda_l1': 0.0024354905303576005, 'lambda_l2': 0.1869406849398541,
'num_leaves': 226, 'feature_fraction': 0.581535519764606, 'bagging_fraction':
0.9996104321762661, 'bagging_freq': 1, 'min_child_samples': 81, 'learning_rate':
0.03930670859492107, 'n_estimators': 800, 'max_depth': 7}. Best is trial 23 with valu
0.07190818959222457.
[I 2025-11-03 17:56:38,429] Trial 98 finished with value: 0.07231268385710002 and
parameters: {'lambda_l1': 0.00031383485320709415, 'lambda_l2': 0.024796541709865214,
'num_leaves': 219, 'feature_fraction': 0.5523650485836129, 'bagging_fraction':
0.943296256794202, 'bagging_freq': 2, 'min_child_samples': 69, 'learning_rate':
0.07372706434484719, 'n_estimators': 800, 'max_depth': 8}. Best is trial 23 with valu
0.07190818959222457.
[I 2025-11-03 17:57:14,513] Trial 99 finished with value: 0.07218389132751356 and
parameters: {'lambda_l1': 0.004072712019490071, 'lambda_l2': 0.042899614757172425,
'num_leaves': 184, 'feature_fraction': 0.5120605785220917, 'bagging_fraction':
0.8908026882488977, 'bagging_freq': 2, 'min_child_samples': 78, 'learning_rate':
0.03182989975545688, 'n_estimators': 900, 'max_depth': 6}. Best is trial 23 with valu
0.07190818959222457.
[I 2025-11-03 17:57:49,359] Trial 100 finished with value: 0.07200883325016037 and
parameters: {'lambda_l1': 1.548783242182826e-05, 'lambda_l2': 0.09414781796199337,
'num_leaves': 244, 'feature_fraction': 0.5268456506156425, 'bagging_fraction':
0.8786983185392977, 'bagging_freq': 3, 'min_child_samples': 92, 'learning_rate':
0.04312428525136948, 'n_estimators': 800, 'max_depth': 7}. Best is trial 23 with valu
0.07190818959222457.
[I 2025-11-03 17:58:29,657] Trial 101 finished with value: 0.07198491398461772 and
parameters: {'lambda_l1': 0.0008354461212423166, 'lambda_l2': 0.28181194751758265,
'num_leaves': 177, 'feature_fraction': 0.5320938874783945, 'bagging_fraction':
0.9243675727635448, 'bagging_freq': 3, 'min_child_samples': 73, 'learning_rate':
0.05510235531819069, 'n_estimators': 900, 'max_depth': 7}. Best is trial 23 with valu
0.07190818959222457.
[I 2025-11-03 17:59:12,903] Trial 102 finished with value: 0.07212174312982021 and
parameters: {'lambda_l1': 0.001003583115916015, 'lambda_l2': 0.03285114119660114,
'num_leaves': 196, 'feature_fraction': 0.509238706534754, 'bagging_fraction':
0.9692890140842106, 'bagging_freq': 3, 'min_child_samples': 85, 'learning_rate':
0.02362988406659952, 'n_estimators': 900, 'max_depth': 7}. Best is trial 23 with valu
0.07190818959222457.
[I 2025-11-03 17:59:57,976] Trial 103 finished with value: 0.0719798908251646 and
parameters: {'lambda_l1': 0.0033930241772588913, 'lambda_l2': 2.3409501897443045e-05,
'num_leaves': 221, 'feature_fraction': 0.5208978723485697, 'bagging_fraction':
0.9176349567980375, 'bagging_freq': 3, 'min_child_samples': 88, 'learning_rate':
0.03747435105818652, 'n_estimators': 1000, 'max_depth': 7}. Best is trial 23 with val
0.07190818959222457.
[I 2025-11-03 18:00:44,837] Trial 104 finished with value: 0.07192969049465865 and
parameters: {'lambda_l1': 0.0005130644723038483, 'lambda_l2': 0.16295391513425586,
'num_leaves': 188, 'feature_fraction': 0.5494887330568881, 'bagging_fraction':
0.9427067627040786, 'bagging_freq': 3, 'min_child_samples': 83, 'learning_rate':
0.04535420963655591, 'n_estimators': 900, 'max_depth': 8}. Best is trial 23 with valu
0.07190818959222457.
[I 2025-11-03 18:01:17,912] Trial 105 finished with value: 0.07203294013934768 and
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parameters: {'lambda_l1': 0.0004960274165527774, 'lambda_l2': 0.06412453306067357,
'num_leaves': 188, 'feature_fraction': 0.5002960617101302, 'bagging_fraction':
0.9421582388364123, 'bagging_freq': 1, 'min_child_samples': 83, 'learning_rate':
0.04641618065011179, 'n_estimators': 800, 'max_depth': 9}. Best is trial 23 with valu
0.07190818959222457.
[I 2025-11-03 18:02:07,546] Trial 106 finished with value: 0.0742412139698164 and
parameters: {'lambda_l1': 0.001427885506107747, 'lambda_l2': 0.15787387077118328,
'num_leaves': 255, 'feature_fraction': 0.5494000871491846, 'bagging_fraction':
0.9861488218227994, 'bagging_freq': 2, 'min_child_samples': 80, 'learning_rate':
0.1873878724799168, 'n_estimators': 900, 'max_depth': 8}. Best is trial 23 with value
0.07190818959222457.
[I 2025-11-03 18:02:59,855] Trial 107 finished with value: 0.0721253877338297 and
parameters: {'lambda_l1': 0.00012693347324342722, 'lambda_l2': 0.1204191196730459,
'num_leaves': 174, 'feature_fraction': 0.5289236935252062, 'bagging_fraction':
0.8612021349921605, 'bagging_freq': 3, 'min_child_samples': 62, 'learning_rate':
0.04956266182484796, 'n_estimators': 1000, 'max_depth': 8}. Best is trial 23 with val
0.07190818959222457.
[I 2025-11-03 18:03:37,521] Trial 108 finished with value: 0.07195106587114979 and
parameters: {'lambda_l1': 0.007584105644032551, 'lambda_l2': 0.005444833620356554,
'num_leaves': 210, 'feature_fraction': 0.5131828510746183, 'bagging_fraction':
0.9567189119297491, 'bagging_freq': 3, 'min_child_samples': 91, 'learning_rate':
0.04379504752927328, 'n_estimators': 700, 'max_depth': 8}. Best is trial 23 with valu
0.07190818959222457.
[I 2025-11-03 18:04:13,377] Trial 109 finished with value: 0.07205211294362059 and
parameters: {'lambda_l1': 0.00777086469181741, 'lambda_l2': 0.013455409223913124,
'num_leaves': 168, 'feature_fraction': 0.5690589199406711, 'bagging_fraction':
0.9554444216511822, 'bagging_freq': 3, 'min_child_samples': 91, 'learning_rate':
0.06520021416153916, 'n_estimators': 700, 'max_depth': 8}. Best is trial 23 with valu
0.07190818959222457.
[I 2025-11-03 18:04:55,133] Trial 110 finished with value: 0.07212044598629813 and
parameters: {'lambda_l1': 0.00534887564301336, 'lambda_l2': 0.001232095240276393,
'num_leaves': 196, 'feature_fraction': 0.5472940435505048, 'bagging_fraction':
0.9087749122835749, 'bagging_freq': 3, 'min_child_samples': 52, 'learning_rate':
0.05414276702666641, 'n_estimators': 700, 'max_depth': 9}. Best is trial 23 with valu
0.07190818959222457.
[I 2025-11-03 18:05:32,464] Trial 111 finished with value: 0.07208871213401302 and
parameters: {'lambda_l1': 0.002237315021434643, 'lambda_l2': 0.0029528573792653723,
'num_leaves': 210, 'feature_fraction': 0.5118185937233218, 'bagging_fraction':
0.5165381844440416, 'bagging_freq': 3, 'min_child_samples': 98, 'learning_rate':
0.03935734186765102, 'n_estimators': 800, 'max_depth': 8}. Best is trial 23 with valu
0.07190818959222457.
[I 2025-11-03 18:06:18,512] Trial 112 finished with value: 0.07195993614070072 and
parameters: {'lambda_l1': 0.0006676382105498615, 'lambda_l2': 0.08970312893604786,
'num_leaves': 244, 'feature_fraction': 0.5164139635283888, 'bagging_fraction':
0.970027925197128, 'bagging_freq': 4, 'min_child_samples': 86, 'learning_rate':
0.043627793505294055, 'n_estimators': 900, 'max_depth': 8}. Best is trial 23 with val
0.07190818959222457.
[I 2025-11-03 18:06:53,113] Trial 113 finished with value: 0.07212206846548251 and
parameters: {'lambda_l1': 0.0003764709881558915, 'lambda_l2': 0.010206910827124292,
'num_leaves': 237, 'feature_fraction': 0.5307312406363432, 'bagging_fraction':
0.9596815205923425, 'bagging_freq': 2, 'min_child_samples': 94, 'learning_rate':
0.03164887405394407, 'n_estimators': 700, 'max_depth': 7}. Best is trial 23 with valu
0.07190818959222457.
[I 2025-11-03 18:07:41,708] Trial 114 finished with value: 0.07193320753164645 and
parameters: {'lambda_l1': 0.0011103062689239497, 'lambda_l2': 0.23120597084396002,
'num_leaves': 186, 'feature_fraction': 0.5220666608219485, 'bagging_fraction':
0.9474660571126536, 'bagging_freq': 3, 'min_child_samples': 89, 'learning_rate':
0.02706553757191827, 'n_estimators': 800, 'max_depth': 9}. Best is trial 23 with valu
0.07190818959222457.
[I 2025-11-03 18:08:35,588] Trial 115 finished with value: 0.07187832368340827 and
```

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parameters: {'lambda_l1': 0.000287138471844204, 'lambda_l2': 0.2399566090667287,
'num_leaves': 186, 'feature_fraction': 0.5832981214648724, 'bagging_fraction':
0.9409004013081631, 'bagging_freq': 3, 'min_child_samples': 88, 'learning_rate':
0.028552397308357853, 'n_estimators': 900, 'max_depth': 9}. Best is trial 115 with va
0.07187832368340827.
[I 2025-11-03 18:09:28,723] Trial 116 finished with value: 0.07193407865085973 and
parameters: {'lambda_l1': 4.418713572227962e-05, 'lambda_l2': 0.26674329981848866,
'num_leaves': 164, 'feature_fraction': 0.575708186082364, 'bagging_fraction':
0.9491342927369777, 'bagging_freq': 3, 'min_child_samples': 89, 'learning_rate':
0.02730424745223108, 'n_estimators': 900, 'max_depth': 9}. Best is trial 115 with val
0.07187832368340827.
[I 2025-11-03 18:10:22,295] Trial 117 finished with value: 0.07193835385191663 and
parameters: {'lambda_l1': 4.007267831209134e-05, 'lambda_l2': 0.26531959527726434,
'num_leaves': 187, 'feature_fraction': 0.5875393158146701, 'bagging_fraction':
0.9405161276710637, 'bagging_freq': 4, 'min_child_samples': 89, 'learning_rate':
0.019967178775403608, 'n_estimators': 900, 'max_depth': 9}. Best is trial 115 with va
0.07187832368340827.
[I 2025-11-03 18:11:15,257] Trial 118 finished with value: 0.07193228377046912 and
parameters: {'lambda_l1': 5.824345649935063e-05, 'lambda_l2': 0.33631571384366493,
'num_leaves': 165, 'feature_fraction': 0.6137723908917987, 'bagging_fraction':
0.9741432983025486, 'bagging_freq': 3, 'min_child_samples': 84, 'learning_rate':
0.028734170711951945, 'n_estimators': 900, 'max_depth': 10}. Best is trial 115 with v
0.07187832368340827.
[I 2025-11-03 18:12:11,631] Trial 119 finished with value: 0.07198685323013142 and
parameters: {'lambda_l1': 0.00016089669805075942, 'lambda_l2': 0.688930115394233,
'num_leaves': 190, 'feature_fraction': 0.5651963670872855, 'bagging_fraction':
0.9790997239739366, 'bagging_freq': 4, 'min_child_samples': 20, 'learning_rate':
0.024450749042864053, 'n_estimators': 1000, 'max_depth': 10}. Best is trial 115 with
0.07187832368340827.
[I 2025-11-03 18:13:08,683] Trial 120 finished with value: 0.07193416775442225 and
parameters: {'lambda_l1': 0.00028028879117321116, 'lambda_l2': 0.3590274109066957,
'num_leaves': 178, 'feature_fraction': 0.6396229097647698, 'bagging_fraction':
0.9713440458248206, 'bagging_freq': 3, 'min_child_samples': 83, 'learning_rate':
0.019634737491239028, 'n_estimators': 900, 'max_depth': 10}. Best is trial 115 with v
0.07187832368340827.
[I 2025-11-03 18:14:02,612] Trial 121 finished with value: 0.07196390262671404 and
parameters: {'lambda_l1': 5.1765006069995895e-05, 'lambda_l2': 0.17159075718943828,
'num_leaves': 184, 'feature_fraction': 0.6138653399112735, 'bagging_fraction':
0.9892624292898674, 'bagging_freq': 3, 'min_child_samples': 84, 'learning_rate':
0.027738238557725493, 'n_estimators': 900, 'max_depth': 9}. Best is trial 115 with va
0.07187832368340827.
[I 2025-11-03 18:14:55,622] Trial 122 finished with value: 0.07190841270650614 and
parameters: {'lambda_l1': 8.166404261620747e-05, 'lambda_l2': 0.564540059988021,
'num_leaves': 164, 'feature_fraction': 0.5761663275807731, 'bagging_fraction':
0.9477238600972492, 'bagging_freq': 3, 'min_child_samples': 88, 'learning_rate':
0.027595640881182652, 'n_estimators': 900, 'max_depth': 9}. Best is trial 115 with va
0.07187832368340827.
[I 2025-11-03 18:15:48,490] Trial 123 finished with value: 0.07192379933795186 and
parameters: {'lambda_l1': 8.758000323518046e-05, 'lambda_l2': 0.5636181631556588,
'num_leaves': 161, 'feature_fraction': 0.5868578550096555, 'bagging_fraction':
0.9390724702778572, 'bagging_freq': 3, 'min_child_samples': 86, 'learning_rate':
0.03419114504287383, 'n_estimators': 900, 'max_depth': 10}. Best is trial 115 with va
0.07187832368340827.
[I 2025-11-03 18:16:41,633] Trial 124 finished with value: 0.07201623067247381 and
parameters: {'lambda_l1': 0.00010374338309207609, 'lambda_l2': 0.5717310732103869,
'num_leaves': 159, 'feature_fraction': 0.6111061543067092, 'bagging_fraction':
0.9638012800124519, 'bagging_freq': 3, 'min_child_samples': 85, 'learning_rate':
0.03498882489020202, 'n_estimators': 900, 'max_depth': 10}. Best is trial 115 with va
0.07187832368340827.
[I 2025-11-03 18:17:34,592] Trial 125 finished with value: 0.071920310320637 and
```

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parameters: {'lambda_l1': 6.551353520113441e-05, 'lambda_l2': 0.7787573018949141,
'num_leaves': 144, 'feature_fraction': 0.5901473797904839, 'bagging_fraction':
0.9383963536763571, 'bagging_freq': 3, 'min_child_samples': 93, 'learning_rate':
0.022284861508055386, 'n_estimators': 900, 'max_depth': 10}. Best is trial 115 with v
0.07187832368340827.
[I 2025-11-03 18:18:30,149] Trial 126 finished with value: 0.07192297987878439 and
parameters: {'lambda_l1': 7.026386159421805e-05, 'lambda_l2': 0.8240773428941087,
'num_leaves': 140, 'feature_fraction': 0.5895404753180553, 'bagging_fraction':
0.9378011008805643, 'bagging_freq': 4, 'min_child_samples': 93, 'learning_rate':
0.022157444070593536, 'n_estimators': 1000, 'max_depth': 9}. Best is trial 115 with v
0.07187832368340827.
[I 2025-11-03 18:19:27,198] Trial 127 finished with value: 0.07191596001864277 and
parameters: {'lambda_l1': 7.404758444538162e-05, 'lambda_l2': 0.8120525586794842,
'num_leaves': 147, 'feature_fraction': 0.5874763749596479, 'bagging_fraction':
0.9411001672848137, 'bagging_freq': 4, 'min_child_samples': 93, 'learning_rate':
0.022867706221817247, 'n_estimators': 1000, 'max_depth': 10}. Best is trial 115 with
0.07187832368340827.
[I 2025-11-03 18:20:21,335] Trial 128 finished with value: 0.07192026749284783 and
parameters: {'lambda_l1': 8.456154124619891e-05, 'lambda_l2': 0.771702230010464,
'num_leaves': 134, 'feature_fraction': 0.6020059682363187, 'bagging_fraction':
0.9273837820459327, 'bagging_freq': 4, 'min_child_samples': 94, 'learning_rate':
0.023659403187978 67, 'n_estimators': 1000, 'max_depth': 10}. Best is trial 115 with v
0.07187832368340827.
[I 2025-11-03 18:21:17,975] Trial 129 finished with value: 0.07192188930031142 and
parameters: {'lambda_l1': 7.906019600220317e-05, 'lambda_l2': 0.7651802885713014,
'num_leaves': 145, 'feature_fraction': 0.5865481081513055, 'bagging_fraction':
0.9186828293060291, 'bagging_freq': 4, 'min_child_samples': 93, 'learning_rate':
0.022157402886230592, 'n_estimators': 1000, 'max_depth': 10}. Best is trial 115 with
0.07187832368340827.
[I 2025-11-03 18:22:16,079] Trial 130 finished with value: 0.07191419424087726 and
parameters: {'lambda_l1': 8.03108887604184e-05, 'lambda_l2': 0.7379591530494649,
'num_leaves': 148, 'feature_fraction': 0.60223353486687, 'bagging_fraction':
0.9228809571866069, 'bagging_freq': 4, 'min_child_samples': 97, 'learning_rate':
0.018305201317527588, 'n_estimators': 1000, 'max_depth': 10}. Best is trial 115 with
0.07187832368340827.
[I 2025-11-03 18:23:11,741] Trial 131 finished with value: 0.07193241221165216 and
parameters: {'lambda_l1': 7.784307316195702e-05, 'lambda_l2': 0.7331323568506267,
'num_leaves': 139, 'feature_fraction': 0.6052778250607939, 'bagging_fraction':
0.9214287063534926, 'bagging_freq': 4, 'min_child_samples': 94, 'learning_rate':
0.015349535181390475, 'n_estimators': 1000, 'max_depth': 10}. Best is trial 115 with
0.07187832368340827.
[I 2025-11-03 18:24:07,927] Trial 132 finished with value: 0.0719416674750937 and
parameters: {'lambda_l1': 3.189921987401906e-05, 'lambda_l2': 0.7379357264192591,
'num_leaves': 149, 'feature_fraction': 0.5915081030994601, 'bagging_fraction':
0.9114539013723302, 'bagging_freq': 4, 'min_child_samples': 97, 'learning_rate':
0.02186154148605874, 'n_estimators': 1000, 'max_depth': 10}. Best is trial 115 with v
0.07187832368340827.
[I 2025-11-03 18:25:02,440] Trial 133 finished with value: 0.07191348232976749 and
parameters: {'lambda_l1': 0.00010087767344713113, 'lambda_l2': 0.5608785424246412,
'num_leaves': 132, 'feature_fraction': 0.6465934153391073, 'bagging_fraction':
0.931079441117922, 'bagging_freq': 4, 'min_child_samples': 100, 'learning_rate':
0.018967089870942314, 'n_estimators': 1000, 'max_depth': 11}. Best is trial 115 with
0.07187832368340827.
[I 2025-11-03 18:25:56,975] Trial 134 finished with value: 0.07192694653175016 and
parameters: {'lambda_l1': 0.00011012986270789068, 'lambda_l2': 0.7056963066850027,
'num_leaves': 132, 'feature_fraction': 0.6323785836477539, 'bagging_fraction':
0.9308059563982396, 'bagging_freq': 4, 'min_child_samples': 97, 'learning_rate':
0.018227235817324633, 'n_estimators': 1000, 'max_depth': 11}. Best is trial 115 with
0.07187832368340827.
[I 2025-11-03 18:26:54,035] Trial 135 finished with value: 0.07193268777368404 and
```

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parameters: {'lambda_l1': 7.3861256237121e-05, 'lambda_l2': 0.4342146783672654,
'num_leaves': 146, 'feature_fraction': 0.6471229094832871, 'bagging_fraction':
0.9264858791624457, 'bagging_freq': 4, 'min_child_samples': 99, 'learning_rate':
0.018761349965528373, 'n_estimators': 1000, 'max_depth': 11}. Best is trial 115 with
0.07187832368340827.
[I 2025-11-03 18:27:47,052] Trial 136 finished with value: 0.0719346406795844 and
parameters: {'lambda_l1': 0.00013897428846915952, 'lambda_l2': 0.8025613921253678,
'num_leaves': 123, 'feature_fraction': 0.6011492100771009, 'bagging_fraction':
0.9121236762293207, 'bagging_freq': 4, 'min_child_samples': 100, 'learning_rate':
0.021836535331778886, 'n_estimators': 1000, 'max_depth': 10}. Best is trial 115 with
0.07187832368340827.
[I 2025-11-03 18:28:44,206] Trial 137 finished with value: 0.0719273694472718 and
parameters: {'lambda_l1': 2.329542174327018e-05, 'lambda_l2': 0.5454667857140324,
'num_leaves': 140, 'feature_fraction': 0.6222639061637331, 'bagging_fraction':
0.9544728974486155, 'bagging_freq': 4, 'min_child_samples': 94, 'learning_rate':
0.015577531366544535, 'n_estimators': 1000, 'max_depth': 11}. Best is trial 115 with
0.07187832368340827.
[I 2025-11-03 18:29:41,596] Trial 138 finished with value: 0.07192392513943152 and
parameters: {'lambda_l1': 3.578529732994569e-05, 'lambda_l2': 0.4027798023969289,
'num_leaves': 150, 'feature_fraction': 0.6008785296448833, 'bagging_fraction':
0.9347009123677139, 'bagging_freq': 4, 'min_child_samples': 96, 'learning_rate':
0.020638836211630998, 'n_estimators': 1000, 'max_depth': 10}. Best is trial 115 with
0.07187832368340827.
[I 2025-11-03 18:30:36,256] Trial 139 finished with value: 0.07201136804582303 and
parameters: {'lambda_l1': 6.530145217454869e-05, 'lambda_l2': 0.7926831192540452,
'num_leaves': 119, 'feature_fraction': 0.5780824414794564, 'bagging_fraction':
0.920924298512239, 'bagging_freq': 4, 'min_child_samples': 92, 'learning_rate':
0.012708422964804 49, 'n_estimators': 1000, 'max_depth': 11}. Best is trial 115 with v
0.07187832368340827.
[I 2025-11-03 18:31:30,770] Trial 140 finished with value: 0.07193149252069045 and
parameters: {'lambda_l1': 5.0394720826482066e-05, 'lambda_l2': 0.5691732655301421,
'num_leaves': 132, 'feature_fraction': 0.6464003740901353, 'bagging_fraction':
0.9368444900655384, 'bagging_freq': 4, 'min_child_samples': 93, 'learning_rate':
0.018500224595259455, 'n_estimators': 1000, 'max_depth': 10}. Best is trial 115 with
0.07187832368340827.
[I 2025-11-03 18:32:27,253] Trial 141 finished with value: 0.07192556440060986 and
parameters: {'lambda_l1': 0.00010042945221622399, 'lambda_l2': 0.5851191116105712,
'num_leaves': 143, 'feature_fraction': 0.587755679289877, 'bagging_fraction':
0.9431119589714426, 'bagging_freq': 4, 'min_child_samples': 98, 'learning_rate':
0.02291966099020837, 'n_estimators': 1000, 'max_depth': 10}. Best is trial 115 with v
0.07187832368340827.
[I 2025-11-03 18:33:27,164] Trial 142 finished with value: 0.0719075953831577 and
parameters: {'lambda_l1': 0.00017326560687991156, 'lambda_l2': 0.49915904687584317,
'num_leaves': 159, 'feature_fraction': 0.6259221298388989, 'bagging_fraction':
0.9577276720002523, 'bagging_freq': 4, 'min_child_samples': 95, 'learning_rate':
0.017229375771094065, 'n_estimators': 1000, 'max_depth': 10}. Best is trial 115 with
0.07187832368340827.
[I 2025-11-03 18:34:25,556] Trial 143 finished with value: 0.07201047573622202 and
parameters: {'lambda_l1': 0.00020167737098619306, 'lambda_l2': 0.4004408780073365,
'num_leaves': 150, 'feature_fraction': 0.6254054409538907, 'bagging_fraction':
0.9612543154815166, 'bagging_freq': 4, 'min_child_samples': 95, 'learning_rate':
0.014038150413623308, 'n_estimators': 1000, 'max_depth': 9}. Best is trial 115 with v
0.07187832368340827.
[I 2025-11-03 18:35:20,692] Trial 144 finished with value: 0.07195239785082622 and
parameters: {'lambda_l1': 0.00015795175272870915, 'lambda_l2': 0.8089901653710736,
'num_leaves': 129, 'feature_fraction': 0.607615641336526, 'bagging_fraction':
0.9519972029998996, 'bagging_freq': 4, 'min_child_samples': 91, 'learning_rate':
0.016850496872511254, 'n_estimators': 1000, 'max_depth': 10}. Best is trial 115 with
0.07187832368340827.
[I 2025-11-03 18:36:14,461] Trial 145 finished with value: 0.07195543230024185 and
```

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parameters: {'lambda_l1': 8.2844257266683e-05, 'lambda_l2': 0.46149332220977984,
'num_leaves': 136, 'feature_fraction': 0.6206944917970914, 'bagging_fraction':
0.90918472548439, 'bagging_freq': 4, 'min_child_samples': 93, 'learning_rate':
0.025150753794104162, 'n_estimators': 1000, 'max_depth': 9}. Best is trial 115 with v
0.07187832368340827.
[I 2025-11-03 18:37:11,230] Trial 146 finished with value: 0.07194294798722639 and
parameters: {'lambda_l1': 5.8131415091797024e-05, 'lambda_l2': 0.30468707682470647,
'num_leaves': 157, 'feature_fraction': 0.6725803733246001, 'bagging_fraction':
0.9270676391685341, 'bagging_freq': 4, 'min_child_samples': 96, 'learning_rate':
0.021829106765835393, 'n_estimators': 1000, 'max_depth': 11}. Best is trial 115 with
0.07187832368340827.
[I 2025-11-03 18:38:08,439] Trial 147 finished with value: 0.07193073320056159 and
parameters: {'lambda_l1': 0.00012661549394468692, 'lambda_l2': 0.9985904125575448,
'num_leaves': 138, 'feature_fraction': 0.6019290275910059, 'bagging_fraction':
0.962036799614324, 'bagging_freq': 4, 'min_child_samples': 98, 'learning_rate':
0.016484852913318356, 'n_estimators': 1000, 'max_depth': 10}. Best is trial 115 with
0.07187832368340827.
[I 2025-11-03 18:39:02,293] Trial 148 finished with value: 0.07191854095252273 and
parameters: {'lambda_l1': 0.00023149851339248639, 'lambda_l2': 0.56207903377286,
'num_leaves': 125, 'feature_fraction': 0.595706996355098, 'bagging_fraction':
0.9486316462955597, 'bagging_freq': 4, 'min_child_samples': 91, 'learning_rate':
0.019793240668724 54, 'n_estimators': 1000, 'max_depth': 10}. Best is trial 115 with v
0.07187832368340827.
[I 2025-11-03 18:39:55,487] Trial 149 finished with value: 0.07198104662494782 and
parameters: {'lambda_l1': 0.00022160391355219568, 'lambda_l2': 0.3684399982222741,
'num_leaves': 111, 'feature_fraction': 0.5763372650007477, 'bagging_fraction':
0.9872256022078362, 'bagging_freq': 4, 'min_child_samples': 100, 'learning_rate':
0.019907872801130 36, 'n_estimators': 1000, 'max_depth': 10}. Best is trial 115 with v
0.07187832368340827.
✅ Best LGBMRegressor parameters: {'lambda_l1': 0.000287138471844204, 'lambda_l2':
0.2399566090667287, 'num_leaves': 186, 'feature_fraction': 0.5832981214648724,
'bagging_fraction': 0.9409004013081631, 'bagging_freq': 3, 'min_child_samples': 88,
'learning_rate': 0.028552397308357853, 'n_estimators': 900, 'max_depth': 9}

⚡ Evaluating Tuned Models on GPU...

XGBRegressor (GPU)              | MSE: 0.07225 | MAE: 0.14734 | R²: 0.55181
LGBMRegressor (GPU)             | MSE: 0.07181 | MAE: 0.14779 | R²: 0.55448
```

In [14]:
```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}")
```

```
✅ Best Model Based on MSE: LGBMRegressor (GPU)
```

In [15]:
```python
# 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}")
```

```
✅ Final Model Evaluation:
Mean Squared Error : 0.07181
Mean Absolute Error: 0.14779
R² Score : 0.55448
```

Selecting best model and Generating Submission

In [16]:
```python
print("\n🚀 Retraining the best model on full training data...")

# Prepare full training features and target
X_full = train_processed.drop(columns=['loan_paid_back'], errors='ignore')
y_full = train_processed['loan_paid_back']

# Ensure all columns are numeric
X_full = X_full.select_dtypes(include=[np.number])

# Scale full data using the same scaler
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_
```

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

In [17]:
```python
# Keep IDs for submission if available
if 'id' in test_df.columns:
    test_ids = test_df['id']
else:
    test_ids = range(len(test_df))  # create sequential IDs if missing

# Encode test data (using your encode_features function)
test_processed = encode_features(test_df.drop('id', axis=1, errors='ignore'))

# Ensure numeric columns only
X_submission = test_processed.select_dtypes(include=[np.number])

# Scale using the same scaler
if scaler is not None:
    X_submission_scaled = scaler.transform(X_submission)
else:
    X_submission_scaled = X_submission
```

In [18]:
```python
print("🔮 Generating predictions using the best model...")
submission_preds = best_model.predict(X_submission_scaled)

# Optional: clip predictions to valid range [0, 1]
submission_preds = np.clip(submission_preds, 0, 1)
```

```
🔮 Generating predictions using the best model...
```

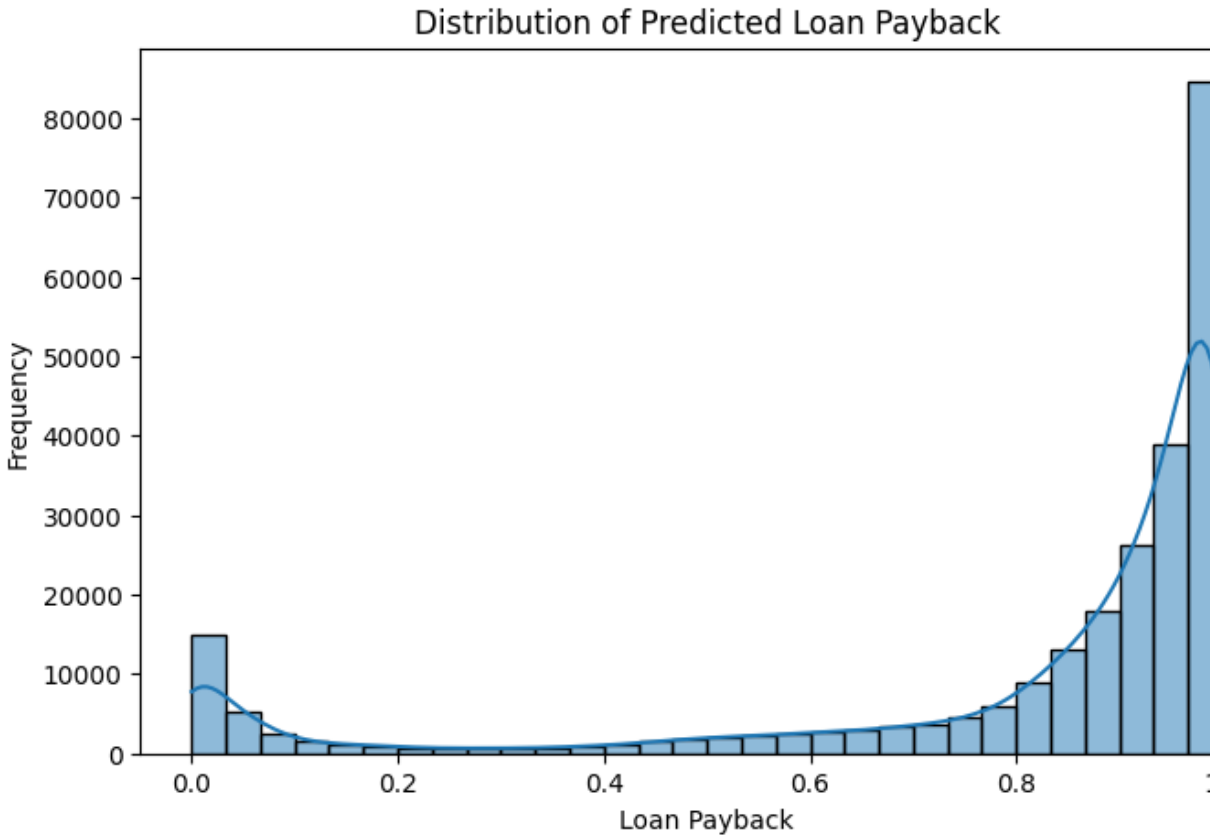
In [19]:
```python
submission = pd.DataFrame({
    'id': test_ids,
    'loan_paid_back': submission_preds
```

```
})
submission.to_csv('submission.csv', index=False)
print("\n✅ Submission file 'submission.csv' generated successfully!")
display(submission.head())
```

```
✅ Submission file 'submission.csv' generated successfully!
```

	id	loan_paid_back
0	593994	0.978789
1	593995	0.983816
2	593996	0.490689
3	593997	0.900999
4	593998	0.968433

In [20]:
```
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()
```



In [ ]: